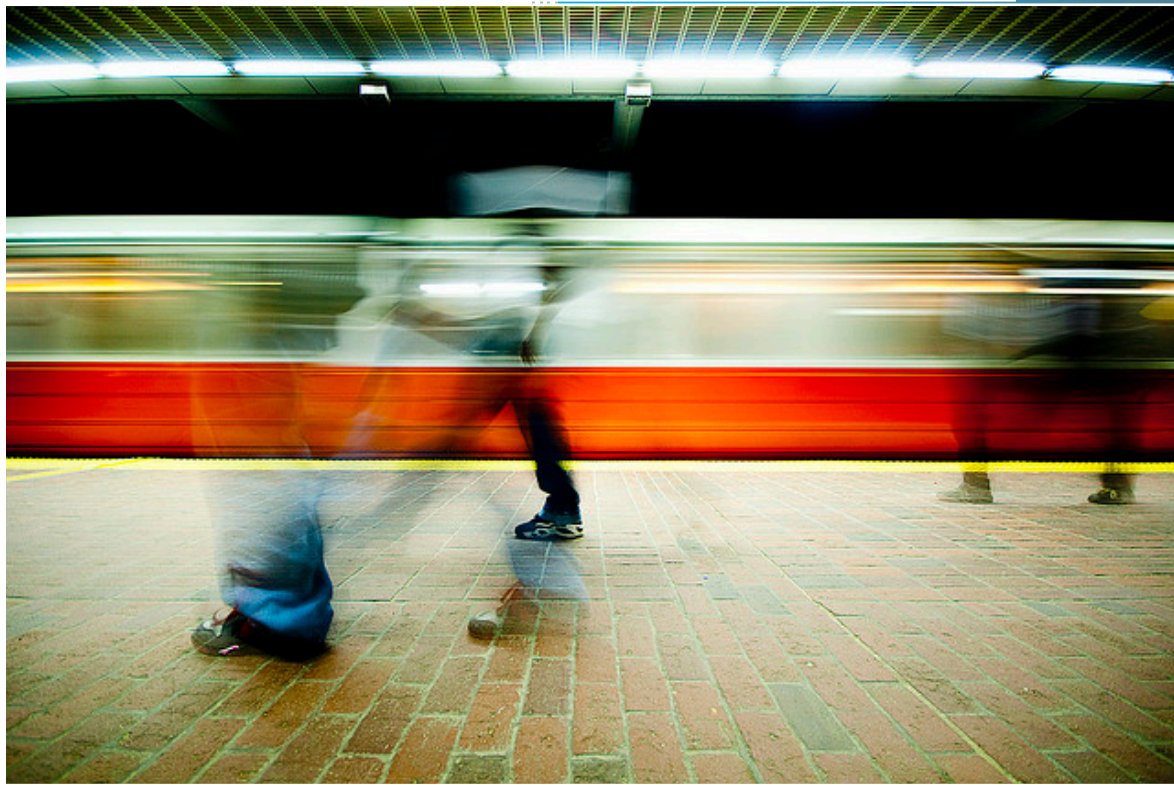




# **10 MBTA Safety Documentation**

**2014**

# MBTA Safety Plan



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September, 2014

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**STATUTES**

49 U.S.C. § 5326  
49 U.S.C. § 5329  
49 U.S.C. § 5330

M.G.L c. 161A § 3(i)

**REGULATIONS**

49 C.F.R. § 659  
220 C.M.R. § 151.00



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## ACRONYMS

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AGM D&C	Assistant General Manager of Design and Construction
ANSI	American National Standards Institute
APTA	American Public Transportation Association
ATO	Automatic Train Operations
BMP	Best Management Practice
CAP	Corrective Action Plan
CFR	Code of Federal Regulations
CMR	Code of Massachusetts Regulations
COO	Chief Operating Officer
COOP	Continuity of Operations Plan
CSO	Chief Safety Officer
DPU	Massachusetts Department of Public Utilities
EE&QA	Equipment Engineering and Quality Assurance
EMP	Emergency Management Plan
FHWA	Federal Highway Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
GM	General Manager
MAP-21	Moving Ahead for Progress in the 21 <sup>st</sup> Century
MassDOT	Massachusetts Department of Transportation
MBTA	Massachusetts Bay Transportation Authority
MIL-STD	Military Standard
MOU	Memorandum of Understanding
MSDS	Material Safety Data Sheet
NFPA	National Fire Protection Association
NTD	National Transit Database
NTSB	National Transportation Safety Board
OCC	Operations Control Center
OHS	Occupational Health and Safety
OSHA	Occupational Safety and Health Administration
PPE	Personal Protective Equipment
Project SSWG	Safety and Security Certification Working Group
QA/QC	Quality Assurance/Quality Control

RFGS	Rail Fixed Guideway System
ROW	Right of Way
SDS	Safety Data Sheets
SGR	State of Good Repair
SMS	Safety Management Systems
SOP	Standard Operating Procedure
SOS	System-of-Systems
SPCC	Spill Prevention Control and Countermeasures
SRCP	Safety Rules Compliance Program
SSCP	Safety and Security Certification Plan
SSEPP	System Security Emergency Preparedness Plan
SSI	Security Sensitive Information
SSPP	System Safety Program Plan
SSRC	Safety and Security Executive Review Committee
SSWG	System Safety Working Group
TAM	Transit Asset Management
TSI	Transportation Safety Institute
USC	United States Code
USDOT	United States Department of Transportation

## GLOSSARY

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**Accident:** An unexpected loss-causing event that results in a fatality, bodily injury, occupational injury/illness, property damage, system disruption and/or environmental damage.

**Annual Safety Audit Report:** The report prepared by the rail fixed guideway system (RFGS) describing safety auditing activities performed during the preceding twelve (12) months.

**Catenary:** The overhead wires that provide the power used to propel electronic equipment, trains and trolleys.

**Closed-loop:** The concept of a loop system where feedback is circulated back to the originator. Within the context of SMS, the employee promptly reports hazards to the manager, who will then notify appropriate parties and complete the loop by following up with the employee.

**Contractor:** An entity that performs tasks required on behalf of the oversight or transit agency.

**Corrective Action Plan:** A Plan developed by the transit agency that describes the actions it will take to minimize, control, correct, or eliminate hazards; and the schedule for implementing the actions it will take to minimize, control, correct, or eliminate hazards.

**Emergency:** A situation that is life threatening or, that causes damage on or in any RFGS facility, right-of-way, or vehicle.

**Environment:** Operating environment, right-of-way, passenger interface, pedestrian/vehicle interface, weather, subway/non-subway, regulatory, political, media, etc.

**Et al.:** Abbreviation of the Latin term *et alia*, which means “and others.”

**Et seq.:** Abbreviation of the Latin term *et sequentia*, which means “and the following.”

**E.g.:** Abbreviation of the Latin term *exempli gratia*, which means “for the sake of example.”

**Form B:** A written document that allows employees to anonymously document unsafe work conditions and bring them to MBTA Safety for resolution.

**Hazard:** Condition or object with the potential of causing injuries to personnel, damage to equipment or structures, loss of material, or reduction of ability to perform a prescribed function.

**Hazard Analysis:** An analysis performed to identify hazardous conditions for the purpose of their elimination or control.

**Hazard Probability:** The probability that a hazard will occur during the planned life of the system. Hazard probability may be expressed in quantitative or qualitative terms. An example of a hazard probability ranking system is:

- Frequent
- Probable
- Occasional
- Remote
- Improbable
- Eliminated

**Hazard Resolution:** The analysis and actions taken to reduce, to the lowest level practical, the risk associated with an identified hazard.

**Hazard Severity:** A qualitative measure of hazards stated in relative terms. The four (4) most commonly identified hazard severity categories are:

- Catastrophic (death or system loss)
- Critical (severe injury, severe occupational illness, or major system damage.)
- Marginal (minor injury, minor occupational illness, or minor system damage.)
- Negligible (less than minor injury, occupational illness, or system damage.)

**Hazard Severity Category:** A categorization that provides a qualitative measure of the most reasonable credible mishap resulting from personnel error, environmental conditions, design inadequacies, procedural deficiencies, or system, subsystem, or component failure or malfunction.

**Hazard Resolution:** The analysis and actions taken to reduce, to the lowest level practical, the risk associated with an identified hazard.

**Incident:** An unforeseen event or occurrence which does not necessarily result in death, injury, or property damage and may affect the safety of operations.

**Investigation:** A process to determine the probable cause of an accident or an unacceptable hazardous condition. This process may involve no more than a review and approval of the transit agency's determination of the probable cause of an accident or unacceptable hazardous condition.

**Lagging Indicators:** Measures of unsafe events that have occurred such as derailments, accidents, casualties, fires, or evacuations; also known as trailing indicators.

**Leading Indicators:** Measures of incident precursors that may be predictive of unsafe events, such as close calls, deterioration of asset conditions, or failures to comply with safety standards.

**Maintainability:** The ease of which a product, system, or equipment can be maintained.

**MBTA Management:** The collective management groups across all MBTA departments, which consist of field managers and executive managers.

**MBTA Personnel:** Employees, encompassing both management and the labor workforce.

**Memorandum of Understanding/Agreement:** Contractually binding summaries of agreements under which parties work together to reach a goal(s).

**Near Miss:** A perilous almost-accident or close call incident that imminently could have resulted in a catastrophic or critical event or failure that was averted due to human intervention or other factors.

**Passenger:** A person who is onboard, boarding, or alighting from a transit vehicle for the purpose of travel.

**Procedures:** Rules, SOPs, orders, training, emergency procedures, notifications, investigations, reporting, data collection, etc.

**Project Safety and Security Certification Working Groups:** Working groups formed on an as needed basis to administer and oversee the safety and security certification tasks and requirements for a specific project. They are then dissolved upon completion of a project. Project SSWGs usually consists of executive management.

**Reportable Event:** Any accident, incident, safety violation, or near miss that occurs within the MBTA transportation system that requires a formalized investigation process, and reporting as required by federal or state regulations, and/or MBTA rules, policies, orders, directives, or regulation.

**Rail Fixed Guideway:** Any light, heavy, or rapid rail system, monorail, inclined plane, funicular, trolley, or automated guideway that is:

- Included in FTA's calculation of fixed guideway route miles or receives funding under FTA's formula program for urbanized areas (49 USC 5336); and

- Not regulated by the Federal Railroad Administration.

**Right of Way:** The property over which trains and authorized rail equipment operate, and ten feet from the centerline of track in any direction, including sidings and yards.

**Risk:** An expression of possible loss over a specific period of time or number of operations cycles. It may be expressed as the product of hazard severity and probability.

**Rolling Stock:** Transit vehicles such as buses, vans, cars, railcars, locomotives, trolley cars and buses, and ferry boats, as well as vehicles used for support services.

**Safety:** Freedom from harm resulting from unintentional acts or circumstances.

**Safety Critical:** A term applied to any system, part, condition, event, operation, process, or item whose failure or malfunction may result in:

- death or serious injury to people;
- loss or severe damage to property, equipment; or
- environmental harm.

**Safety Culture:** The safety culture of an organization is the product of the individual and group values, attitudes, competencies, and patterns of behavior that determine the commitment to, and the style and proficiency of, an organization's health and safety programs. Organizations with a positive safety culture are characterized by communications founded on mutual trust, shared perceptions of the importance of safety, and confidence in the efficacy of preventative measures.

**Safety Management Systems:** An integrated collection of policies, processes, and behaviors to ensure a formalized, proactive, and data-driven approach to safety risk management. SMS operates on four principles or pillars: 1) Safety Policy; 2) Safety Risk Management; 3) Safety Assurance; and 4) Safety Promotion.

**Security:** Freedom from harm resulting from intentional acts or circumstances.

**Safety and Security Executive Review Committee:** The executive management team that meets regularly to discuss safety issues and forward recommendations to the GM.

**State Safety Oversight Agency:** The entity, other than the transit agency, designated by the State or several States to implement 49 CFR 659.

**System:** A composite of people, procedures and equipment that are integrated to perform a specific operational task or function within a specific environment.

**System Lifecycle:** All phases of the system's life, including design, research, development, test and evaluation, production, deployment (inventory), operations and support, and disposal. Considering all phases of a system lifecycle is a standard practice of system safety.

**System-of-systems:** A set or arrangement of interdependent systems that are related or connected to provide a given capability.

**System Safety:** The application of operating, technical, and management techniques and principles to the safety aspects of a system throughout its life cycle to reduce hazards to the lowest practical level through the most effective use of available resources.

**System Safety Engineering:** An engineering discipline that employs specialized professional knowledge and skills in applying scientific and engineering principals, criteria, and techniques to identify and eliminate hazards, in order to reduce the associated risk.

**System Safety Program:** The combined tasks and activities of system safety management and system safety engineering that enhance operational effectiveness by satisfying the system safety requirements in a timely manner throughout all phases of a system life-cycle.

**System Safety Program Plan:** Document developed by the transit agency describing its safety policies, objectives, responsibilities, and procedures.

**System Safety Program Standard:** The standard codified in 220 CMR 151, and adopted by the State Safety Oversight Agency.

**System Safety Working Groups:** Safety committees formed for the purpose of addressing safety issues within a system, or subsystem. SSWGs consist of representatives, usually executive managers, from various departments. SSWGs are a way of establishing interdepartmental communication when addressing safety issues. They report to the SSRC.

**Triennial Safety Review:** A formal, comprehensive, on-site examination by the oversight agency of a transit agency's safety practices to determine whether they comply with the policies and procedures required under the transit agency's system safety program plan.

**Transit Agency:** An entity (public or private) responsible for administering and managing transit activities and services.

# Safety Policy Statement

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The Massachusetts Bay Transportation Authority's (MBTA) top priority is safety. MBTA is committed to forward-thinking safety innovation, management, performance and continuous improvement.

MBTA's Safety Plan utilizes a Safety Management Systems (SMS) approach to safety. SMS is a management system and a core organizational function to ensure that all transit activities are appropriately resourced and supported to achieve the highest level of safety performance.

By definition, SMS is the formal, top-down, organization-wide approach to managing safety risk and assuring the effectiveness of safety risk controls. It includes systematic procedures, practices, policies, practices and policies for the management of safety risk.

MBTA is committed to implementing, supporting and improving its safety program and safety culture through the SMS model which is built upon four essential components or pillars, which represent the foundational aspects and driving forces of MBTA's Safety Plan, summarized as follows:

- 1) **Safety Policy:** The creation of a sound safety management policy, with quantifiable accountabilities, responsibilities, controls in place to enhance the implementation and maintenance of MBTA's SMS program, with applicable integration with public safety and emergency management objectives.
- 2) **Safety Risk Management:** A robust, collaborative and well defined hazard identification, analysis, risk assessment and mitigation program; to eliminate, reduce and or segregate safety hazards, risk and or deficiencies to the lowest practical level.
- 3) **Safety Assurance:** An array of monitoring data driven tools, processes and activities to assess, quantify and inform MBTA of its effectiveness and efficiency in terms of safety performance and intended safety targets aimed towards continual improvement.
- 4) **Safety Promotion:** Ensure through effective multidimensional means and delivery management, employee and contractors training and competencies skills, tasks and activities commensurate with their duties, responsibilities and accountabilities, including but not limited to safety specific training and communication of pertinent elements of MBTA's Safety Plan, operational safety, workplace safety, safety performance, and the distribution of two-way safety information.

All levels of management, all employees, all contractors and all responding are responsible and accountable to deliver the highest performance of safety. Together with MBTA's Safety Plan and supporting initiatives we can demonstrate to safety as MBTA's top priority.



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Beverly G. Scott

Date 9/30/2014

I, Dr. Beverly Scott, MBTA General Manager and Rail & Transit Administrator,  
do fully authorize and endorse the MBTA Safety Plan.

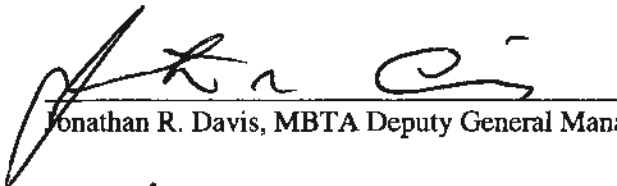
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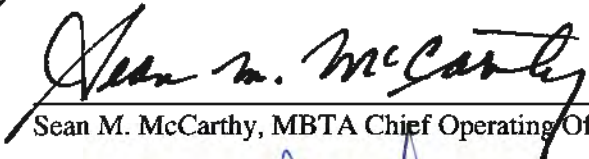
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Ronald W. Nickle, MBTA Chief Safety Officer



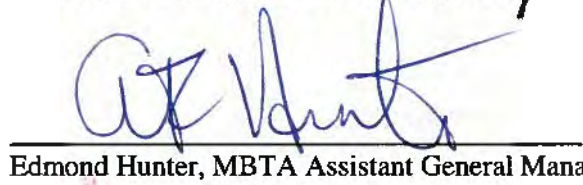
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Jonathan R. Davis, MBTA Deputy General Manager and Chief Financial Officer



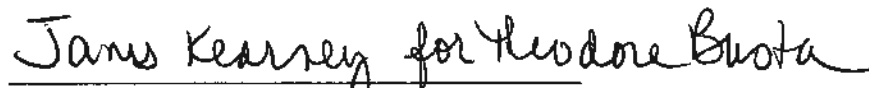
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Sean M. McCarthy, MBTA Chief Operating Officer



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Edmond Hunter, MBTA Assistant General Manager of Design and Construction



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Theodore Basta, MBTA Chief of Strategic Business Initiatives



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Paul MacMillan, MBTA Transit Police Chief

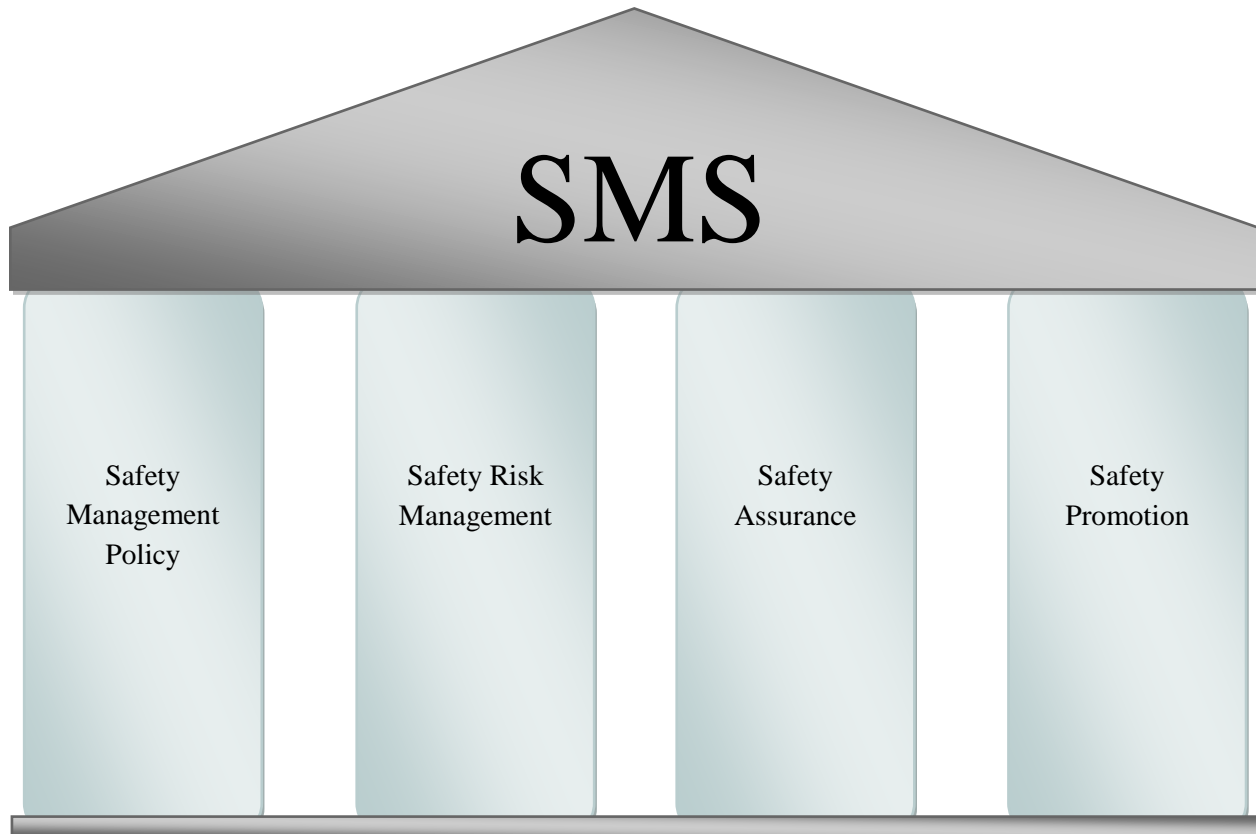
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## Preface

As part of a transitional plan, MBTA's 2014 Safety Plan incorporates aspects of Safety Management System (SMS) elements into its existing system safety program, while remaining compliant with 49 CFR 659, all inclusive.

SMS is built upon four structural pillars which highlight key components of an effective safety program, as follows:

1. Safety Management Policy
2. Safety Risk Management
3. Safety Assurance
4. Safety Promotion



These four pillars set forth the framework of MBTA's SMS program. Within each pillar are key subcomponents or SMS elements that define critical aspects of the program. These SMS elements, as detailed below, represent key features of MBTA's 2014 Safety Plan.

Key FTA SMS Framework definitions	Key § 659.19 definitions
<p><i>Hazard</i> means an obstacle or condition with the potential of causing injuries to personnel, damage to equipment or structures, loss of material, or reduction of ability to perform a prescribed function.</p>	<p><i>Hazard</i> means any real or potential condition (as defined in the rail transit agency’s hazard management process) that can cause injury, illness, or death; damage to or loss of a system, equipment or property or damage to the environment (MIL-STF-882).</p>
<p><i>Safety</i> means the state in which the potential of harm to persons or property damage during operations related to provisions of services is reduced to and maintained at an acceptable level through continuing hazard identification and safety risk management activities.</p>	<p><i>Safety</i> means freedom from harm resulting from unintentional acts or circumstances.</p>
FTA SMS Framework contents (12 elements)	§ 659.19 System Safety Program Plan (SSPP) contents (21 elements)
<p>1.1 The Safety Management Policy</p> <p><i>For the SMS to be effective, it will require executive leadership commitment to the allocation of resources for the SMS. The Accountable Executive and Senior Management Team must develop and implement a written safety management policy that sets a clear, high-level direction for the public transportation agency to follow to manage safety. The safety management policy also should specify safety objectives and performance indicators measures and targets, as well as commitment to actively support FTA and State oversight.</i></p>	<p>§ 659.19(a) Policy Statement</p> <p><i>A policy statement signed by the agency’s chief executive that endorses the safety program and described the authority that establishes the system safety program plan.</i></p> <p>§ 659.19(b) Goals and Objectives</p> <p><i>A clear definition of the goals and objectives for the safety program and stated management responsibilities to ensure they are achieved.</i></p>
<p>1.2 Safety Accountabilities and Responsibilities</p> <p><i>The public transportation agency will appoint an Accountable Executive who, irrespective of other functions will have ultimate responsibility and accountability for the implementation and operations of the SMS. The accountabilities and authorities of the Accountable Executive will be commensurate with the responsibilities underlying the effective and efficient operation of the SMS.</i></p> <p><i>The public transportation agency will appoint an SMS Manager to be the responsible individual and focal point o the implementation and operation of the SMS. The qualifications of the SMS Manager will be commensurate with the responsibilities underlying the effective and efficient operation of the SMS. The public transportation agency will also identify the accountabilities of all members of management, irrespective of other functions, as well as of employees, with respect to the safety performance of the SMS.</i></p> <p><i>Safety responsibilities, accountabilities, and authorities</i></p>	<p>§ 659.19(a) Management Structure</p> <p><i>An overview of the management structure of the rail transit agency, including:</i></p> <ul style="list-style-type: none"> <li><i>(1) An organization chart;</i></li> <li><i>(2) A description of how the safety function is integrated into the rest of the rail transit organizational; and</i></li> <li><i>(3) Clear identification of the lines of authority used by the rail transit agency to manage safety issues.</i></li> </ul>

<p><i>will be documented and communicated throughout the organization; and, depending on the size and complexity of the public transportation agency may include a definition of the levels of management with authority to make decisions regarding safety risks tolerability.</i></p> <p><i>The public transportation agency will establish a safety management policy that reflects its organizational commitments regarding the management of safety; includes a clear statement about the provision of the necessary resources for the implementation of the safety policy and is communicated, with visible endorsement from the Accountable Executive, throughout the organization.</i></p> <p><i>The safety management policy will also include the agency's requirements for employee reporting of safety hazards.</i></p>	
<p><b>1.3 Integration with System Safety, Public Safety and Emergency Preparedness Program Activities</b></p> <p><i>The public transportation agency will prepare and maintain an index of all procedures and plans implemented to ensure the safety, security and emergency preparedness of the public transportation agency.</i></p>	<p><b>§ 659.19(k) Coordination with Emergency Management Program</b></p> <p><i>A description of the process used by the Transportation Authority to develop an approved, coordinated schedule for all emergency management program activities, which includes:</i></p> <ul style="list-style-type: none"> <li><i>(1) Meetings with external agencies;</i></li> <li><i>(2) Emergency planning responsibilities and requirements;</i></li> <li><i>(3) Process used to evaluate emergency preparedness, such as annual emergency field exercises;</i></li> <li><i>(4) After action reports and implementation of findings;</i></li> <li><i>(5) Revision and distribution of emergency response procedures;</i></li> <li><i>(6) Familiarization training for public safety organizations; and</i></li> <li><i>(7) Employee training.</i></li> </ul>
<p><b>1.4 SMS Documentation and Records</b></p> <p><i>The public transportation agency will develop and maintain an SMS manual. Depending on the size and complexity of the public transportation agency, the SMS manual will vary in size from a few pages to a much larger document.</i></p> <p><i>The SMS manual will include the system description, the gap analysis, the safety management policy, the accountabilities, responsibilities and authorities of the Accountable Executive and the SMS manager, the activities and tools for safety risk management and safety assurance, the safety management training requirements and the means for safety communication.</i></p>	<p><b>§ 659.19(e) System Safety Program Implementation Activities</b></p> <p><i>A description of the specific activities required to implement the system safety program, including:</i></p> <ul style="list-style-type: none"> <li><i>(1) Tasks to be performed by the rail transit safety function, by position and management accountability, specified in matrices and/or narrative format; and</i></li> <li><i>(2) Safety-related tasks to be performed by other rail transit departments, by position and management accountability, specified in matrices and/or narrative format.</i></li> </ul>



<p><i>The SMS manual shall also include a description of the public transportation agency's system of safety risk management records.</i></p>	
<p><b>2.0 Safety Risk Management</b></p> <p><i>SMS provides a logical and proven approach to the evaluation of safety risks and the application of appropriate resources to their control. In this approach, hazards are identified and their consequences are analyzed. The Safety risks of the consequences analyzed are evaluated, and the consequences are controlled.</i></p>	
<p><b>2.1 Hazard Identification and Analysis</b></p> <p><i>The public transportation agency will develop and maintain formal activities that ensure that hazards are identified and their potential consequences analyzed. Hazard identification shall be based on a combination of reactive and proactive methods of safety data collection. The extensiveness of hazard identification and analysis activities will vary based on the size and complexity of the public transportation agency and the nature of the hazards being identified and analyzed.</i></p>	<p><b>§ 659.19(f) Hazard Management Program</b></p> <p><i>A description of the process used by the rail transit agency to implement its hazard management program, including activities for:</i></p> <ul style="list-style-type: none"> <li><i>(1) Hazard identification;</i></li> <li><i>(2) Hazard investigation, evaluation and analysis;</i></li> <li><i>(3) Hazard control and elimination;</i></li> <li><i>(4) Hazard tracking; and</i></li> <li><i>(5) Requirements for on-going reporting to the oversight agency relating to the hazard management activities and status.</i></li> </ul> <p><b>§ 659.19 (j) Accident and Incident Investigation</b></p> <p><i>A description of process used by the rail transit agency to perform accident notification, investigation and reporting, including:</i></p> <ul style="list-style-type: none"> <li><i>(1) Notification thresholds for internal and external organizations;</i></li> <li><i>(2) Accident investigation process and references to procedures;</i></li> <li><i>(3) The process used to develop, implement, and track corrective actions that address investigation findings.</i></li> </ul>
<p><b>2.2 Risk Assessment and Mitigation</b></p> <p><i>The public transportation agency will develop and maintain formal activities that ensure assessment and control of safety risks in transit operations.</i></p>	<p><b>§ 659.19(h) Safety Certification Program</b></p> <p><i>A description of the safety certification process required by the Transportation Authority to ensure that safety concerns and hazards are adequately addressed prior to the initiation of New Starts and subsequent major projects to extend, rehabilitate, or modify an existing system, or to replace vehicles and equipment.</i></p> <p><b>§ 659.19(u) Safety Integration into Procurement Process</b></p> <p><i>A description of the measures, controls, and assurances in place to ensure that safety principles, requirements and representatives are included in the rail transit agency's procurement process.</i></p>

<p><b>3.0 Safety Assurance</b></p> <p><i>The public transportation agency will develop and implement a process to monitor its safety performance. The safety assurance component of the SMS will investigate incidents and accidents, develop and maintain formal activities that ensure assessment and control of safety risks in transit operations, monitor and audit operational and maintenance processes, monitor effectiveness of corrective action plans, and manage employee reporting of hazards. The public transportation agency will also develop and maintain formal activities to identify changes within the organization which may affect provision of services; to describe the arrangements to ensure safety performance before implementing changes; and to eliminate or modify safety risk controls that are no longer needed or effective due to changes in the operation environment.</i></p>	
<p><b>3.1 Safety Performance Monitoring and Measurement</b></p> <p><i>The public transportation agency will develop and maintain the means to verify the safety performance of the SMS and to validate the effectiveness of safety risks controls. The safety performance of the SMS will be verified in reference to the safety performance indicators and safety performance targets of the SMS.</i></p>	<p>§ 659.19(i) Safety Data Acquisition</p> <p><i>A description of the process used to collect, maintain, analyze, and distribute safety data, to ensure that the safety function of the Transportation Authority receives the necessary information to support implementation of the system safety program.</i></p> <p>§ 659.19(m) Rules Compliance Monitoring Program</p> <p><i>A description of the process used by the Transportation Authority to develop, maintain, and ensure compliance with rules and procedures having a safety impact, including:</i></p> <ul style="list-style-type: none"> <li><i>(1) Identification of operating and maintenance rules and procedures, subject to review;</i></li> <li><i>(2) Techniques used to assess the implementation of operating and maintenance rules and procedures by employees, such as performance testing;</i></li> <li><i>(3) Techniques used to assess the effectiveness of supervision relating to the implementation of operating and maintenance rules; and</i></li> <li><i>(4) Process for documenting results and incorporating them into the hazard management program.</i></li> </ul> <p>§ 659.19(n) Facilities and Equipment Inspections</p> <p><i>A description of the process used for facilities and equipment safety inspections, including:</i></p> <ul style="list-style-type: none"> <li><i>(1) Identification of the facilities and equipment subject to regular safety-related inspection and testing;</i></li> <li><i>(2) Techniques used to conduct inspections and testing;</i></li> <li><i>(3) Inspection schedules and procedures; and</i></li> <li><i>(4) Description of how results are entered into the hazard management process.</i></li> </ul>

	<p>§ 659.19(o) Maintenance Audit and Inspection Programs</p> <p><i>A description of the maintenance audits and inspections program, including identification of the affected facilities and equipment, maintenance cycles, documentation required, and the process for integrating identified problems into the hazard management process.</i></p>
<p>3.2 Management of Change</p> <p><i>The public transportation agency will develop and maintain formal activities to identify changes within the organization which may affect provision of services; to describe the arrangements to ensure safety performance before implementing changes; and to eliminate or modify safety risk controls that are no longer needed or effective due to changes in the operational environment.</i></p>	<p>§ 659.19(g) Modification of Rail Transit System</p> <p><i>A description of the process used by the Transportation Authority to ensure that safety concerns are addressed in modifications to existing systems, vehicles, and equipment, which do not require formal safety certification but which may have safety impacts.</i></p> <p>§ 659.19(h) Safety Certification Program</p> <p><i>A description of the safety certification process required by the Transportation Authority to ensure that safety concerns and hazards are adequately addressed prior to the initiation of New Starts and subsequent major projects to extend, rehabilitate, or modify an existing system, or to replace vehicles and equipment.</i></p> <p>§ 659.19(q) Configuration Management Process</p> <p><i>A description of the configuration management control process, including:</i></p> <ul style="list-style-type: none"> <li><i>(1) The authority to make configuration changes;</i></li> <li><i>(2) Process for making changes; and</i></li> <li><i>(3) Assurances necessary for formally notifying all involved departments.</i></li> </ul>
<p>3.3 Continuous Improvement</p> <p><i>The public transportation agency will develop and maintain formal activities to identify the causes of sub-standard performance of the SMS, determine the implications of substandard performance of the SMS in operations, and eliminate or mitigate such causes.</i></p>	<p>§ 659.19(d) Process Used to Control SSPP</p> <p><i>The process used to control changes to the system safety program plan, including:</i></p> <ul style="list-style-type: none"> <li><i>(1) Specifying an annual assessment of whether the system safety program plan should be updated; and</i></li> <li><i>(2) Required coordination with the oversight agency, including timeframes for submission, revision, and approval.</i></li> </ul> <p>§ 659.19(l) Internal Safety Audit Program</p> <p><i>A description of the process used by the Transportation Authority to ensure that planned and scheduled internal safety reviews are performed to evaluate compliance</i></p>

	<p>with the SSPP, including:</p> <ul style="list-style-type: none"> <li>(1) Identification of departments and functions subject to review;</li> <li>(2) Responsibility for scheduling reviews;</li> <li>(3) Process for conducting reviews, including the development of checklists and procedures and the issuing of findings;</li> <li>(4) Review of reporting requirements;</li> <li>(5) Tracking the status of implemented recommendations; and</li> <li>(6) Coordination with the oversight agency.</li> </ul>
<p><b>4.0 Safety Promotion</b></p> <p><i>The public transportation agency will develop and maintain a safety management training program that ensures that personnel are trained and competent to perform their SMS duties. The scope of the safety training shall be appropriate to each individual's involvement in the SMS. The public transportation agency will also develop and maintain formal means for safety communication, which ensures that all employees are aware of the SMS, that appropriate personnel within the organization convey safety critical information to all employees, and to explain why particular safety actions are taken and why safety procedures are introduced or changed.</i></p>	
<p><b>4.1 Safety Communication</b></p> <p><i>The public transportation agency will develop and maintain formal means for safety communication, that ensures that all personnel are fully aware of the SMS, conveys safety critical information, and explains why particular safety actions are taken and why safety procedures are introduced or changed.</i></p>	
<p><b>4.2 Competencies and Training</b></p> <p><i>The public transportation agency will develop and maintain a safety management training program that ensures that personnel are trained and competent to perform their SMS duties. The scope of the safety management training will be appropriate to each individual's involvements in the SMS.</i></p>	<p><b>§ 659.19(p) Training and Certification Program</b></p> <p><i>A description of the training and certification program for employees and contractors, including:</i></p> <ul style="list-style-type: none"> <li>(1) Categories of safety-related work requiring training and certification;</li> <li>(2) A description of the training and certification program for employees and contractors in safety-related positions;</li> <li>(3) Process used to maintain and access employee and contractor training records; and</li> <li>(4) Process used to assess compliance with training and certification requirements.</li> </ul> <p><b>§ 659.19(r) Compliance with Applicable Safety Regulations</b></p> <p><i>A description of the safety program for employees and contractors that incorporates the applicable local, state and federal requirements, including:</i></p> <ul style="list-style-type: none"> <li>(1) Safety requirements that employees and contractors</li> </ul>

	<p><i>must follow when working on, or in close proximity to, rail transit agency property; and</i>                  (2) <i>Processes for ensuring the employees and contractors know and follow the requirements.</i></p> <p>§ 659.19(s) Hazardous Materials Program</p> <p><i>A description of hazardous materials program, including the process used to ensure knowledge of and compliance with program requirements.</i></p> <p>§ 659.19(t) Drug and Alcohol Testing Program</p> <p><i>A description of the drug and alcohol program and the process used to ensure knowledge of and compliance with program requirements.</i></p>
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MBTA’s Safety Plan is arrayed following 49 CFR 659, which includes 21 system safety program elements which MBTA has been using in the past. Each of these elements parallel and provide a foundational base for many expectations for SMS.

As MBTA transitions its system safety program in phases towards a fully integrated SMS program, the table below depicts the correlation between MBTA’s past system safety program and the SMS program envisioned.

FTA SMS Framework	MBTA Safety Plan	
<b>Pillar 1: Safety Management Policy</b>		
<i>Safety Management Systems</i>	<i>System Safety</i>	<i>49 CFR 659</i>
<b>1.1 The Safety Management Policy</b>	Element 1: Policy Statement and Authority	§ 659.19(a)
	Element 2: Purpose, Scope, and Performance Objectives	§ 659.19(b)
<b>1.2 Safety Accountabilities and Responsibilities</b>	Element 3: Overview of Management Structure	§ 659.19(c)
<b>1.3 Integration with System Safety, Public Safety, and Emergency Preparedness Program Activities</b>	Element 11: Emergency Management	§ 659.19(k)
<b>1.4 Documentation and Records</b>	Element 5: Implementation, Tasks, Activities, and Responsibilities	§ 659.19(e)

FTA SMS Framework	MBTA Safety Plan	
<b>Pillar 2: Safety Risk Management</b>		
<b>2.1 Hazard Identification and Analysis</b>	Element 6: Safety Risk Management	§ 659.19(f)
	Element 8: Safety and Security Certification	§ 659.19(h)
	Element 10: Accident Investigation	§ 659.19(j)
	Element 21: Procurement	§ 659.19(u)
<b>2.2 Risk Assessment and Mitigation</b>	Element 6: Safety Risk Management	§ 659.19(f)
<b>Pillar 3: Safety Assurance</b>		
<b>3.1 Safety Performance Monitoring and Measurement</b>	Element 9: Data Collection and Analysis	§ 659.19(i)
	Element 13: Rules Compliance	§ 659.19(m)
	Element 14: Facilities and Equipment Inspection	§ 659.19(n)
	Element 15: Maintenance Audits/Inspection	§ 659.19(o)
<b>3.2 Management of Change</b>	Element 7: Management of Change	§ 659.19(g)
	Element 8: Safety and Security Certification	§ 659.19(h)
	Element 17: Configuration Management	§ 659.19(q)
<b>3.3 Continuous Improvement</b>	Element 4: MBTA Safety Plan Control and Update	§ 659.19(d)
	Element 12: Internal Safety Audit	§ 659.19(l)
<b>Pillar 4: Safety Promotion</b>		
<b>4.1 Safety Communication</b>		
<b>4.2 Competencies and Training</b>	Element 16: Training and Certification Review/Audit	§ 659.19(p)
	Element 18: Workplace Safety	§ 659.19(r)
	Element 19: Hazardous Materials Program	§ 659.19(s)
	Element 20: Human Factors	§ 659.19(t)

MBTA's 2014 Safety Plan represents a first generation phase to incorporate and correlate SMS principles, functions, and activities into existing system safety program elements.

MBTA will continue to enhance its SMS program in phases and in accordance with federal and state, regulations and guidance, and in accordance with transit and safety management system best practices.

## **PART I: Administration and Safety Risk Management**

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## ELEMENT 1: INTRODUCTION

The Massachusetts Bay Transportation Authority (MBTA) Safety Plan is a comprehensive document intended to ensure the safety of customers, employees, contractors, emergency responders, and the general public. The MBTA Safety Plan governs and defines the authority, responsibilities, roles, and processes prescribed herein. It assures compliance with and application of federal, state, and local regulations as well as industry best practices. Through collaborative and progressive measure, the MBTA Safety Plan demonstrates the MBTA's commitment to safety as its top priority.

### 1.1 Federal, State, and Local Authority

Moving Ahead for Progress in the 21st Century Act (MAP-21) amends the following United States Codes:

- 49 U.S.C. § 5326, “**Transit Asset Management**”;
- 49 U.S.C. § 5329, “**Public Transportation Safety Program**”<sup>i</sup>; and
- 49 U.S.C. § 5330, “**State Safety Oversight**.”<sup>ii</sup>

Federal Transit Administration (FTA) requirements govern the MBTA Safety Plan in the interim, pursuant to 49 U.S.C. § 5329(d)(2), as prescribed in:

- 49 C.F.R. 659, et. seq., “*Rail Fixed Guideway Systems*.”

The Department of Public Utilities (DPU) is the State Safety Oversight Agency (SSOA) for the Commonwealth of Massachusetts as prescribed in:

- 220 C.M.R. 151.00, et seq., “*Rail Fixed Guideway System Safety Program*.”

The MBTA Safety Plan shall ensure compliance with and application of:

- Safety Management Systems principles;
- All applicable federal, state, and local regulations;
- Occupational health and safety best practices, as applicable; and
- Transit industry best practices, as applicable.

### 1.2 Authority for the MBTA Safety Plan

MBTA is a “body politic and corporate, and a political subdivision” of the Commonwealth of Massachusetts, authorized to provide mass transportation services.

On September 11, 2012, Governor Patrick appointed a seven-member Board of Directors (Board) with expertise in transportation, finance, and engineering to oversee both the Massachusetts Department of Transportation (MassDOT) and MBTA. The Board is the highest MassDOT/MBTA management authority committed to prioritizing safety when making its decisions.

MassDOT is administered by the Secretary of Transportation, who has been appointed by the Governor to service as its Chief Executive Officer, overseeing the divisions of Rail & Transit, Highway, Aeronautics, and the Registry of Motor Vehicles (RMV), in addition to an Office of Planning and Programming.

<sup>i</sup> The Public Transportation Safety Program propagates § 5329(b) and § 5329(d), the creation of a National Public Transportation Safety Plan, and provides the requirements of a Public Transportation Agency Safety Plan, respectively.

<sup>ii</sup> § 5330 will be repealed and replaced by § 5329(e) effective three years after effective date of the Final Rule issued for § 5329(e); see § 5329(e), State Safety Oversight Program.

MBTA is one of fifteen regional authorities overseen by the MassDOT Rail & Transit division, but also retains a separate legal existence.

The Board has appointed a General Manager (GM) and Rail & Transit Administrator as chief executive of MBTA, who is ultimately responsible for ensuring safety, and has authorized and endorsed the MBTA Safety Plan. Under the SMS approach, the GM is the “accountable executive” who must balance the safety needs, capital investments, and operational and service demands of the transit system as they factor into making safe and sound financial decisions.

### 1.2.1 Chief Safety Officer Authority

The GM has delegated to the Chief Safety Officer (CSO) the authority and responsibility to govern, administer, oversee, and monitor the MBTA’s Safety Plan and resulting safety programs, policies, rules, orders, implementation, and processes. The CSO reports directly to the General Manager.

The CSO collaborates with MBTA management to enforce safe work practices, and interfaces with federal, state, and local authorities, and industry professional organizations. With the assistance of MBTA Safety, the CSO works jointly with MBTA management, employees, contractors, and the general public to advance transit safety.

When an immediate and serious safety critical hazard exists, the CSO has the authority and responsibility to order hazardous conditions corrected, at minimum, to acceptable levels if they cannot be eliminated. Accordingly, the CSO is also empowered to order the cessation of unsafe activities or operations that are evaluated as creating immediate and serious safety critical hazards within the system. The CSO is authorized to conduct mandatory internal safety reviews to determine compliance with the MBTA Safety Plan. He or she may also perform announced or unannounced audits, reviews, inspections, or assessments for the purpose of identifying and eliminating unsafe practices, operations, or conditions not immediately corrected by MBTA management.

### 1.2.2 MBTA Management Authority

MBTA management implements the day-to-day functional safety aspects of the MBTA Safety Plan, and affirms the safe operation of the system through its organizational structure, ensuring all employees, contractors, and invitees abide by the system safety requirement.

MBTA management is directly responsible to ensure, improve, and promote safety of customers, employees, contractors, emergency responders, and the general public. When a safety concern is brought to management, the issue must be seriously considered, and if warranted, investigated. Thus, MBTA management is empowered to utilize safety risk management techniques and implement risk control strategies to preserve safe operation of the system on a daily basis.

## 1.3 State Safety Oversight Program

In April 2005, the U.S. Congress expanded FTA’s regulatory role by granting authority to develop State Safety Oversight Programs, as defined by **49 CFR 659 – Final Rule, “Rail Fixed Guideway Systems; State Safety Oversight.”**

In July 2012, Congress passed MAP-21, which went into effect in October 2012 through September 2014. MAP-21 creates a new Public Transportation Agency Safety Program, which, once finalized, will bring about major safety-specific changes to all modes of the transit industry. Specifically, this will shape the way the FTA Transit Safety and Oversight division regulates rail fixed guideway public transportation systems (heavy and light rail transit) owned and operated by transit agencies throughout the country.

MAP-21 will advance a comprehensive approach to the system safety decision-making process. Accordingly, this will significantly impact how MBTA ensures implementation and compliance with the MBTA Safety Plan, federal and state regulations, and industry best practices.

The National Public Transportation Safety Plan requires a state, as a condition of federal funding, to establish a State Safety Oversight Program that oversees the Public Transportation Agency Plan, approved by the U.S. Secretary of Transportation, under which the state shall:

- Assume responsibility for regulating heavy and light rail transit safety;
- Adopt and enforce relevant federal and state transportation safety laws;
- Establish a State Safety Oversight Agency (SSOA);
- Determine, in consultation with the Secretary, an appropriate SSOA staffing level depending on the number, size, and complexity of rail fixed guideway public transportation systems in the state;
- Ensure SSOA employees and designees are adequately trained and certified under the public transportation safety certification training program; and
- Prohibit a public transit agency from providing funds to a SSOA.

### 1.3.1 Department of Public Utilities

M.G.L. c. 161A, s. 3(i) empowers the Massachusetts Department of Public Utilities (DPU) to regulate the safety of equipment and operations at MBTA. FTA recognizes DPU as the SSOA for the state of Massachusetts.

DPU promulgated 220 CMR 151.00, et seq., which established the state’s oversight through the Rail Fixed Guideway System Safety Standard (DPU Standard), as required to implement the provisions of 49 U.S.C. § 5329, § 5330, and 49 CFR 659.

DPU exercises jurisdiction over safety of equipment and operations of MBTA and is responsible for establishing standards for rail safety practices. In addition, DPU oversees the execution of these practices and procedures to ensure compliance by utilizing a broad range of tools and powers. DPU is required to:

- Remain financially and legally independent from MBTA;
- Avoid providing transit services by heavy or light rail subject to the requirements of § 5329;
- Avoid employing any person who is responsible for the administration of heavy and light public transit systems subject to the requirements of the § 5329;
- Have the authority to review, approve, oversee, and enforce implementation of the MBTA Safety Plan required under the § 5329;
- Have investigative and enforcement authority with respect to heavy and light rail public transit systems;
- Conduct compliance audits of MBTA at least once every three years; and
- Provide a status report on the safety of the heavy and light rail system to FTA, the Governor, the Board, and MBTA GM at least once every year.

MBTA is required to develop and implement the MBTA Safety Plan to comply with 49 CFR 659 and 220 CMR 151.00, and is subject to acceptance by DPU and ultimately FTA.

MBTA’s relationship with its SSOA, DPU, is a safety partnership on many levels through regulation and collaboration. DPU and MBTA’s CSO meet at least monthly. DPU and the SSRC meet at least quarterly and DPU meets at least annually with the GM and Board of Directors.

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## ELEMENT 2: PURPOSE, SCOPE, AND PERFORMANCE OBJECTIVES

Under MAP-21, the U.S. Department of Transportation (USDOT) and FTA have established safety performance criteria and state of good repair standards in the National Public Transportation Safety Plan that all transit agencies must meet at a minimum. Consequently, the MBTA Safety Plan provides for safety performance objectives that meet or exceed those federal performance criteria and state of good repair standards. The General Manager reviews the MBTA Safety Plan annually for approval.

### 2.1 MBTA Safety Plan Purpose

MBTA is committed to developing forward-thinking innovation in managerial and technical safety processes. To that end, the MBTA Safety Plan establishes the four major Safety Management System (SMS) principles that apply to all facets of the Authority:

1. Safety policy: to align the entire MBTA under a safety management system for the purpose of prioritizing safety in management decision making;
2. Safety risk management: to implement processes that will identify, evaluate, and resolve risks; and track risk controls;
3. Safety assurance: to oversee that all the objectives are met through effective data collection and assessment; and
4. Safety promotion: to encourage workplace and public confidence in MBTA's commitment to ensuring safety.

These four principles are the means to achieve the highest level of safety for MBTA's customers, employees, contractors, emergency responders, and the general public.

The basic premise of system safety is to remove hazards that have an "accident potential" before they cause mishap, and in doing so to take a preferred *proactive* approach towards safety over a *reactive* approach. The underlying purpose is to prevent hazards from occurring, reduce hazards to the lowest practical level, or eliminate them through the most effective use of MBTA's available resources.

The MBTA Safety Plan, and resulting safety programs, plans, policies, rules, orders, implementation and processes, represents MBTA's governing agency safety plan; defines the authority, responsibilities, roles, and processes prescribed herein; and follows federal, state, and local regulations, standards, oversight, and industry best practices.

### 2.2 MBTA Safety Plan Scope

The scope of the MBTA Safety Plan spans all facets of safety management to systematically achieve the highest practical level of safety for MBTA's transit system. Specifically, the MBTA Safety Plan:

- Applies to all MBTA modes and activities including but not limited to operations, engineering, maintenance, administration, design, and construction; and including all equipment, vehicles, systems, sub-systems, and infrastructure;
- Establishes specific risk control strategies;
- Establishes and describes performance objectives;
- Describes the process for update and continual improvement of the MBTA Safety Plan;
- Illustrates MBTA's system safety management, oversight, and organizational structure, interfaces and processes;

- Defines roles, responsibilities, and tasks for each department to perform and comply with safety management processes;
- Describes collaboration, interaction, and distribution processes between departments;
- Conveys interaction and reporting activities with external agencies;
- Details mechanisms for identifying, tracking, assessing, and resolving safety hazards; and methods to eliminate, minimize, or control risks;
- Delineates notification, investigation, and reporting processes for accidents, incidents, near misses, and unsafe acts or conditions;
- Describes the process used to collect, maintain, analyze, and distribute safety data;
- Describes safety initiatives, activities, and training programs designed to promote a positive safety culture and ensure that MBTA personnel are trained and competent to perform their safety duties; and
- Specifies the activities to disseminate the MBTA Safety Plan to MBTA management and all departments, ensuring that MBTA management and all relevant employees and contractors are knowledgeable of its contents.

## 2.3 Responsibilities

**Safety and Security Executive Review Committee (SSRC):** Responsible for overall implementation of the MBTA Safety Plan under the SMS application.

**MBTA Safety:** Responsible for corporate oversight of the safety processes and objectives described within the MBTA Safety Plan, and for providing corporate safety guidance to MBTA management in working to achieve safety performance objectives.

**MBTA Management:** Responsible for the implementation, success, and continual monitoring of the MBTA Safety Plan objectives, and must ensure integration of SMS processes within all MBTA divisions, departments, working groups, committees, and activities.

## 2.4 MBTA Safety Plan Performance Objectives

The MBTA Safety Plan provides strategic and management performance objectives to affirm and execute its commitment to provide a safe, reliable, and sustainable regional transportation service, and ensures compliance with federal, state, and local regulations and appropriate industry best practices. It establishes collaborative and progressive system safety, oversight, and management processes for all MBTA modes to demonstrate the Authority’s dedication to safety.

The following is not an exhaustive list of all MBTA safety-related performance objectives, but includes the agency’s overarching goals of the highest priority:

### Casualties

- Prevent and reduce safety critical incidents, including but not limited to: mainline derailments, mainline collisions, grade crossing collisions, fires, and evacuations due to safety reasons.
- Prevent and reduce injuries and eliminate fatalities to customers, employees, contractors, emergency responders, and the general public.

### Operations

- Prevent and reduce rule violations and unsafe conditions measured by leading indicators (such as near misses) through performance observations and evaluations.

- Ensure that all safety sensitive employees are adequately trained and fit for duty at all times.
- Develop, implement, and monitor a strong occupational health and safety program.

**Systems and Equipment**

- Strengthen and improve customer, employee, and public safety by maintaining a safe and functional inventory of rolling stock.
- Manage asset conditions and maintain a state of good repair in the various MBTA facility and infrastructure systems.

**Organizational Culture and Human Performance**

- Develop, measure, and continually improve a strong safety culture that permeates all levels of MBTA through continual learning, communication, and accountability.
- Develop an extensive employee safety training program that enhances safety culture, increases employee and passenger safety, and sets a standard of excellence for the industry.
- Establish procedures for identifying, monitoring, managing and/or reducing risks and hazards to the greatest extent possible.

**2.5 Safety and State of Good Repair**

The State of Good Repair (SGR) standards will be defined by the National Safety Program and National TAM System upon FTA’s final ruling. These set forth conditions when safety risk analysis must be performed on capital assets such as equipment, rolling stock, infrastructure, and facilities. MBTA shall set safety performance objectives based on this definition when it is available, and make informed investments in order to strive for a State of Good Repair for all assets.

**2.6 Performance Assessment**

MBTA will be required to report to FTA of its progress in reaching its annual objectives and targets.<sup>3</sup> The assessment of MBTA’s progress through studies, surveys, internal audits, and peer reviews will assist FTA in promulgating improvements of performance criteria standards rulemaking as transit safety industry practices and safety issues continue to evolve.

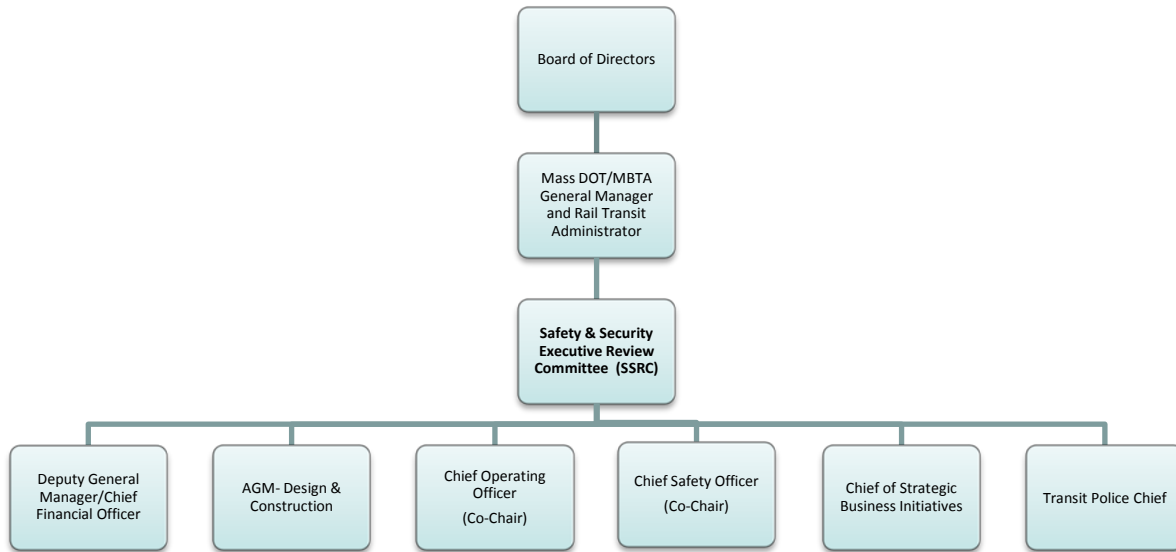
<sup>3</sup> 49 U.S.C § 5326(c)(3)



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**ELEMENT 3: OVERVIEW OF MANAGEMENT STRUCTURE**

Effective implementation of SMS requires top management commitment to safety. At the MBTA, the Safety and Security Executive Review Committee (SSRC) was formed at the behest of the GM with the goal of making MBTA as safe as it can be for everyone, starting with transforming the core values of the organization into a positive safety culture.



**Figure 1: Executive Management Team**

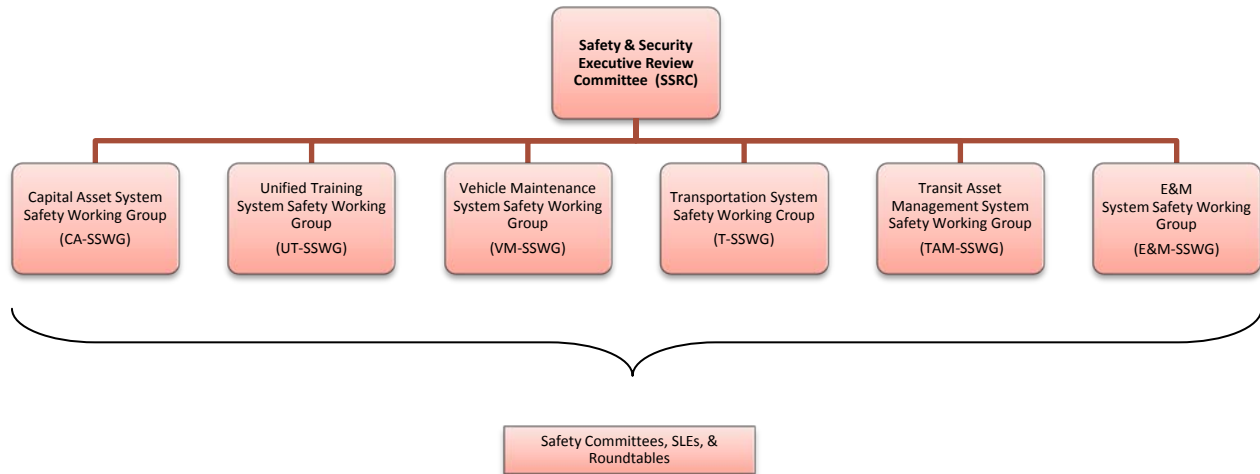
The **GM** is responsible for approval of the MBTA Safety Plan, adoption of safety performance objectives, review of quarterly and annual safety data reports, reviewing and approving MBTA Safety Plan modifications, and reviewing summary reports related to accidents, injuries, and other safety occurrences. The GM is responsible for day-to-day aspects of the transit system and is ultimately the accountable executive responsible for ensuring safety.

The **Safety & Security Executive Review Committee (SSRC)** is the executive management team that meets regularly to discuss safety issues and forward recommendations to the GM. The GM has charged the SSRC and MBTA management to effectively lead, direct, measure, and promote the functional day-to-day aspects of safety as MBTA’s top priority, and to comply with the MBTA Safety Plan. Safety critical issues are elevated to the SSRC from MBTA’s **System Safety Working Groups (SSWGs)**. MBTA’s SSRC members have significant roles in the MBTA Safety Plan’s implementation, effectiveness, and accountability. SSRC members include:

- MBTA Chief Safety Officer
- MBTA Chief Operating Officer
- MBTA Assistant General Manager of Design and Construction
- MBTA Deputy General Manager/Chief Financial Officer
- MBTA Chief of Strategic Business Initiatives
- MBTA Transit Police Chief

The SSRC and other senior executives report directly to the GM. The senior executive team meets regularly with the GM, individually and as a team, on a regular, scheduled, and non-scheduled basis. The

GM and senior executives fully endorse MBTA’s safety policy, safety objectives, the MBTA Safety Plan, and established safety standards.



**Figure 2: System Safety Working Groups**

**System Safety Working Groups (SSWGs)** are management groups which include department directors and/or their designees. They meet monthly to discuss cross-departmental safety issues. The primary mission of each SSWG is to reinforce safety as a priority at the executive management level by demonstrating a commitment to system safety compliance by: convening meetings to review and discuss issues related to the safety of operating vehicles and related facilities (e.g., NTSB recommendations; hazards); ensuring implementation of the MBTA Safety Plan; maintaining an action item matrix, conducting reviews and safety assessments; developing solutions; and making recommendations to the SSRC.

**Safety Committees, Safety Leadership Exchanges (SLEs), & Roundtables** were formed to discuss safety related issues at the non-management level. Regular meetings are held at employee locations and include supervisors, forepersons, officials, union representatives, and employees. Meeting minutes and action items are recorded and tracked to resolution. Issues that cannot be resolved at this level or are identified as a safety hazard trend are raised to SSWGs for review.

**Executive management<sup>4</sup> and field management<sup>5</sup> (MBTA management)** report directly to the senior executives of their respective departments. Executive management personnel may serve as members of SSWGs and thus partake in the discussions of safety topics as outlined above.

Field management reports to their department’s executive management, and may also be members of Safety Committees, SLEs, task groups, and roundtables. At an individual level they are model examples of management committed to prioritizing safety over productivity, and are expected to be at the forefront of duly managing all safety issues brought forth by employees and contractors on a daily basis.

<sup>4</sup> E.g., chiefs, deputy chiefs, department managers, directors, and deputy directors.

<sup>5</sup> E.g., inspectors, facility managers, foremen, and field or facility supervisors.

An essential component of SMS is establishing an effective closed-loop communication line between management and employees needed to further a positive safety culture.

**Employees and contractors** have responsibilities to perform safety functions to ensure their own safety and the safety of coworkers, customers, contractors, emergency responders, and the general public.

### 3.1 Chief Safety Officer

MBTA's Chief Safety Officer (CSO) has been empowered by the GM to govern, administer, oversee, and support the implementation of the MBTA Safety Plan, and resulting safety programs, rules, initiatives, procedures, orders, and processes. The CSO is also responsible for the management and implementation of the MBTA Safety Plan.

The CSO is supported by a department of professional safety leaders known as MBTA Safety. The CSO reports directly to the GM, and meets regularly with the GM, or as necessary in the event of a high priority safety concern. Additionally, the CSO participates in the GM's weekly Senior Staff meeting, with safety included as a standing item on the weekly agenda.

#### 3.1.1 MBTA Safety

MBTA Safety works collaboratively with MBTA management, labor, and contractors to:

- Confirm safety as MBTA's number one priority;
- Advance the MBTA Safety Plan requirements, implementation, and resulting safety programs, policies, improvements, rules, procedures, training programs, and other processes;
- Develop safety performance metrics;
- Follow MBTA's safety risk management processes to track the identification, assessment, and resolution of hazards or concerns in an oversight function;
- Collect, maintain, and analyze safety data to monitor incidents and identify hazards;
- Measure Authority's amenability to the MBTA Safety Plan, and other MBTA Safety requirements;
- Advance implementation and endorse concurrence with applicable transit industry best practices;
- Ensure compliance with federal, state, and local regulations;
- Coordinate and lead ongoing reporting processes and interfaces with federal, state, and local agencies; and
- Effectively communicate changes in safety documents and processes to all personnel.

MBTA Safety consists of a system safety leadership team to administer, facilitate, oversee, and support MBTA management's functional performance of safety and adherence to the MBTA Safety Plan. The team's safety functions include:

- **Safety Oversight** is primarily responsible for compliance with MBTA Safety Plan and safety regulations, data integrity, and reporting. This is accomplished through data collection and analysis, inspections, assessments, and auditing.
- **Transportation Safety** is primarily responsible for hazard investigation and reporting to oversight agencies. This is accomplished through investigations, inspections, and audits of current practices.
- **Engineering and Construction Safety** is primarily responsible for safety oversight of construction projects and practices. This is accomplished by reviewing new and modification plans, monitoring projects to completion, and certifying safety critical items and systems related to projects.

- **Quality Assurance and Workplace Safety** is primarily responsible for oversight of workplace safety using OSHA guidelines as a best practice model. This is accomplished through the development of programs and procedures which are monitored through inspection.
- **Acquisition and Procurement Safety** is primarily responsible for system safety certifications required for vehicles, equipment, and contracted services to ensure compliance with MBTA Safety Plan.

## 3.2 Chief Operating Officer

The Chief Operating Officer (COO) reports directly to the GM. The COO has been delegated by the GM as the responsible executive officer for the safe operation and maintenance of: the heavy rail, light rail, and bus systems; service development; operations security; vehicle engineering; and oversight of contracted services including commuter rail, water transportation, subsidized private carrier bus services, and paratransit services. The day-to-day management and responsibility of safe heavy rail and light rail operations and maintenance functions to the highest practical level have been delegated to: the Chief Maintenance Officer, the Director of Light Rail, the Director of Heavy Rail, the Director of Operations Control Center and Training, the Director of Operations Service Development, the Director of Security Initiatives for Operations, the Director of Vehicle Engineering, and the Chief Railroad Officer.

The COO coordinates with the CSO and other responsible officers and departments to ensure that hazards are quickly and effectively eliminated. The COO has the responsibility to provide job-related safety training for rail personnel and to ensure compliance with the applicable safety rules and regulatory standards through the Director of Operations Control Center and Training. The COO is responsible, through the Director of Operations Control Center and Training, for publishing, issuing, and maintaining rulebooks, which include safety-related rules and procedures for operations and maintenance activities.

### 3.2.1 Transportation Operations

The Transportation Operations directorate includes the following departments:

- Bus Operations
- Heavy Rail Operations
- Light Rail Operations
- OCC & Training
- Rail and Water Transportation Services

### 3.2.2 Operations Mechanical

The Operations Mechanical directorate includes the following department:

- Vehicle Engineering Maintenance
- Vehicle Quality Assurance
- Heavy Rail Maintenance
- Light rail Maintenance
- Bus Maintenance

### 3.2.3 Engineering and Maintenance

The Engineering & Maintenance (E&M) directorate assures safety and MBTA Safety Plan implementation through a variety of documentable identification, inspection, assessment, scheduling, reporting, and prioritization processes; to proactively and responsively address safety hazards and concerns in an expeditious or scheduled manner with available resources, to the highest practical level of safety.

E&M is responsible for design, complying with the safety and security certification, workplace safety and supervision of E&M projects, system maintenance, improvement, and modernization programs associated with facilities, track, signals, communications, and power systems; contract administration; and station, facility, power, track, signal, communication, and security systems engineering and maintenance.

Activities are allocated accordingly to the following departments in the directorate:

- Asset Management and Quality
- Power
- Buildings and Structures
- Finance and Administration
- Signals & Communications
- Maintenance of Way
- Transit Facilities Maintenance
- Training and Resource Development

E&M activities follow federal, state, local, and industry safety regulations, codes, standards, and recommendations (e.g., NTSB, industry best practices). MBTA Safety and E&M management and team members work closely to continually improve safety, reliability, sustainability, and betterment of the transit system.

### 3.3 Assistant General Manager of Design & Construction

The Assistant General Manager of Design and Construction (AGM D&C), at the behest of the GM, is responsible for MBTA's capital expansion, rehabilitation, improvement, and modernization projects. The AGM D&C's management team ensures that projects are designed, engineered, and built safely, pursuant to applicable federal, state, local and industry safety regulations, codes, standards, recommendations, and requirements of the MBTA Safety Plan, including:

- Configuration management & control;
- Safety certification; and
- System modification processes.

Working collaboratively with MBTA management and MBTA Safety, the AGM D&C and his/her team ensure that safety hazards and concerns are adequately addressed prior to revenue service or system changes, following verifiable safety certification, modification, and acceptance processes. Activities are allocated accordingly to the following departments in the directorate:

- Design
- Engineering and Construction
- Quality Assurance/Quality Control
- Communication and Coordination

- Contract Administration

### **3.4 Transit Police Chief**

The Transit Police Chief has been delegated by the GM to provide public safety, security, and law enforcement services to MBTA. Although there is a separate security program in addition to the MBTA Safety Plan, the Transit Police Chief collaborates with MBTA Safety and MBTA management in a coordinated manner to improve and address overlapping safety and security concerns, hazards, and threats; and to work jointly to advance emergency management planning, response, coordination, and drills. As part of Safety Certification and System Modification processes, the Transit Police Chief works with MBTA Safety to integrate and verify security methodologies and criteria into capital projects and changes to the system.

### **3.5 Chief Financial Officer**

The Chief Financial Officer (CFO) reports to the GM and has been delegated responsibilities for management of automated support systems and financial resources. The CFO coordinates with the CSO to ensure that safety goals are met by allocating resources for prioritized safety-related expenses and projects. The CFO's management team operates within the following departments:

- Information Technology
- Treasury Control
- Budget

### **3.6 Chief of Strategic Business Initiatives**

The Chief of Strategic Business Initiatives (CSBI) reports directly to the GM and is responsible for managing a centralized procurement, developing strategic initiatives, service planning, performance monitoring, business analysis, and being involved in environmental affairs and federal / MPO activities. Activities are allocated within the following departments:

- Compliance
- Community Outreach
- Environmental
- Plans and Schedules
- Materials Management

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## ELEMENT 4: MBTA SAFETY PLAN CONTROL AND UPDATE

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This section explains the process used to review, control, and incorporate changes in the MBTA Safety Plan. It includes: performing ongoing assessments of the need for MBTA Safety Plan updates; the process for developing and incorporating Safety Plan updates through interdepartmental cooperation between MBTA Safety, SSWGs, and MBTA management; the requirement for GM approval; and coordination with DPU for submissions and approvals.

### 4.1 Responsibilities

The **GM** has overall responsibility for ensuring review and approval of all MBTA Safety Plan updates on an annual basis and ensuring that the MBTA Safety Plan adequately describes current system safety processes. The GM is also responsible for any submissions required by DPU. GM endorsement of the MBTA Safety Plan is required before implementation.

The **SSRC** is responsible for ensuring review and acceptance of all MBTA Safety Plan updates on an annual basis and to ensure the MBTA Safety Plan adequately describes current system safety processes. SSRC acceptance of the MBTA Safety Plan is required before implementation.

The **Chief Safety Officer**, with support from MBTA Safety, is responsible for overall MBTA Safety Plan control, including distribution of a DPU-approved revision of the MBTA Safety Plan throughout the organization.

**SSWG**s are responsible for contributing to developing and updating the MBTA Safety Plan sections as necessary.

### 4.2 Revision and Update Process

The MBTA Safety Plan continually evolves to reflect system safety advances, changes, or modifications to tasks, activities, and processes. As such, the MBTA Safety Plan is analyzed, reviewed, and/or revised annually and as needed in the event of significant transformations. The MBTA Safety Plan revision and update process is subject but not limited to:

- DPU standards, regulations, and orders;
- Federal, state, and local regulations;
- NTSB recommendations, as applicable;
- Industry best practices, circulars, and guidance, as applicable;
- Capital improvements, modifications, and expansions;
- MBTA Safety Plan policy changes;
- Identification, addition, refinement, and improvement of the MBTA Safety Plan processes, tasks and activities; and
- Organizational changes in safety management systems.

### 4.3 MBTA Safety Plan Internal Review

MBTA shall make all reasonable efforts to adhere to the MBTA Safety Plan internal review process. The process ensures executive management has reviewed and approved the MBTA Safety Plan before any changes are submitted to DPU. The MBTA Safety Plan internal review shall commence March 1, 2015.



#### 4.3.1 SSWG's and MBTA Management Review

- Within thirty (30) calendar days of receiving MBTA Safety Plan element components for review from MBTA Safety, the SSWG's and MBTA management shall submit any comments and/or corrections to MBTA Safety.
- Within fifteen (15) calendar days of receiving SSWG and MBTA management comments and corrections, if any, MBTA Safety shall make those corrections before submitting to the SSRC for review.

#### 4.3.2 SSRC Review

- Within twenty (20) calendar days of receiving the updated version of the MBTA Safety Plan from MBTA Safety, the SSRC shall review and approve, or approve with corrections, the MBTA Safety Plan.
- Within ten (10) calendar days of receiving the SSRC's review and corrections, if any, MBTA Safety shall make those corrections and then submit a revised version to the GM for review.

#### 4.3.3 GM Review

- Within twenty (20) calendar days of receiving the MBTA Safety Plan, the GM shall review and approve the MBTA Safety Plan before it can be submitted to DPU.
- Within ten (10) calendar days of receiving the GM's review and corrections, if any, MBTA Safety shall make those corrections before submitting the revised MBTA Safety Plan to DPU.

### 4.4 State Safety Oversight Safety Plan Review and Approval

The MBTA Safety Plan internal review process must meet mandatory deadlines set by DPU. The GM must review and approve any revisions before submissions to DPU.

#### 4.4.1 Annual Review Cycle

- On or before August 1<sup>st</sup>, annually, MBTA shall start a review of the MBTA Safety Plan.
- On or before September 1<sup>st</sup>, annually, the Chief Safety Officer shall submit an updated MBTA Safety Plan, and any accompanying procedures, for review and approval by DPU. The Authority may request an extension of the deadline for submission, which may be granted or denied at the discretion of DPU.

MBTA must include an identification and explanation of any and all changes. If there are no updates required, MBTA shall notify DPU in writing before September 1<sup>st</sup>.

#### 4.4.2 Modification Requests

Written modification requests may arise outside of the annual review cycle. Modification requests may come from:

- DPU, due to internal audit report results, on-site reviews and investigations, changing trends in accident/incident or security data, or other reasons that may come to the attention of DPU.
- MBTA management, where changes identified will require modification of the MBTA Safety Plan outside the annual review cycle, such as organizational changes or reassignment of functional responsibilities.

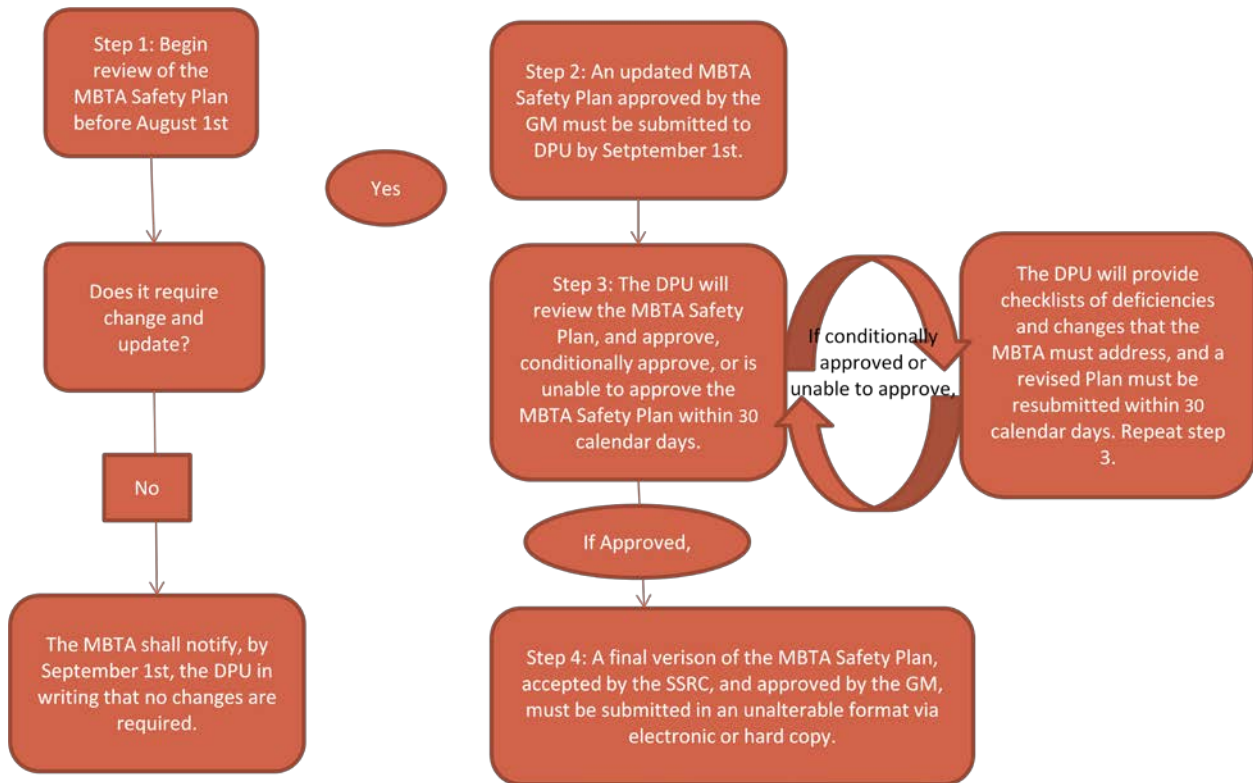
Within thirty (30) calendar days of the event prompting the modification request, MBTA must submit any MBTA Safety Plan changes to DPU for approval in electronic format via email. If MBTA objects to the request change, it must state its objection and suggest alternatives within thirty (30) calendar days.

**4.4.3 Approval**

- Within thirty (30) calendar days of receipt of the revised MBTA Safety Plan, DPU will issue a response that it approves, conditionally approves, or is unable to approve the revisions, along with checklists used to review the MBTA Safety Plan. DPU and MBTA shall then review these objections and alternatives and agree on an appropriate course of action within thirty (30) calendar days once an agreement has been made.
- Within thirty (30) calendar days of DPU’s notice of approval, conditional approval, or inability to approve, MBTA must address noted deficiencies and requested changes in the plan and then submit the revised MBTA Safety Plan to DPU.
- Within thirty (30) calendar days of a DPU issuance of noted deficiencies, if any, MBTA may object and shall state its objections and suggest alternatives. DPU and MBTA shall then review these objections and alternatives and agree on an appropriate course of action within thirty (30) calendar days once an agreement has been made.

**4.4.4 Method of Delivery**

The MBTA Safety Plan should be delivered to DPU in electronic format via email. Once the MBTA Safety Plan has been approved by DPU, MBTA must submit a copy to DPU in an unalterable format (electronic or hard copy). Supporting procedures and referenced materials may be submitted in hard copy, by fax, mail or in-hand delivery.



**Figure 3: SSO Annual Review Cycle**

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## **ELEMENT 5: IMPLEMENTATION, TASKS, ACTIVITIES, AND RESPONSIBILITIES**

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The successful implementation of the MBTA Safety Plan requires full proactive involvement by the entire MBTA. In order to achieve the organization's safety goals and objectives, all MBTA personnel are expected to consider safety as the top priority when making work-related or business decisions.

While MBTA Safety provides management oversight to the implementation of and adherence to the MBTA Safety Plan, the success of this plan is largely dependent on the safety culture that is fostered within each department and the overall workforce. To achieve this, the promotion of a positive safety culture must be undertaken by management staff by defining, understanding, and integrating effective safety practices into day-to-day work activities. Interdepartmental cooperation and clear communication between all levels of the organization are paramount to ensure that the safety of employees, passengers, and guests remain a top priority.

This section delineates specific safety-related activities and/or tasks to be performed, and rules and procedures to be adhered to, by every employee and contractor at MBTA.

Every job description and contract will include its safety roles and responsibilities. Each department is accorded safety functions that it is responsible for implementing.

### **5.1 Element Implementation**

Departments at MBTA will periodically run across issues with safety implications, in the form of hazards. Safety functions must be performed proactively, more so than reactively, to mitigate or eliminate hazards and ensure prevention of incidents or accidents. The MBTA Safety Plan consists of Elements, which are strategic tools used as the means to control risks encountered throughout the organization. The Elements specify safety functions that must be implemented throughout MBTA by every department, as applicable.

The Elements, with the exception of Elements one through six, are not descriptive processes. Each Element is comprehensive in nature, sometimes consisting of more than one process and possibly comprising multiple systems. Multiple supporting documents may be necessary to fully illustrate the functions of an Element.

The MBTA Safety Plan should be read as a guidance document. As such, MBTA personnel are expected to adhere to and exercise their responsibilities prescribed where applicable, and utilize all resources referenced in each Element in order to accomplish the Elements' safety functions.<sup>6</sup>

### **5.2 Responsibilities**

Successful implementation of the MBTA Safety Plan depends upon active participation of MBTA management and MBTA employees, including contractors.

#### **5.2.1 MBTA Safety Functions**

The Chief Safety Officer manages and directs MBTA Safety. MBTA Safety consists of five interdependent functional units: Safety Oversight; System Safety Engineering and Management;

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<sup>6</sup> For example: Under Element 10 (E10), Accident Investigation, MBTA management must respond to an accident incident, or near miss. MBTA management must then refer to the MBTA Accident Investigation Manual listed in E10 for the detailed guide on how to properly conduct the investigation.

Transportation Safety; Corporate Safety, Assurance, & Control; and Acquisitions & Procurement.<sup>7</sup>

MBTA Safety works collaboratively with all other MBTA departments to ensure proper monitoring and implementation of the MBTA Safety Plan.

The **Chief Safety Officer** is responsible for:

- Reporting directly to the General Manager, and advising executive and senior management on all safety policies and related matters, with support from MBTA Safety; and
- Management and oversight of all aspects of the MBTA Safety Plan.

**MBTA Safety** is responsible for:

- Dissemination of the MBTA Safety Plan throughout the organization;
- Monitoring and supporting the implementation and effectiveness of all aspects of the MBTA Safety Plan;
- Monitoring the reporting of accidents and system failures, and determining causes contributing to deficiencies;
- Monitoring occupational safety and health programs for the MBTA's employees and performing periodic evaluations to assure compliance;
- Monitoring, guiding, and supporting activities which may be required to execute the system safety programs throughout MBTA;
- Monitoring the development and implementation of policies and procedures that govern the safety of MBTA vehicles, rights-of-way, facility management, emergency preparedness, and occupational and environmental safety practices;
- Reviewing design documents and specifications and participating in the safety certification process for all construction projects including: MBTA expansion and construction of new facilities; adjacent construction that affects MBTA facilities; and systems, facility and equipment modification and rehabilitation;
- Establishing safety goals, objectives, and performance targets, and analyzing data to monitor achievement of goals, objectives, and performance targets;
- Developing and implementing an internal safety audit program;
- Auditing design changes to ensure that they do not degrade the safety and/or fire protection of MBTA systems;
- Serving as a liaison between MBTA and DPU, FTA, NTSB, and all other applicable agencies;
- Reviewing and promoting safety training programs for employees and contractors; and
- Providing emergency response seven (7) days per week, twenty-four (24) hours a day.

### 5.2.2 Department Management of Safety Functions

MBTA management advocates a healthy work environment and positive safety culture. To accomplish this, management must develop effective safety training programs, provide open communication channels for employees and contractors, and maintain safety vigilance.

**Executive Management** is responsible for:

- The implementation and communication of the MBTA Safety Plan to all MBTA employees and contractors;

<sup>7</sup> See [MBTA Safety Plan 3.1.1](#)

- Clearly communicating these policies to their employees in a manner that promotes safety awareness and encourages all employees to incorporate safety practices into their everyday work;
- Maintaining knowledge of all standard safety policies and procedures, as well as specific safety practices pertinent to his/her division/department/work group;
- Ensuring all employees understand that safety is a priority in the workplace;
- Ensuring compliance with the MBTA Safety Plan, as well as MBTA Safety Policies and Procedures, which includes cooperation with all safety investigations conducted by MBTA or outside agencies such as DPU, NTSB, FTA, or other regulatory agency;
- Ensuring compliance with applicable rules and standard operating procedures;
- Ensuring all safety issues are reported in a timely manner to the proper authority;
- Immediate responsiveness, taking quick corrective action if necessary, and following up on all safety issues reported by an MBTA employee, passenger, external agency, or the general public;
- Ensuring compliance in reporting and evaluating alleged hazards as described in Element 6 of the MBTA Safety Plan;
- Developing and conducting training programs in consultation with MBTA Safety relative to the Safety Plan to underscore and maximize its effectiveness; and
- Ensuring resources are identified in order to support the implementation of identified safety programs and goals.

**Field Management** is responsible for:

- Implementing and monitoring all required safety programs, policies, and procedures in their areas of responsibility, including the safety of employees, customers, the general public, facilities, equipment, operations, and services provided;
- Ensuring employees and contractors comply with all safety programs, policies, rules, and procedures;
- Coordinating and promoting participation in safety committees;
- Communicating with employees and contractors regarding occupational health and safety issues;
- Being able to identify, evaluate, and resolve hazards in a thorough and timely manner;
- Communicating identified hazards and the status of their resolution to employees and contractors.
- Assisting other organizational units in resolving hazards;
- Ensuring that all accidents, injuries, and illnesses occurring in his/her area of responsibility are investigated thoroughly and diligently and recommendations for corrective actions are developed and implemented as warranted; and
- Evaluating the potential impact of proposed modifications on the safety of all affected systems prior to implementation.

### 5.2.3 Employee and Contractor Safety Responsibilities

Every MBTA employee and contractor must know their roles and responsibilities for safety when executing their work activities. All employees and contractors shall actively participate in the MBTA Safety Plan and must adhere to other applicable rulebooks, procedures, standard operating procedures (SOPs), special orders, plans, and policies. Active communication of hazards, sharing of lessons learned, and conscious concern for safety of other employees and the public will ensure an effective safety culture.

**Employees and Contractors** are responsible for:

- Adhering to the transit rules and standard operating procedures in applicable rulebooks as well as all related safety policies, procedures, and practices;

- Promptly reporting accidents, incidents, near misses, and hazards or unsafe conditions to their supervisors, and if necessary, the Safety Hotline, Form B, or invoke a Good Faith Safety Challenge; and
- Being knowledgeable of their roles and responsibilities for safety by successfully completing safety and certification training, as established in their job descriptions and contracts.

## ELEMENT 6: SAFETY RISK MANAGEMENT

Safety Risk Management, also referred as “Hazard Risk Management,” is the formal process to systematically:

- Recognize, identify, and evaluate hazards;
- Resolve or reduce those hazards to an acceptable risk level; and
- Track the effectiveness of hazard controls.

Hazards may be associated with the design, construction, testing, start-up, and operation of a project as well as changes to existing systems.

The system safety approach encourages hazard management throughout the system’s life cycle. Hazard management is most effective when applied during preliminary engineering and final design. Hazard management must also be used to evaluate the safety impacts of deviations from the baseline design, construction change orders and approved equivalencies, and other modifications made during construction, testing, and project activation.

A comprehensive process for identifying, resolving, and tracking safety hazards throughout all phases of project development activity is shown below (Figure 4). Managing hazards through identification, assessment, resolution, acceptance, or tracking closure is an essential function in design from concept through development. An effective hazard management program also provides a crucial tool for determining the safety impacts of engineering change proposals, construction change orders, operational equivalencies, and the issuance of temporary permits and certificates.

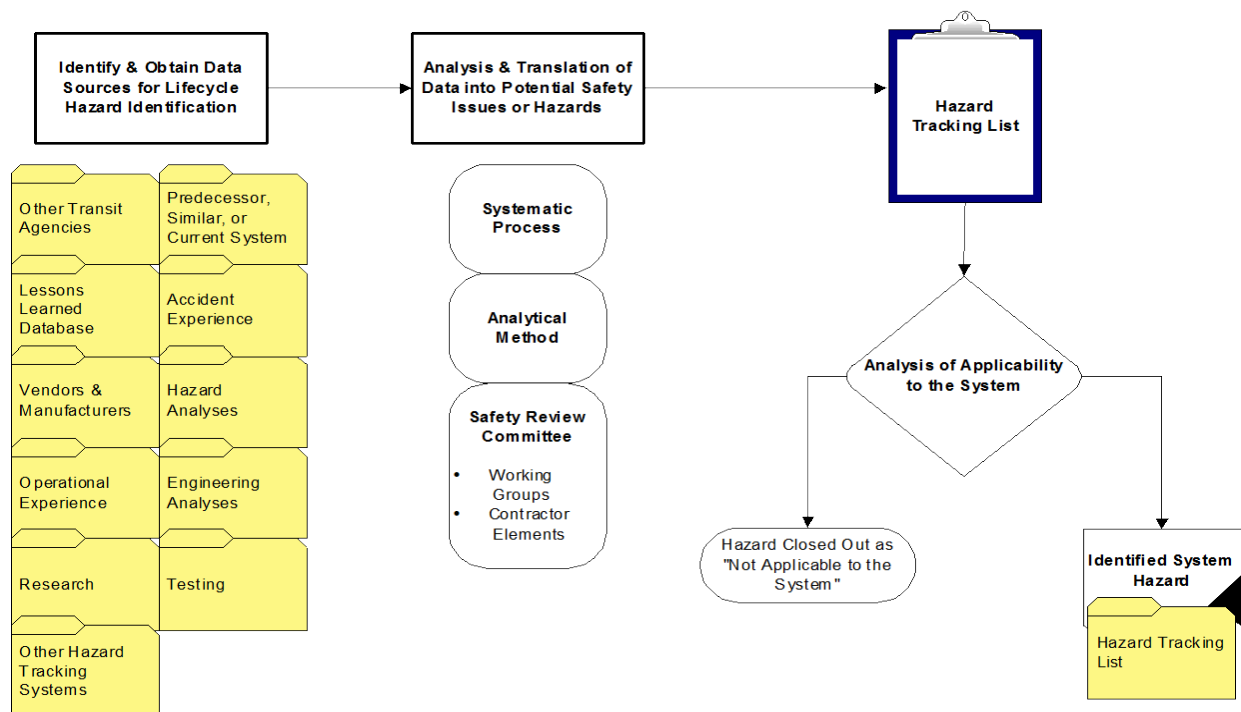


Figure 4: Safety Hazard Identification and Risk Acceptance Process



## 6.1 Responsibilities

**The Safety and Security Executive Review Committee (SSRC):** Responsible for overall oversight, review, analysis, tracking, and resolution of highly safety critical issues that affect or may potentially negatively impact MBTA's system safety programs, plans, processes, committees, and interfaces for all modes of transit.

**System Safety Working Groups (SSWGs):** Responsible for convening monthly meetings to review and discuss issues related to the safety of operating vehicles and industry best practices; ensuring implementation of the MBTA Safety Plan; maintaining an action item matrix; conducting reviews and safety assessments; developing solutions; and making recommendations to the SSRC.

**Safety Committees, SLEs, & Roundtables:** Responsible for rendering evaluation and resolution of hazards and safety risks that cannot be resolved individually by MBTA management. Hazards and risks that cannot be resolved at this level will be elevated to the SSWGs.

**MBTA Safety:** Responsible for the development, implementation, documentation, and oversight of the safety risk management process and safety risk management tools. Additionally, MBTA Safety is responsible for ensuring sign-off by the CSO on acceptance of risk and subsequent sign-off by appropriate MBTA management.

**MBTA Management:** With support from MBTA Safety, responsible for the proactive and continual involvement in the application of the safety risk management process and safety risk management tools in order to identify, evaluate, and resolve safety risks in their areas of responsibilities. MBTA management must ensure their employees are adequately trained to conduct hazard analysis, risk assessment, resolution, and hazard tracking (with MBTA Safety assistance). Specifically, field management (facility managers, supervisors, and forepersons) is responsible for rendering immediate notification, evaluation, resolution, and tracking of day-to-day identified hazards and safety risks. Management must then communicate the resolution of the hazard to the employees within their area(s) of responsibility. Hazards and risks that cannot be immediately resolved through them are elevated to the Safety Committees.

**Employees and Contractors:** Responsible for adhering to all safety procedures and precautions. In the event of discovering a hazard, the employee or contractor must immediately report to MBTA management. A number of sources for internal hazard reporting are available.

## 6.2 Hazard Risk Assessment

Risk is an expression of possible loss over a specific period of time or number of operation cycles and probability of a hazardous event occurring. The hazard management process consolidates all hazard information developed pursuant to the various methodologies for identifying and assessing hazards into a single coordinated process.

A safety risk (level of exposure) assessment procedure is required to establish priorities for corrective action and resolution of identified hazards. Because the priority for system safety is to eliminate hazards by design, a risk assessment procedure considering hazard severity only will generally suffice during the early design phase to minimize hazards. When hazards are not eliminated during the early design phase, a risk assessment procedure, based upon the hazard probability, as well as hazard severity and the cost of corrective action, is required to establish priorities for remedial action and resolution of identified safety risks.

The primary severity and probability classifications to be used are as currently adopted by the U.S. Department of Defense in MIL-STD-882E (2012), the American Public Transportation Association and

the Federal Transit Administration. Manuele’s Risk Score Formula (RSF) from *F.A. Manuele’s Advanced Safety Management: Focusing on Z10 and Serious Injury Prevention* (2008) has been introduced as another viable risk assessment tool.

At MBTA, comparative risk assessment processes will be utilized. The process will be based on the principles, descriptions, and definitions of MIL-STD-882E, and may be enhanced by considering the cost of corrective actions. MBTA may undertake discretionary use of other risk assessment standards (e.g., Manuele’s Risk Score Formula, Pilz Four-Dimensional, MIL-STD-882E’s Software Criticality Assessment, and other best practices) where applicable and appropriate for the task, or at the direction of the CSO.

**6.2.1 MIL-STD-882E**

<b>Descriptive Word</b>	<b>Level</b>	<b>Within Specific Individual Items</b>	<b>Within a Fleet or Inventory</b>
Frequent	A	Likely to occur frequently	Continuously experienced
Probable	B	Will occur several times in life of an item	Will occur frequently
Occasional	C	Likely to occur sometime in life of an item	Will occur several times
Remote	D	Unlikely but possible to occur in life of an item	Unlikely, but can reasonably be expected to occur
Improbable	E	So unlikely, it can be assumed occurrence may not be experienced	Unlikely to occur, but possible
Eliminated	F	Incapable of occurrence. This level is used when potential hazards are identified and later eliminated.	Incapable of occurrence. This level is used when potential hazards are identified and later eliminated.

**Table 1: Qualitative Hazard Probability Ranking**

Category	Severity Descriptions
Category I	Catastrophic: Death or system loss.
Category II	Critical: Severe injury, severe occupational illness, or major system damage.
Category III	Marginal: Minor injury, minor occupational illness, or minor system damage.
Category IV	Negligible: Less than minor injury, occupational illness, or system damage.

Table 2: Severity

Frequency of Occurrence	Hazard Categories			
	I Catastrophic	II Critical	III Marginal	IV Negligible
Frequent	1A - UN	2A - UN	3A - UN	4A - AC/WR
Probable	1B - UN	2B - UN	3B - UD	4B - AC/WR
Occasional	1C - UN	2C - UD	3C - UD	4C - AC
Remote	1D - UD	2D - UD	3D - AC/WR	4D - AC
Improbable	1E - AC/WR	2E - AC/WR	3E - AC/WR	4E - AC
Eliminated	Eliminated			

Table 3: Hazard Risk Assessment Matrix (Probability x Severity)

Legend:	Hazard Risk Index	Acceptance Criteria
	1A, 1B, 1C, 2A, 2B, 3A	UN - Unacceptable
	1D, 2C, 2D, 3B, 3C	UD - Undesirable (decision required)
	1E, 2E, 3D, 3E, 4A, 4B	AC/WR - Acceptable with review
	4C, 4D, 4E	AC - Acceptable without review

Table 4: Acceptance Criteria

### 6.2.1.1 Probability

The probability that a hazard will occur during the planned life expectancy can be described in potential occurrences per unit of time, events, population, terms, or activity. Assigning a quantitative hazard probability to a potential design or procedural hazard may not be possible in all cases. A qualitative hazard probability may be derived from research, analysis, and evaluation of historical safety data from similar systems. Supporting rationale for assigning a hazard probability shall be documented in hazard analysis reports.

*See Table 1*

The assessment of probability of occurrence shall consider the actual size of the fleet inventory or items in the specific system under consideration, based on the current system configuration.

Additionally, frequency of human-induced fault conditions shall be estimated based on systematic review of task and procedure complexity, man-machine interfaces, employee proficiency, and historical data of human-induced error-rates in similar operations (e.g., 1/1000 errors per transaction, for given tasks). The following two aspects of potential hazards should be reviewed in human-induced fault conditions:

- The occupational health and safety hazard to the employee performing the task.
- The system safety hazard that can be inducted into the operational system as a result of the employee act of omission or commission (e.g., maintenance-induced hazard by leaving jumper-wires in vital circuitry of train control, rendering it non-failsafe).

### 6.2.1.2 Severity

Severity is defined as the qualitative measure of a credible mishap resulting from personnel error, environmental conditions, design inadequacies, procedural deficiencies for system, subsystem, or component failure or fault. Severity categories are defined in Table 2.

### 6.2.1.3 Acceptance of Risk

Hazard Risk Index: Following their classification by severity and probability of occurrence, hazards will be given a general priority ranking, so that MBTA management may further assess them through the following criteria:

- Acceptability of the risk to management from a safety-criticality standpoint and determination of the appropriate hazard risk index ranking. This priority ranking of a hazard is called its criticality and is a function of both severity and probability of occurrence. Assigning numeric values to each severity category and probability level and combining them mathematically can quantify criticality. Hazard criticality will be determined qualitatively. The hazard criticality ratings, for acceptability of risk, will be classified in one of the following categories:
  - Unacceptable
  - Undesirable (MBTA management decision required)
  - Acceptable with MBTA management review
  - Acceptable without review
- Determination of cost of corrective action for unacceptable and undesirable hazards.

MBTA's process for acceptance of risk follows the accepted practice of risk assessment described in MIL-STD 882E. Table 3 depicts the hazard risk assessment matrix to evaluate acceptability of risk in identified hazards.

#### 6.2.1.4 Hazard Risk Index & Acceptance Criteria

The Hazard Risk Index (HRI) provides four levels of risk priority. Acceptance Criteria indicates how the hazard should be treated based on the risk priority it poses. For instance, a hazard that has the probability to occur frequently at a catastrophic level will yield an HRI of 1A, a high risk priority. According to the Acceptance Criteria, this hazard would be unacceptable and must be controlled immediately.

*See Table 4*

##### Unacceptable

Hazards with a combination of severity and probability of occurrence 1A, 1B, 1C, 2A, 2B, and 3A are unacceptable and corrective action must be taken to eliminate or control them, by reducing the severity and/or probability of the hazard to an acceptable level.

##### Undesirable

Hazards with a combination of severity and probability 1D, 2C, 2D, 3B, and 3C are undesirable. MBTA management decision is required on the specific method of corrective action based on additional considerations such as the availability of acceptable equivalent methods (workarounds), on a permanent or temporary basis, to mitigate the attendant risk. Undesirable hazards shall be appropriately slated for corrective action as practicable.

##### Acceptable with review

Hazards with a combination of severity and probability 1E, 2E, 3D, 3E, 4A, and 4B are acceptable with review by MBTA management. MBTA management may accept the risk associated with retaining the identified hazard in an “as-is” condition with no further corrective action. Alternatively, MBTA management may prescribe periodic tests and inspections or other preventive measures, to ensure, on a continuing basis, that the original severity and probability ratings are not invalidated over time, by degradation of conditions in the subject item. Proper sign-off on the acceptance of the attendant risk by management is required.

##### Accept without review

Hazards with a combination of severity and probability 4C, 4D, and 4E are acceptable without MBTA management review.

MBTA Safety shall accomplish proper sign-off on acceptance of risk after a review and subsequent sign off by appropriate MBTA management. The resolution action and sign-off on the accepted risk will be coordinated by MBTA Safety, which will maintain all records of the hazard identification, analysis, assessment, and the hazard risk acceptance process.

## 6.3 Resolution

The best method of resolving potential system hazards is to eliminate them. However, this may be impossible or impractical at times. Determination of the method to be employed can be made by conducting a thorough analysis of the system, considering the possible tradeoffs between various alternatives and the system safety requirements. The philosophy dictating these analyses should result in the resolution of alternatives. In general accordance with MIL-STD-882E practices, a number of different means can be employed to resolve identified hazards. These include design changes, the installation of controls and warning devices, and the implementation of special procedures. The order of preference for the means to be used in resolving hazards at MBTA shall be as follows:

- **Design for Minimum Hazard:** Design, redesign, refurbish, or retrofit to eliminate (a.k.a.

“design out”) the hazards through design selection. This may be accomplished through the use of fail-safe devices and principles in design, the incorporation of high-reliability systems and components, and the use of redundancy in hardware and software design.

- **Safety Devices:** Hazards that cannot be eliminated or controlled through design selection shall be controlled to an acceptable level through the use of fixed, automatic, or other protective safety design features or devices. Examples of safety devices include interlock switches, protective enclosures, or machine guards. Care must be taken to ascertain that the operation of the safety device reduces the loss or risk and does not introduce an additional hazard. Safety devices shall also permit the system to continue to operate in a limited manner. Provisions shall be made for periodic functional checks of safety devices.
- **Warning Devices:** When neither design nor safety devices can effectively eliminate or control an identified hazard, devices shall be used to detect the condition and generate an adequate warning signal to correct the hazard or provide for remedial action such as evacuation. Warning signals and their application shall be designed to minimize the probability of incorrect personnel reaction to the signals and shall be standardized within similar systems.
- **Procedures and Training:** Where it is impossible to eliminate or adequately control a hazard through design selection or use of safety and warning devices, procedures and training shall be used to control the hazard. Procedures may include the use of personal protective equipment. Precautionary notations shall be standardized as specified by MBTA Safety. Safety critical tasks and duties and activities throughout MBTA, such as rail vehicle operators’ duties, shall require organizational certification of personnel proficiency.

Resolution of all identified hazards will be monitored by MBTA Safety. IndustrySafe, or a hazard log equivalent, shall be used for tracking the hazard resolution process. Additional documentation, such as comprehensive corrective action plans, shall be developed for those hazards requiring complex and multifaceted resolutions.

If a resolution of a hazard results in the introduction of a new system(s), equipment, or procedure(s), the affected departments(s) must follow the process set forth in Element 7, Management of Change.<sup>8</sup>

## 6.4 Corrective Action Plan Procedure

Upon receipt of a final unacceptable hazardous condition report, MBTA will have 60 days from the triggering event to develop a Corrective Action Plan (CAP) to resolve identified deficiencies and submit it to DPU for review and approval in accordance with DPU regulations, 220 CMR 151.07, Corrective Action Plans.

DPU-approved CAP will be forwarded to the Chief Safety Officer for implementation.

## 6.5 Areas for Hazard Identification and Analysis

Hazard analyses used for hazard identification and assessment encompass all areas within MBTA operations system, including the following:

- All existing elements of the system, which are continually reviewed as part of the Authority’s ongoing risk assessment process;
- Safety analyses conducted by consultants and contractors on new construction and procurement

<sup>8</sup> See MBTA Safety Plan [Element 7, Management of Change](#)

- programs;
- Proposed engineering changes;<sup>9</sup>
- Fixed facilities;
- Vehicles;
- Equipment and subsystems;<sup>10</sup>
- Operating and maintenance rules and procedures, including normal, abnormal, and emergency rules and procedures. These safety hazards include MBTA occupational and employee safety (human error, acts of commission or omission) as well as system and passenger safety hazards;<sup>11</sup>
- Data from accidents, incidents or near misses;<sup>12</sup> and
- Internal and external safety data sources and the experiences of similar systems.<sup>13</sup>

## 6.6 Hazard Notification, Ongoing Reporting, and Tracking

Having a process for notifying reporting, and tracking the hazards allows them to be documented and acknowledged through the proper authorities. It also allows MBTA to track the effectiveness of a safety control to assure that the hazard has been adequately resolved.

### 6.6.1 Hazard Notification to DPU

Pursuant to 220 CMR 151.06, DPU shall be notified by MBTA Safety and/or the OCC of the following types of operation safety hazards:

- Unacceptable condition: Within two to four hours of its occurrence or confirmation of its occurrence and in writing via email or fax by close of business the next business day.
- Undesirable condition: Within 24 to 48 hours of the occurrence or confirmation of its occurrence.
- Any occurrence categorized by one of the following codes (listed in MBTA’s “Manual of Operations”) within two to four hours:
  - Code 1 - Fire or smoke.
  - Code 2 - Person under a train.
  - Code 3 - Train or car derailed.
  - Code 6 - Unusual occurrence.
  - Code 7 - Bomb threat.

Other codes as may be determined by DPU.

After initial notification, DPU may require the Authority to conduct further activities in order to provide more detailed information, including conducting an investigation pursuant to 220 CMR 151.09(3) through (9).

### 6.6.2 Hazard Tracking

MBTA has developed a Hazard Tracking Log that reflects the consolidation of information in the safety risk management process by listing all identified hazards.

<sup>9</sup> See [Element 7, Management of Change](#).

<sup>10</sup> See [Element 14, Facilities and Equipment Safety Inspection](#)

<sup>11</sup> See [Element 13, Rules Compliance](#); see also [Element 11, Emergency Management](#).

<sup>12</sup> See [Element 10, Accident Investigation](#).

<sup>13</sup> See [Element 9, Safety Data Collection and Analysis](#).



MBTA Safety tracks and consolidates all identified hazards and assessment information into a single coordinated electronic database process, called the IndustrySafe Safety Management Software (IndustrySafe), a product by TRA, Inc. It is a web-based software that allows MBTA Safety to accurately, securely, and conveniently log and track all reported hazards, as well as incidents and accidents.

Applicable MBTA departments shall identify and maintain a similar database to track hazards and assessment information, referred to as the Hazard Log. At a minimum, the Hazard Log will include:

- Hazard tracking number;
- Date hazard discovered;
- Type of hazard;
- Source of discovery;
- System, subsystem, or function potentially affected by hazard;
- How the hazard was identified;
- Hazard Risk Assessment (Severity/Probability)
- Corrective action (elimination or control), or assumption of risk;
- Post mitigation Hazard Risk Assessment
- Open or Closed; and
- Follow up Activity (monitor effectiveness, unexpected hazards), if any.

## 6.7 Investigation Procedures for Hazardous Conditions

The following investigation procedures for hazardous conditions shall be utilized:

- MBTA Safety will institute an initial investigation upon notification of the existence of a hazardous condition.
- During the investigation process, if it is determined that an unacceptable hazardous condition exists, MBTA Safety will immediately notify the responsible department manager and DPU, and provide regular status updates regarding the resolution of the unacceptable hazard.
- Upon completion of the investigation process, MBTA Safety will submit an investigation report to the responsible manager(s), executive leadership, and/or DPU, as applicable.

## 6.8 Safety Data Sources for Hazard Identification

MBTA provides a variety of internal and external methods for the employees and the public to report hazards anonymously. Internal safety data sources for hazard identification include, but are not limited to:

- Form B, "Notification to MBTA Safety," Fax to: (617)-222-5127;
- Safety Hotline, (617)-222-5135;
- Safety analysis (when conducted);
- Testing, inspections, and audits (by MBTA Safety and/or by others);
- System Rules Compliance Program Inspection;
- Monitoring special orders and speed restrictions;
- QA/QC data and inspections, Monthly Safety Data Analysis Report; and
- OCC daily logs, load dispatcher reports, yard tower reports, and passenger reports, corroborated by personnel reports.



External safety data sources, which may be reviewed for hazard identification, may include:

- Reports from other properties, outside consultants, APTA, FTA, NTSB, and the FRA; and
- Results from DPU triennial safety review.

## 6.9 Hazard Identification and Analysis Tools

A hazard is any real or potential condition that can cause injury, illness, or death; damage to or loss of a system, equipment or property; or damage to the environment.<sup>14</sup> Recognized hazards must be identified and categorized as to their potential severity and probability of occurrence, and analyzed for potential impact. Those hazards must then be resolved by a hierarchy of controls such as design-out, elimination, substitution, engineering controls, procedures, warning devices, protective equipment, or another method, so that they fall within the level of risk acceptable to responsible MBTA leadership.

The objective of the hazard identification function is to recognize those conditions which have the potential for causing an accident or which can create an unsafe condition. Two basic strategies involve inductive and deductive processes. The most effective inductive or deductive methods should be used as deemed appropriate to identify hazards on a case by case basis. More than one method can be utilized when analyzing a system, subsystem, or component. Formal hazard analysis shall be performed by competent and trained individuals, usually with the assistance of MBTA Safety.

### 6.9.1 Inductive Method

The inductive method or approach, sometimes called the “bottom up” methodology, involves the analysis of system components and their failure states to identify the effects on the total system. Inductive analyses determine the conditions that must be created for part of a subsystem to fail to operate when required, operate when not required, or operate improperly. The inductive method is the preferred approach when proactively identifying potential hazards within a system. The item to be analyzed is first listed by its constituent major assemblies and by its subassemblies. Several inductive methods can be used depending on the circumstances of each case, and at the discretion of management:

- Preliminary Hazard Analysis (PHA);
- Security Analysis (SA);
  - Threat and Vulnerability Assessment (TVA);
- Subsystem Hazard Analysis (SSHA);
- System/Interface Hazard Analysis (SHA);
- Operations and Support Hazard Analysis (O&SHA);
- Human Factors Analysis;
- Hazard and Operability Analysis (HAZOP);
- “What If” Analysis;
  - Checklists;
  - Why & How;
- Failure Modes and Effects Analysis (FMEA);
- Software Safety Analysis;
- Fault Tree Analysis; and
- Root Cause Analysis.

<sup>14</sup> See 220 CMR § 151.02, Definitions.

### 6.9.1.1 Preliminary Hazard Analysis

Purpose: PHA is used to identify and evaluate safety critical areas of subsystems and components within the system and provide input for the hazard analysis.

When to use: It is usually performed during early design stages, and then may be repeatedly performed at various stages of the design. It is also used in evaluating existing designs and can be performed as a follow up activity over the course of a system's life cycle. Various inputs for preliminary hazard analysis include:

- Preliminary system description;
- Generic hazards;
- Known hazards;
- Codes, standards, and recommended practices;
- Mathematical models, scale models, mock-ups, and breadboards; and
- Fault trees.

### 6.9.1.2 Subsystem Hazard Analysis

Purpose: SSHA is used to identify and evaluate specific hazards of a major subsystem, in addition to safety concerns such as failures, faults, processes, or procedures, and human errors resulting from multi-subsystem, component, equipment, and human interfacing. SSHA also evaluates hazard controls that are in place and how those controls are verified.

When to use: It is usually performed during the early stages (*e.g.*, design, construction, and procurement) of system development. Various inputs for subsystem hazard analysis include:

- Previous experience;
- Manufacturer's drawings and designs;
- Reliability data;
- Codes, standards, and recommended practices;
- Results of PHA; and
- Results of Security Analysis (SA).

### 6.9.1.3 System/Interface Hazard Analysis

Purpose: SHA is used to identify and evaluate hazards across subsystems and interfaces as a whole system. The analysis is identical to SSHA, including the inputs used.

When to use: It is usually performed at the same time as SSHA; during the early stages.

### 6.9.1.4 Operating and Support Hazard Analysis

Purpose: O&SHA is used to identify and evaluate hazards associated with operations and support procedures. It also evaluates the effectiveness of operations and support procedures used to eliminate or reduce hazards.

When to use: The analysis should be performed during the modification or upgrade of a system or process. However, it is best performed during the final design and then performed as a follow up activity over the course of a system's life cycle. Various inputs for an O&SHA include:

- All types of operations related to hardware, software, facilities, equipment, procedures, personnel, operating environment, and human-machine interfaces;
- Support operations;

- Maintenance; and
- Other hazard analyses.

#### 6.9.1.5 Human Factors Analysis

Purpose: Human Factors Analysis is used to identify and evaluate hazards associated with human behavior. It can be considered an extension of the O&SHA analysis, but Human Factors Analysis focuses more on correcting human errors when interacting with machines and other people, as opposed to O&SHA's broader scope.

When to use: The analysis should be performed during the final design and then again as a follow up activity over the course of a system's life cycle. Various inputs for Human Factors Analysis include:

- Work environment;
- Procedures and instructions;
- Performance requirements;
- Design;
- Training;
- Skill;
- Psychological factors;
- Stressors;
- Mismatching tasks with the person; and
- Other hazard analyses.

#### 6.9.1.6 Hazard and Operability Analysis

Purpose: HAZOP analysis is used to comprehensively identify and evaluate hazards and inefficiencies in a system. The analysis is group oriented: a team of varied experiences and expertise systematically analyzes, through use of guide words, a system by identifying potentially hazardous scenarios; providing documented recommendations for control; and tracking implementations for hazard control. An example for beginning a HAZOP analysis is for the team to pose the question, "How could a system deviate from its intended function and what would its effects be?" The use of guide words assist in stimulating brainstorming ideas to address potential deviations that may result in a hazard.

When to use: HAZOP can be performed during any stage of the life cycle of the system, though it is usually performed in the early design. Various inputs for a HAZOP analysis include:

- Process and instrument drawings;
- Manufacturer's drawings and designs;
- Process flow diagrams;
- Operation procedures;
- Operating parameters;
- Results of other hazard analyses (including other HAZOPs of similar systems);
- Incident or accident reports; and
- Equipment specifications.

#### 6.9.1.7 Failure Modes and Effects Analysis

Purpose: FMEA is used to identify and evaluate failures of the component or subsystem, which could lead to a hazard or single point failure. A single point failure is an individual malfunction that could lead to a shutdown of the entire system. Once a single point failure is identified, it must be designed out or

addressed with controls that make the system less sensitive to a failure/shutdown. A failure is not to be confused with a hazard, as a hazard can still be present in a system where failure has not occurred.

When to use: FMEA should be performed from preliminary design and at various points until actual construction. Various inputs for FMEA include:

- Premature operation;
- Failure to operate at a prescribed time;
- Intermittent operation;
- Failure to cease operation at a prescribed time;
- Loss of output or failure during operation;
- Inefficient output or operational capability; and
- Single point failure.

**6.9.1.8 Software Safety Analysis**

Purpose: SSA is used to identify software hazards that could compromise the operability and safety of the transit system, subsystems, or components. It also highlights key automated equipment and what their failures could entail.

When to use: SSA is usually conducted during the planning and design stages of a project. Various inputs for SSA include:

- Results of other hazard analyses;
- Software functionality;
- Out-of-time functions;
- Out-of-time sequences;
- Function degradation;
- Inappropriate response to system stimuli; and
- Human error.

**6.9.1.9 Security/Threat and Vulnerability Assessment<sup>15</sup>**

Purpose: TVA provides a process to consider the likelihood that a specific threat will endanger the system. TVA also identifies activities or engineer design that can be used to reduce endangerment or mitigate consequences.

When to use: TVA shall be conducted whenever a new asset or facility is added to the system. Various inputs for TVA include:

- Historical data;
- Intelligence assessment;
- Capabilities assessment;
- Critical assets analysis;
- Threat identification;
- Vulnerability identification;
- Accessibility;

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<sup>15</sup> Subject to Security Sensitive Information (SSI) restrictions pursuant to M.G.L. ch. 313 of the Acts of 2002, and 49 C.F.R. § 15. Additionally, TVA is usually performed with the assistance of MBTA Transit Police and MassDOT Security and Emergency Management Department.

- Location;
- Scenarios; and
- Other hazard analyses.

#### 6.9.1.10 “What if”/ Safety Checklists

Purpose: “What if”/Safety Checklists are similar to HAZOP, but require less training and expertise to perform. The analysis is also less comprehensive than HAZOP, but is much easier to implement. A “What if?” considers scenarios that would cause undesirable events. By having a knowledgeable person about the system conduct a “What if?” assessment, this simplistic method may yield very useful information.

When to use: A “What if” analysis is an informal and inexpensive way to estimate the extent of a system’s safety issues. It may be used when there is not a lot of time for decision making and for contingency planning.

### 6.9.2 Deductive Method

The deductive process, or “top down” methodology, involves defining an undesired event (hazard) and then deducing the combinations of conditions and acts necessary to produce that hazard. A deductive approach is preferred when identifying the root cause of an incident. Examples of deductive processes include:

- Fault Tree Analysis (FTA); and
- Root Cause Analysis (RCA).

#### 6.9.2.1 Fault Tree Analysis

Purpose: Fault Tree Analysis is a logic model used to identify a combination of faults and component failures of subsystems or components that must occur in order to cause an undesired outcome or event. It is also used to determine the effectiveness of a corrective action. Fault Tree Analysis is a powerful tool for qualitative analysis, though it can also be quantified.

When to use: The fault tree analysis should be performed between preliminary design and end of final design stages. It may be performed to determine the effectiveness of a corrective action, or to demonstrate how many things must go wrong for an accident or incident to occur. Various inputs include:

- Component hardware failures;
- Software glitches;
- Human errors; and
- Environmental conditions.

#### 6.9.2.2 Root Cause Analysis

Purpose: RCA identifies the root causes of events in order to make recommendations to prevent reoccurrence. RCA is a reactive approach to hazard analysis, and is an effective tool for understanding why and how an event occurred.

When to use: RCA is used during investigation after the occurrence of an event. Various inputs include:

- Information gathered from investigation;
- Causal factors;
- Design;

- Human errors;
- Equipment failures; and
- Training.

## 6.10 Alternate Risk Assessment Tools

In addition to the primary risk assessment tool based on MIL-STD-882E, alternate risk assessment tools (e.g., Manuele’s RSF, Pilz Four-Dimensional, MIL-STD-882E’s Software Criticality Assessment, and other best practices) may be utilized where applicable and appropriate, at the direction of the CSO, or as prescribed by contractual requirements.

### 6.10.1 The Risk Score Formula

Manuele’s Risk Score Formula<sup>16</sup> is a numerical statistical risk-scoring system which allows more effective quantification of the level of risk posed by various hazards and their associated incidents and exposures, with a greater degree of risk certainty. A quantitative risk score rating can be calculated using Manuele’s Risk Score Formula:

$$Risk\ Score = (Probability\ Rating + Frequency\ of\ Exposure\ Rating) \times Severity\ Rating$$

$$RS = (PR + FER) \times SR$$

The ratings for risk evaluation are enumerated below:

Probability		Frequency of Exposure		Severity	
Frequent (Fre)	15	Often (Of)	13	Catastrophic (Cat)	50
Likely (Lik)	9	Occasional (Oc)	10	Critical (Cri)	40
Occasional (Occ)	4	Infrequent (In)	7	Medium (Med)	25
Remote (Rem)	1	Seldom (Se)	4	Minimal (Min)	10
Improbable (Imp)	0.5				

**Table 5: Risk Ratings**

<sup>16</sup> Manuele, Fred A. *Advanced Safety Management: Focusing on Z10 and Serious Injury Prevention*. New York: John Wiley & Sons, 2008.

The action and acceptance criteria as recommended by Manuele (shown below) denote the recommended response based on the associated Risk Score. In addition, the scale allows for prioritization of hazard mitigation based on the score.

Risk	Score	Action or Acceptance
High	>800	Operation not permissible
Serious	500–799	High priority remedial action
Moderate	200–499	Remedial actions taken at appropriate time
Low	<200	Risk is acceptable, remedial action discretionary

**Table 6: Manuele Action or Acceptance Criteria**

### 6.10.2 Software Contribution to System Risk

The assessment of risk for software, and consequently software-controlled or software-intensive systems, cannot rely solely on the risk severity and probability. Determining the probability of failure of a single software function is difficult and cannot be based on historical data. Software is generally application-specific and reliability parameters associated with it cannot be estimated in the same manner as hardware. Therefore, another approach shall be used for the assessment of software’s contributions to system risk that considers the potential risk severity and the degree of control that software exercises over the hardware.

Level of Rigor (LOR) is the specification of the depth and breadth of software analysis and verification activities necessary to provide a sufficient level of confidence that a safety-critical or safety-related software function will perform as required.

#### 6.10.2.1 Software Assessments

Tables 7-9 shall be used for software risk assessment, unless tailored alternative matrices are formally approved. The degree of software control is defined using the Software Control Categories (SCC) in Table 7 (or approved tailored alternative). Table 8 provides the Software Safety Criticality Matrix (SSCM) based on Table 2 severity categories and Table 7 SCCs. The SSCM establishes the Software Criticality Indices (SwCIs) used to define the required LOR tasks. Table 9 provides the relationship between the SwCI, the LOR tasks, and how failure to meet LOR task requirements affects software’s contribution to risk.

All SCCs should be re-evaluated if legacy software functions are included in a System-of-Systems (SoS) environment. The legacy functions should be evaluated at both the functional and physical interfaces for potential influence or participation in top-level SoS mishap and hazard causal factors.

The system safety and software system safety hazard analysis processes identify and mitigate the exact software contributors to hazards and mishaps. The successful execution of pre-defined LOR tasks increases the confidence that the software will perform as specified to software performance requirements, while reducing the number of contributors to hazards that may exist in the system. Both processes are essential in reducing the likelihood of software initiating a propagation pathway to a hazardous condition or mishap.



SOFTWARE CONTROL CATEGORIES		
Level	Name	Description
1	<b>Autonomous (AT)</b>	<ul style="list-style-type: none"> <li>Software functionality that exercises autonomous control authority over potentially safety-significant hardware systems, subsystems, or components without the possibility of predetermined safe detection and intervention by a control entity to preclude the occurrence of a mishap or hazard. <i>(This definition includes complex system/software functionality with multiple subsystems, interacting parallel processors, multiple interfaces, and safety-critical functions that are time critical.)</i></li> </ul>
2	<b>Semi-Autonomous (SAT)</b>	<ul style="list-style-type: none"> <li>Software functionality that exercises control authority over potentially safety-significant hardware systems, subsystems, or components, allowing time for predetermined safe detection and intervention by independent safety mechanisms to mitigate or control the mishap or hazard. <i>(This definition includes the control of moderately complex system/software functionality, no parallel processing, or few interfaces, but other safety systems/mechanisms can partially mitigate. System and software fault detection and annunciation notifies the control entity of the need for required safety actions.)</i></li> <li>Software item that displays safety-significant information requiring immediate operator entity to execute a predetermined action for mitigation or control over a mishap or hazard. Software exception, failure, fault, or delay will allow, or fail to prevent, mishap occurrence. <i>(This definition assumes that the safety-critical display information may be time-critical, but the time available does not exceed the time required for adequate control entity response and hazard control.)</i></li> </ul>
3	<b>Redundant Fault Tolerant (RFT)</b>	<ul style="list-style-type: none"> <li>Software functionality that issues commands over safety-significant hardware systems, subsystems, or components requiring a control entity to complete the command function. The system detection and functional reaction includes redundant, independent fault tolerant mechanisms for each defined hazardous condition. <i>(This definition assumes that there is adequate fault detection, annunciation, tolerance, and system recovery to prevent the hazard occurrence if software fails, malfunctions, or degrades. There are redundant sources of safety-significant information, and mitigating functionality can respond within any time-critical period.)</i></li> <li>Software that generates information of a safety-critical nature used to make critical decisions. The system includes several redundant, independent fault tolerant mechanisms for each hazardous condition, detection and display.</li> </ul>
4	<b>Influential</b>	<ul style="list-style-type: none"> <li>Software generates information of a safety-related nature used to make decisions by the operator, but does not require operator action to avoid a mishap.</li> </ul>
5	<b>No Safety Impact (NSI)</b>	<ul style="list-style-type: none"> <li>Software functionality that does not possess command or control authority over safety-significant hardware systems, subsystems, or components and does not provide safety-significant information. Software does not provide safety-significant or time sensitive data or information that requires control entity interaction. Software does not transport or resolve communication of safety-significant or time sensitive data.</li> </ul>

Table 7: Software Control Categories

### 6.10.2.2 Software Safety Criticality Matrix

The SSCM (Table 8) uses Table 2 severity categories for the columns and Table 8 software control categories for the rows. Table 8 assigns SwCI numbers to each cross-referenced block of the matrix. The SSCM shall define the LOR tasks associated with the specific SwCI. Although it is similar in appearance to the Risk Assessment Matrix (Table 3), the SSCM is not an assessment of risk. The LOR tasks associated with each SwCI are the minimum set of tasks required to assess the software contributions to the system-level risk.



SOFTWARE SAFETY CRITICALITY MATRIX				
	SEVERITY CATEGORY			
SOFTWARE CONTROL CATEGORY	Catastrophic (1)	Critical (2)	Marginal (3)	Negligible (4)
1	SwCI 1	SwCI 1	SwCI 3	SwCI 4
2	SwCI 1	SwCI 2	SwCI 3	SwCI 4
3	SwCI 2	SwCI 3	SwCI 4	SwCI 4
4	SwCI 3	SwCI 4	SwCI 4	SwCI 4
5	SwCI 5	SwCI 5	SwCI 5	SwCI 5

SwCI	Level of Rigor Tasks
SwCI 1	Program shall perform analysis of requirements, architecture, design, and code; and conduct in-depth safety-specific testing.
SwCI 2	Program shall perform analysis of requirements, architecture, and design; and conduct in-depth safety-specific testing.
SwCI 3	Program shall perform analysis of requirements and architecture; and conduct in-depth safety-specific testing.
SwCI 4	Program shall conduct safety-specific testing.
SwCI 5	Once assessed by safety engineering as Not Safety, then no safety specific analysis or verification is required.

NOTE: Consult the Joint Software Systems Safety Engineering Handbook and AOP 52 for additional guidance on how to conduct required software analyses.

Table 8: Software Safety Criticality Matrix

**6.10.2.3 Assessment of Software Contribution to Risk**

The Table 8 LOR tasks shall be performed to assess the software contributions to the system-level risk. Results of the LOR tasks provide a level of confidence in safety-significant software and document causal factors and hazards that may require mitigation. Results of the LOR tasks shall be included in the risk management process.

If the required LOR tasks are not performed, then the system risk contributions associated with unspecified or incomplete LOR tasks shall be documented according to Table 9. Table 9 depicts the relationship between SwCI, risk levels, completion of LOR tasks, and risk assessment.

All software contributions to system risk, including any results of Table 9 application, shall be documented in the Hazard Tracking System.

RELATIONSHIP BETWEEN SwCI, RISK LEVEL, LOR Tasks, AND RISK		
Software Criticality Index (SwCI)	Risk Level	Software LOR Tasks and Risk Assessment/Acceptance
SwCI 1	High	<ul style="list-style-type: none"> <li>If SwCI 1 LOR tasks are unspecified or incomplete, the contributions to system risk will be documented as HIGH and provided to the PM for decision. The PM shall document the decision of whether to expend the resources required to implement SwCI 1 LOR tasks or prepare a formal risk assessment for acceptance of a HIGH risk.</li> </ul>
SwCI 2	Serious	<ul style="list-style-type: none"> <li>If SwCI 2 LOR tasks are unspecified or incomplete, the contributions to system risk will be documented as SERIOUS and provided to the PM for decision. The PM shall document the decision of whether to expend the resources required to implement SwCI 2 LOR tasks or prepare a formal risk assessment for acceptance of a SERIOUS risk.</li> </ul>
SwCI 3	Medium	<ul style="list-style-type: none"> <li>If SwCI 3 LOR tasks are unspecified or incomplete, the contributions to system risk will be documented as MEDIUM and provided to the PM for decision. The PM shall document the decision of whether to expend the resources required to implement SwCI 3 LOR tasks or prepare a formal risk assessment for acceptance of a MEDIUM risk.</li> </ul>
SwCI 4	Low	<ul style="list-style-type: none"> <li>If SwCI 4 LOR tasks are unspecified or incomplete, the contributions to system risk will be documented as LOW and provided to the PM for decision. The PM shall document the decision of whether to expend the resources required to implement SwCI 4 LOR tasks or prepare a formal risk assessment for acceptance of a LOW risk.</li> </ul>
SwCI 5	Not Safety	<ul style="list-style-type: none"> <li>No safety-specific analyses or testing is required.</li> </ul>

Table 9: Relationship Between SwCI, Risk Level, LOR Tasks, and Risk

### 6.11 Safety Design Reviews

Several activities are conducted to assure that designs incorporate and achieve safety requirements. MBTA Safety reviews all facilities and systems designs for safety input. Disposition of comments are resolved through MBTA design review process. In addition, designs are formally certified and safety items are identified through standards and requirements. Industry standards and experience are also used to evaluate unique issues related to transit safety. In several cases, special studies or analyses are performed to address specific safety issues. Figure 5 provides the basic hazard reduction order of precedence to eliminate hazards and minimize risk. In the case of new capital projects, the Chief Safety Officer works with both the Design and Construction Directorate and the Transit Police to develop a Safety and Security Management Plan as required by FTA.

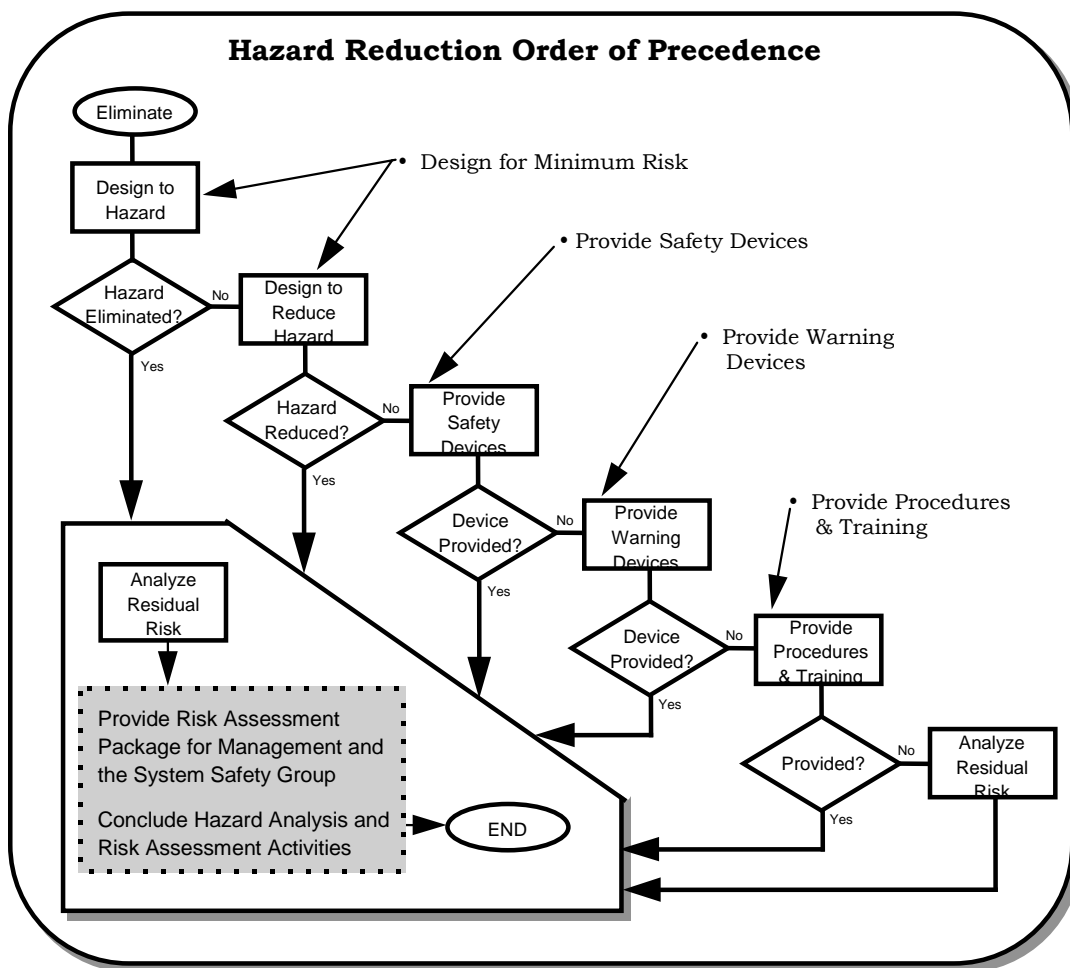


Figure 5: Hazard Reduction Order of Precedence

## **PART II: RISK CONTROL STRATEGIES**

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## ELEMENT 7: MANAGEMENT OF CHANGE

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### Purpose

The purpose of Management of Change is to ensure that a process is in place for the control of changes and/or system modifications to MBTA owned and operated equipment and/or facilities. This process will ensure that changes and/or modifications to any aspect of MBTA's system have been systematically planned, evaluated, and approved by all appropriate departments and/or personnel. It ensures all modifications to MBTA systems, vehicles, equipment, facilities, plans, procedures, and training programs are systematically reviewed for compliance with established system safety and security requirements, and verified prior to implementation of revenue service.

The Management of Change process is documented through the MBTA System Modification Safety Program and all other pertinent documents within, and as referenced below.

### Scope

Management of Change verifies that safety and security requirements have been appropriately addressed and incorporated into the modification of vehicles, equipment, operating and maintenance plans, facilities, and procedures. System modifications are typically performed for the following reasons:

- Improving safety;
- Introducing new materials;
- New equipment or facilities;
- Expanding service;
- Improving performance;
- Increasing reliability;
- Creating better maintainability;
- Financial considerations; or
- Introduction of new codes, standards, or regulations.

The scope of the Management of Change program may include those activities requiring formal Safety and Security Certification, such as major capital improvements and new vehicle procurements and acquisitions.

### Regulatory Compliance

In accordance with 49 CFR 659.19(g), DPU is required to review and approve the Safety and Security Certification section of the MBTA Safety Plan. In response to 49 CFR 659, the Massachusetts state legislature promulgated 220 CMR 151.03(2)(g), which requires:

“A description of the process used by the Transportation Authority to ensure that safety concerns are addressed in modifications to existing systems, vehicles, and equipment, which do not require formal safety certification but which may have safety impacts.”

## Responsibilities

**Safety and Security Executive Review Committee (SSRC):** Responsible for internal oversight providing assurance that safety and security related elements are in compliance with applicable guidelines, and are properly integrated with existing MBTA standards for maintaining a safe and fully functional transit system.

**System Safety Working Groups (SSWGs):** Safety committee formed for the purpose of developing and reviewing proposed changes within a facility, vehicle, station or a system/subsystem. The SSWG consists of representatives, usually executive managers, from various departments. SSWGs are a way of establishing interdepartmental communication when addressing safety issues.

**Capital Asset System Safety Working Group (CA-SSWG):** Responsible, in part or in whole, for the oversight of system modification activities including the review of proposed changes, test results, and other documentation submitted. In addition, the CA-SSWG is responsible for recommending approval of various project elements to the SSRC before the elements enter revenue service. The multi-departmental members of the CA-SSWG include a wide range of expertise on the systems being installed, as well as their impact and integration into existing operations and maintenance.

**MBTA Safety:** Responsible for the development of the Management of Change Program and monitoring its implementation and effectiveness. In addition, MBTA Safety co-chairs the CA-SSWG, and Safety and Security Certification Working Groups (Project SSWGs), as well as the SSRC. MBTA Safety also supports Design and Construction, Vehicle Maintenance, Engineering and Maintenance, MBTA Operations, and MBTA management across all other departments as necessary in evaluating hazards associated with the change or its implementation.

**MBTA Management:** Responsible for identifying and resolving hazards associated with a change or its implementation through the safety risk management process. They must also communicate with other departments who are affected by a change or modification. Specific departmental responsibilities are described below.

**Design and Construction:** Responsible for MBTA's capital improvements program, which includes the planning phases, design/engineering phase, and the construction and closeout phases. In addition, Design and Construction, with its complete project team, plans, directs, and manages all tasks required to complete the project from preliminary engineering through construction and project closeout.

Smaller Design and Construction projects, such as renovating/reconstructing existing facilities and structures, are considered system modifications. Some of these projects require a documented modified level of Safety and Security Certification.

**Vehicle Maintenance:** Responsible for proposing, designing, implementing, testing, and documenting MBTA's vehicle modifications and changes.

**Engineering and Maintenance:** Responsible for proposing, designing, implementing, testing, and documenting modifications and changes to MBTA system infrastructure, including but not limited to track, signals, power systems, communications, and facilities.

**MBTA Operations:** Responsible for requesting, proposing, implementing, testing, and documenting modifications and changes to MBTA system infrastructure that will affect operations directly. In addition, MBTA Operations is responsible for the development and revision of operating rules.

**MBTA Transit Police:** Responsible for working collaboratively with MBTA management and MBTA Safety to identify security threats and vulnerabilities. MBTA Transit Police also participates in the process as a member of the SSRC and the project SSWGs.

## References

*Documents listed within this element are incorporated by reference, and intended to comply with federal and state regulation requirements.*

MBTA System Modification Safety Program # SAF2.01.00 – drafted 04/18/14 (under review)

Applicable MBTA Standard Operating Procedures, Rules, and Special Orders



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## ELEMENT 8: SAFETY AND SECURITY CERTIFICATION

### Purpose

The purpose of Safety and Security Certification is to ensure that all MBTA project systems, equipment, facilities, plans, procedures, and training programs are systematically reviewed for compliance with established system safety and security requirements, and verified prior to implementation of revenue service.

The objectives of Safety and Security Certification are to:

- Establish a formalized process through documentation to verify compliance with system safety and security requirements;
- Ensure that system safety and security is an integral part of design, procurement, construction, testing, and operations;
- Ensure that system safety and security decisions are made by appropriate Project Managers, committees, and responsible contractors;
- Ensure that all system safety and security hazards and vulnerabilities that become apparent during reviews, audits, inspections, or system testing are resolved through the most appropriate means of eliminating or reducing hazards to an acceptable level of risk; and
- Ensure that affected outside response agencies, including the affected fire and police departments, are prepared to respond to normal, abnormal, and emergency situations.

The Safety and Security Certification process is documented in the MBTA Safety and Security Certification Program (SSCP) and all other pertinent documents within, and as referenced below.

### Scope

Safety and Security Certification verifies that safety and security requirements have been appropriately addressed and incorporated in the equipment, operating and maintenance plans, facilities, and procedures for the following three categories:

- **System-wide Elements:** Includes but not limited to: Passenger vehicles, catenary, traction power, train control system, voice and data communications, Closed Circuit TV, grade crossing and traffic control system, intrusion detection system, traction power substations, central instrument houses, track, fare collection, supervisory control, fire protection and suppression systems, and auxiliary vehicles and equipment.
- **Fixed Facilities:** Includes but not limited to: Stations and shelter stops, pedestrian bridges, yard and shop, structures, and the control center. Equipment installed in stations or shelter stops such as HVAC, escalators, and elevators is also considered part of the facility.
- **Plans, Procedures, and Training:** Includes but not limited to: Emergency preparedness plans, security plans and procedures, training programs, rule books, and standard operating procedures.

## Regulatory Compliance

In accordance with 49 CFR 659.19(h), DPU is required to review and approve the Safety and Security Certification section of the MBTA Safety Plan. In response to 49 CFR 659, the Massachusetts state legislature promulgated 220 CMR 151.03(2)(h), which requires:

“A description of the safety certification process required by the Transportation Authority to ensure that safety concerns and hazards are adequately addressed prior to the initiation of major projects to extend, rehabilitate, or modify an existing system, or to replace vehicles and equipment.”

## Responsibilities

**Safety and Security Executive Review Committee (SSRC):** Responsible for the overall acceptance and certification of a project’s safety and security. Their internal oversight provides assurance that the related safety and security elements are in compliance with applicable guidelines, and are properly integrated with existing MBTA standards for maintaining a safe and fully functional transit system. Acceptance by the SSRC will be based on recommendations from the Safety and Security Certification Working Group.

**Safety and Security Certification Working Groups (Project SSWGs):** Responsible for managing, coordinating, and verifying project safety and security certification activities, including the review of safety- and security-related test results as well as all other related documentation. The multi-departmental members of the Project SSWGs include a wide range of expertise on the systems being installed, as well as their impact and integration into existing operations and maintenance. In addition, the Project SSWGs are responsible for recommending the Safety and Security Certification approval of various project elements to the SSRC before the elements enter revenue service. Members of the Project SSWGs have the opportunity to recommend a disposition for each safety and security element through a voting process.

**MBTA Safety:** Responsible for the development of the Safety and Security Certification Program and monitoring its implementation and effectiveness. In addition, MBTA Safety co-chairs Project SSWGs, as well as the SSRC, supporting Design and Construction, Vehicle Engineering, and MBTA management. At the completion of the project, the Chief Safety Officer, on behalf of the SSRC, will submit a Project/Procurement certification letter to the General Manager and MBTA/MassDOT Board as described in the Safety and Security Certification Program.

**Design and Construction:** Responsible for MBTA’s capital improvements program, which includes the planning, design/engineering, and construction and closeout phases. In addition, Design and Construction, with its complete project team, plans, directs, and manages all tasks required to complete the project from preliminary engineering through construction and project closeout. The project team is also responsible for coordinating safety and security certification activities.

**Vehicle Engineering:** Responsible for MBTA’s vehicle procurement program, which includes the planning, design/engineering, and acquisition and closeout phases. In addition, Vehicle Engineering, with its complete project team, plans, directs, and manages all tasks required to complete the procurement from preliminary engineering through acquisition and project closeout. Lastly, the project team is responsible for coordinating safety and security certification activities for procured vehicles.

**MBTA Transit Police:** Responsible for working collaboratively with MBTA management and MBTA Safety to identify security threats and vulnerabilities. MBTA Transit Police also participates in the process as a member of the SSRC and the project SSWGs.

**References**

*Documents listed within this element are incorporated by reference, and intended to comply with federal and state regulation requirements.*

MBTA Safety and Security Certification Program # SAF2.02.00 - (presently being drafted)

Applicable MBTA Standard Operating Procedures, Rules, and Special Orders

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## ELEMENT 9: DATA COLLECTION AND ANALYSIS

### Purpose

The purpose of Data Collection & Analysis is to ensure safety-related data acquired from all aspects of the organization are documented, maintained, and analyzed for: identifying and assessing risks, evaluating if performance targets are met, and distributing lessons learned. Safety assurance at MBTA is affirmed by effective collection and analysis of safety-related data.

### Scope

Safety Data Collection & Analysis verifies that the MBTA Safety Plan is effectively and continuously implemented by acquiring all manners of safety-related data, from all areas of MBTA as needed. All applicable departments are expected to maintain their own databases, and allow access by MBTA Safety when necessary.

Types of sources utilized to obtain safety data may include:

- **Internal Safety Data Sources:** Includes but is not limited to: OCC, SRCP findings,<sup>17</sup> Worker’s Compensation, Transit Police, IndustrySafe,<sup>18</sup> Form B, Safety Hotline, and other internal data sources as deemed necessary.
- **External Safety Data Sources:** Includes but is not limited to: FTA National Transit Database (NTD), customers and passengers (through the customer service line, MBTA website, or Transit Police app, “MBTA See Say”), trends and reports from transit agencies, and other external data sources as deemed necessary.

The types of data collected may include but are not limited to:

- Hazard analyses and risk assessments;
- Operations logs and other data;
- Dispatcher logs;
- Vehicle Maintenance logs and other data;
- Facility Inspections;<sup>19</sup>
- Accident/incident investigations;<sup>20</sup>
- Near misses;
- Employee injuries;
- Passenger injuries;
- Training evaluations;<sup>21</sup>
- Surveys;
- Rule violations;<sup>22</sup>
- Internal safety reviews;<sup>23</sup> and

<sup>17</sup> See MBTA Safety Plan [Element 13, Rules Compliance](#)

<sup>18</sup> See *id.*, [§ 6.4.2, Hazard Tracking](#); see also [Element 6, Safety Risk Management](#) (data gathered from hazard analyses and risk assessments are tracked in IndustrySafe)

<sup>19</sup> See *id.*, [Element 14, Facilities and Equipment Inspection](#)

<sup>20</sup> See *id.*, [Element 10, Accident Investigation](#)

<sup>21</sup> See *id.*, [Element 16, Training](#)

<sup>22</sup> See *id.*, [Element 13, Rules Compliance](#)

- Other types of safety-related data as deemed necessary.

### Regulatory Compliance

In accordance with 49 CFR 659.17(i), DPU is required to review and approve the Safety and Security Certification section of the MBTA Safety Plan. In response to 49 CFR 659, the Massachusetts state legislature promulgated 220 CMR 151.03(2)(i), which requires:

“A description of the process used to collect, maintain, analyze, and distribute safety data, to ensure that the safety function of the Transportation Authority receives the necessary information to support implementation of the system safety program.”

### Responsibilities

**Safety and Security Executive Review Committee (SSRC):** Responsible for overall oversight of data collection and analysis. Their internal oversight provides assurance that data collection and analysis are effectively tracking all known hazards and integrated with the safety risk management process necessary for maintaining a safe and fully functional transit system

**System Safety Working Groups (SSWGs):** Responsible for making recommendations on appropriate means of reporting, collecting, and analyzing data. Additionally, SSWGs will work with MBTA Safety to interpret data and implement corrective recommendations as a result of data trends.

**MBTA Safety:** Responsible for overseeing the collection and analysis of safety-related data by MBTA departments and external sources. MBTA Safety receives data, as needed, from the respective departments and performs its own analysis to identify, evaluate, resolve or reduce, and track hazards. Analyses are documented and distributed to senior staff in the form of monthly reports, system safety assessments, root cause analyses and other formal hazard analyses, and risk assessments. MBTA Safety uses safety-related data to make corrective recommendations to MBTA management and SSWG.

MBTA Safety is also responsible for reporting data to external agencies as required. Data that meet threshold requirements are reported to DPU.<sup>24</sup> Data are also reported to FTA via the National Transit Database (NTD), on a monthly basis, in accordance with published NTD accident and incident thresholds.

The Safety Data Analysis Report (SDAR) is a monthly report provided to the GM and senior management which shows accident and injury trends throughout MBTA. The SDAR serves as an oversight tool that broadly measures safety performance within its areas of review, and provides safety recommendations. The SDAR is also flexible in that it may expand to include other types of data (both lagging and leading indicators) and safety issues as necessary and in response to emerging trends.

**MBTA Management:** Responsible for ensuring that safety-related data is collected, maintained, analyzed, and reported in a timely manner (on an ongoing basis, or as requested) in collaboration with MBTA Safety. Management is also responsible for implementing safety improvements originating from corrective recommendations, corrective action plans, hazard analysis results, SDAR, or other forms of recommendation. MBTA management and MBTA Safety collaboratively track and monitor the effectiveness of their safety corrective recommendations or corrective action plans.

<sup>23</sup> See *id.*, [Element 12, Internal Safety Audit](#)

<sup>24</sup> See Accident Investigation Manual, DPU Notification.

**MBTA Transit Police:** Responsible for recording, verifying and updating incidents of assault on MBTA employees; sharing the data with MBTA Safety on a monthly basis; and submitting reportable data and incident reports of security-related events to NTD.

**References**

*Documents listed within this element are incorporated by reference, and intended to comply with federal and state regulation requirements.*

Applicable MBTA Standard Operating Procedures, Rules, and Special Orders



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## ELEMENT 10: ACCIDENT INVESTIGATION

### Purpose

The purpose of Accident Investigation is to prescribe responsibilities and direction in facilitating an investigation of an accident, incident, or near miss at a standard consistent with federal and state regulation as well as industry best practices. Although accident/incidents investigations take place after an event has occurred, MBTA's ultimate goal is to identify and correct hazards and deficiencies before any injuries or property damage can occur. To that end, Accident Investigation is a crucial tool of the Safety Risk Management process to identify, evaluate, resolve, and track any existing or potential hazards, which include those that result from or could result in an accident, incident, or near miss.

The objectives of Accident Investigation are to:

- Gather and assess the facts in order to determine the cause and contributing factors of an accident, incident, or near miss;
- Coordinate with DPU and other outside agencies as necessary; and
- Develop practical corrective measures to prevent or reduce the possibility of a recurrence.

The investigation process is documented through the MBTA Accident Investigation Manual and all other pertinent documents within, and as referenced below.

### Scope

The MBTA Accident Investigation Manual describes the process for an investigation at MBTA properties, Right of Way (ROWs), equipment, environment, rolling stock, personnel, and facilities where an accident, incident, or near miss may occur or has already occurred. The investigation process includes the following:

- Site inspection and investigation;
- Notification requirements;
- Root cause analysis;
- Lessons learned;
- Corrective Action Plan development and implementation; and
- Communication and distribution of lessons learned.

### Regulatory Compliance

In accordance with 49 CFR 659.17(j), DPU is required to review and approve the Safety and Security Certification section of the MBTA Safety Plan. In response to 49 CFR 659, the Massachusetts state legislature promulgated 220 CMR 151.03(2)(j), which requires:

“A description of the process used by the Transportation Authority to perform accident notification, investigation and reporting, including:

- (1) Notification thresholds for internal and external organizations;
- (2) Accident investigation process and references to procedures;
- (3) The process used to develop, implement, and track corrective actions that address investigation findings;
- (4) Reporting to internal and external organizations; and
- (5) Coordination with the Department.”

## Responsibilities

**Safety & Security Executive Review Committee (SSRC):** Responsible for generally overseeing the investigation of accidents, incidents, or near misses; ensuring MBTA management are adequately performing all requirements of an investigation according to the Accident Investigation Manual; and ensuring that the Safety Risk Management process is correctly implemented.

**System Safety Working Groups (SSWGs):** Responsible for reviewing issues that may arise from accident investigations. These issues may include rule revisions, procurement changes, review of configuration management techniques, and review of cross-departmental initiatives to mitigate conditions that may have contributed to an accident, incident, or near miss. Safety risks that cannot be resolved by the System Safety Working Groups are elevated to the SSRC.

**MBTA Safety:** Responsible for supporting MBTA management and, when required, conducting an independent investigation as directed by the Chief Safety Officer. Such an investigation is performed in coordination and collaboration with MBTA Transit Police, MBTA management, and external agencies as required. The investigation will include, if applicable, safety assessments, hazard analysis, and root cause analysis. The investigation will conclude by producing and providing written reports to internal and external organizations as described in the MBTA Accident Investigation Manual. MBTA Safety will also monitor the implementation of a CAP plan, if applicable.

**MBTA Management:** Responsible for immediate response to an incident scene and for initiating MBTA's on-scene investigative processes. A lead investigator shall be selected from MBTA management based on their expertise and circumstances of the incident.<sup>25</sup> If outside agencies establish Incident Command, the designated on-scene lead investigator shall coordinate with them to form a Unified Incident Command.

**Operations:** Responsible for, when applicable, documenting all casualty data; photographing relevant conditions; determining fit for duty status; determining if testing is required for operators involved; reviewing operating rules; conducting operator interviews; and reviewing and documenting all related human factors, including employee history, performance, and fatigue factors.

**Vehicle Engineering and Maintenance:** Responsible for, when applicable, documenting vehicle condition, dynamics, and maintenance history; conducting damage estimates; photographing relevant conditions; and assisting in the investigation of an incident.

**Engineering and Maintenance:** Responsible for, when applicable, documenting infrastructure conditions, environmental conditions, and maintenance history; measuring and diagramming the incident; photographing relevant conditions; conducting damage estimates; and updating the event log data.

**MBTA Transit Police:** Responsible for initiating an investigation involving criminal activity, serious injury death, or as directed by MBTA's Chief of Police; serving as lead investigator; establishing on-site security measures; coordinating with outside law enforcement, as well as state and federal security agencies; and working collaboratively with MBTA management and MBTA Safety.

<sup>25</sup> In most cases, the lead investigator will be a member of Operations management.

**References**

*Documents listed within this element are incorporated by reference, and intended to comply with federal and state regulation requirements.*

MBTA Accident Investigation Manual

Applicable MBTA Standard Operating Procedures, Rules, and Special Orders

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## ELEMENT 11: EMERGENCY MANAGEMENT

### Purpose

The purpose of Emergency Management is to ensure that MBTA systems, including the employees, facilities, passengers, and operations personnel, as well as local emergency responders, planning organizations, and mutual aid partners within service area communities, have the ability to respond to and recover from any emergency incident or major disaster. Through effective safety management, Emergency Management assists in the implementation of MBTA's safety commitments by utilizing the industry's best practices and federal standards to:

- Establish a formalized process of verifying compliance with emergency management requirements;
- Ensure collaboration with external agencies in the preparation of emergency responses;
- Establish emergency management responsibilities and ensure tasks and activities are documented, understood, and can be executed effectively by the applicable parties, including external agencies, employees, and contractors;
- Establish communication protocols, backup communication systems, and maintenance of records;
- Establish a formalized process of evaluating the effectiveness of emergency response procedures, and revisions if necessary; and
- Ensure special needs services are addressed during emergencies.

The Emergency Management process is documented in the MBTA Emergency Management Plan (EMP) and all other pertinent documents within, and as referenced below.

### Scope

MBTA responders and personnel work in synchronization with external agencies such as police, fire, and medical services in order to successfully manage an emergency incident or major disaster. The goal is to effectively respond to *all* types of emergencies under an "all hazards approach," including but not limited to: train accidents, fires, floods, chemical spills, major infrastructure collapses, violent crime, and terrorist attacks. This is accomplished in part by the preparation of an effective Emergency Management Plan, which contains various integral and strategic functions:

- **Planning:** Includes the development and implementation of the EMP, Continuity of Operations Plan (COOP), SOPs, Memorandum of Understandings (MOUs), and special orders in anticipation of, preparation for, response to, and recovery from an emergency incident or major disaster.
- **Training:** Includes the collaborative education and training of employees at all levels of the organization and external agencies, to familiarize them with MBTA-specific environments and provide the knowledge necessary to perform critical functions in the event of an emergency incident or major disaster.
- **Exercise:** Includes the coordination of drill exercises to: evaluate responders' training, evaluate effectiveness of the planning components, evaluate emergency management capabilities by MBTA and external agencies, and evaluate overall MBTA and external agency preparedness for emergencies.
- **Response:** Includes notification of the incident to all relevant parties, establishment of the initial Incident Command and corresponding supporting roles, and activation of MOUs as necessary.
- **Recovery:** Includes the reduction of all known hazards, extraction of the injured from the scene, removal of debris, and other post-incident recovery activities.

## Regulatory Compliance

In accordance with 49 CFR 659.19(k), DPU is required to review and approve the Emergency Management section of the MBTA Safety Plan. In response to 49 CFR 659, the Massachusetts state legislature promulgated 220 CMR 151.03(2)(k), which requires:

“A description of the process used by the Transportation Authority to develop an approved, coordinated schedule for all emergency management program activities, which includes:

- (1) Meetings with external agencies;
- (2) Emergency planning responsibilities and requirements;
- (3) Process used to evaluate emergency preparedness, such as annual emergency field exercises;
- (4) After action reports and implementation of findings;
- (5) Revision and distribution of emergency response procedures;
- (6) Familiarization training for public safety organizations; and
- (7) Employee training.”

## Responsibilities

**Safety and Security Executive Review Committee (SSRC):** Responsible for overall acceptance of emergency management components. Their internal oversight provides assurance that the related safety and security elements are in compliance with applicable guidelines, and are properly integrated with existing MBTA standards for maintaining a safe and fully functional transit system.

**MBTA Safety:** Responsible for coordinating with other departments in developing and monitoring the effectiveness of MBTA’s emergency management procedures, employee training programs, and yearly scheduled emergency drill activities; assisting in safety risk management activities associated with emergencies and emergency drills; supporting MBTA fire/life safety programs; and implementing fundamental emergency management functions where applicable.

**MassDOT Security and Emergency Management Department:** Responsible for administering and maintaining the MBTA Emergency Management Plan (EMP) and other procedures, in addition to conducting and assessing emergency drills, exercises, training, and after-action reviews. Each emergency drill acts out the scenario of a plausible major mass casualty emergency involving the MBTA Transit system. The department is also responsible for coordinating with external responders participating in the drill, including local fire, police, emergency medical services, hospital emergency room personnel, and regulatory agencies as applicable.

**MBTA Drill Steering Committee (“Drill Committee”):** Responsible for establishing and maintaining a centralized database of all drills or emergency exercise activities, establishing a yearly drill schedule, developing exercises involving wide range of scenarios, reviewing emergency management related SOPs and other procedures, ensuring compliance with Boston Center for Independent Living Settlement Agreement mandates as they relate to emergency response, and preparing and distributing a comprehensive after-action report on each exercise. The Drill Committee is co-chaired by the CSO, Director of Security Initiatives, and the Deputy Transit Police Chief, or their designees.

**MBTA Management:** Responsible for proactively participating in emergency response preparedness and supporting emergency response activities to the fullest extent possible. In addition, each operations division is responsible for maintaining an up-to-date EMP as well as applicable emergency response procedures, and for providing emergency response training to all field personnel.

**MBTA Transit Police:** Responsible for working collaboratively with MBTA management and MBTA Safety to identify security threats and vulnerabilities related to emergency management. Additionally, the MBTA Transit Police Department is responsible for administering and maintaining the MBTA System Security and Emergency Preparedness Plan (SSEPP).

## References

*Documents listed within this element are incorporated by reference, and intended to comply with federal and state regulation requirements.*

MBTA Emergency Management Plan (to be drafted)

System Security and Emergency Preparedness Plan (SEPP) (under revision)

MBTA Emergency Management Exercise Program

Applicable MBTA Standard Operating Procedures, Rules, and Special Orders



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## ELEMENT 12: INTERNAL SAFETY REVIEW

### Purpose

The purpose of Internal Safety Audit is to prescribe responsibilities and direction in facilitating internal safety audits of safety-related tasks and activities performed by key MBTA departments at a standard consistent with federal and state regulation as well as industry best practices. Reports generated from these audits may also serve as data for hazard identification. Through objective evidence, internal safety audits verify the MBTA Safety Plan is effectively implemented, performing its intended functions, achieving its performance objectives, and ultimately safeguarding MBTA, its personnel and contractors, and the public from hazards.

Internal Safety Audit objectives are to:

- Ensure the MBTA Safety Plan is reviewed in an on-going manner over a three year cycle;
- Document fulfillment of safety activities and programs conducted by MBTA departments;
- Verify performance objectives are met;
- Identify potential hazards through audit results;
- Develop corrective action recommendations; and
- Track corrective measures.

### Scope

All MBTA departments that conduct safety-related activities or implement safety-related programs are subject to mandatory internal safety audits on a regular basis, in addition to occasional non-scheduled audits. Personnel in management and employee capacities shall be expected to participate in the internal safety audits. All twenty-one (21) Elements shall be evaluated over a three year period at least once.

Internal Safety Audit is a process which includes the following functions:

- **Scheduling:** At a minimum, at least seven (7) Elements shall be evaluated each year. A review schedule of what Elements will be evaluated is provided to DPU and MBTA departments. DPU shall be given notification thirty (30) calendar days prior to an internal safety audit. MBTA departments shall be given notification at least ten (10) calendar days prior to an internal safety audit. There is no prior notification of unannounced spot audits.<sup>26</sup>
- **Checklists and Performance:** Checklists are prepared, approved by DPU, and provided to MBTA departments in advance of an internal safety audit. Performance of the audit includes the following activities: review and verification of documents<sup>27</sup>, inspection of facilities and equipment, interviews with department staff, and field observations. DPU are invited to attend internal safety audits as observers only.
- **Audit Reporting:** Includes the following procedures,
  - (1) Checklists shall be completed and accompanied with the findings within thirty (30) calendar days. The findings shall be provided to the audited department.
  - (2) The audited department shall provide comments, if any, to the findings within ten (10) business days.

<sup>26</sup> An exception is audits of Rules Compliance. DPU shall be notified via email of all audits of Rules Compliance.

<sup>27</sup> Types of documentation: plans, programs, Special Orders, SOPs, rules, and policies.

- (3) An Internal Safety Review Report (ISRR) shall be issued within ninety (90) calendar days of the audit date, which includes corrective recommendations. Findings of non-compliance shall include a Non-Compliance Report (NCR) and a Corrective Action Request (CAR) form in the ISRR.<sup>28</sup>
- (4) The audited department shall respond to the CAR within sixty (60) calendar days. An appropriate response shall include a developed CAP, verification the CAP has been implemented, and results of its implementation thus far.
- (5) The audited department must determine if it requires an extension, and shall provide notification at least fifteen (15) calendar days prior to deadline with reasons to support the extension. A resolved CAP shall be closed. A CAP which requires an extension shall be kept open until resolved.
- (6) MBTA Safety shall develop an Annual Report of Internal Safety Reviews, and provide to the GM, DPU and FTA.<sup>29</sup> The deadline for the Annual Report of Internal Safety Reviews is February 15<sup>th</sup> of each year. Included in the report is a formal letter written by the GM certifying the MBTA is in compliance to the MBTA Safety Plan, or state it is noncompliant. If noncompliant, the GM must state the nature of the noncompliance and the steps it will take to achieve compliance.

### Regulatory Compliance

In accordance with 49 CFR 659.19(1), DPU is required to review and approve the Rules Compliance section of the MBTA Safety Plan. In response to 49 CFR 659, the Massachusetts state legislature promulgated 220 CMR 151.03(2)(1), which requires:

“A description of the process used by the Transportation Authority to ensure that planned and scheduled internal safety reviews are performed to evaluate compliance with the SSPP, including:

- (1) Identification of departments and functions subject to review;
- (2) Responsibility for scheduling reviews;
- (3) Process for conducting reviews, including the development of checklists and procedures and the issuing of findings;
- (4) Review of reporting requirements;
- (5) Tracking the status of implemented recommendations; and
- (6) Coordination with the oversight agency.”

### Responsibilities

**General Manager (GM):** Responsible for certifying, in a written formal letter, the MBTA is compliant with the MBTA Safety Plan.<sup>30</sup> If the MBTA is noncompliant, the GM must identify the nature of its noncompliance and steps it will take to achieve compliance.

<sup>28</sup> A CAR consists of an order to develop a CAP, a list of findings to support the order, and a requirement of tracking the CAP implementation.

<sup>29</sup> Security related findings shall not be provided in the report but shall be made available at MBTA offices for DPU review and inspection upon request; *see* 220 CMR 151.05(3).

<sup>30</sup> In accordance with 220 CMR 151.05, along with an annual report the GM certifies compliance with SSPP or SEPP

**Safety and Security Executive Review Committee (SSRC):** Responsible for overall acceptance of the Internal Safety Audit process. They also oversee the tracking of corrective recommendations and CAPs developed from the internal safety audits.

**MBTA Safety:** Responsible for administering internal safety audit procedures consistent with this Element including: development and dissemination of internal safety audit schedules; development and dissemination of the ISRR and Annual Report of Internal Safety Reviews; identification of hazards from findings; and oversight of corrective recommendations and CAPs developed from the internal safety audits. Identified hazards shall be notified to DPU as appropriate through the Safety Risk Management process.<sup>31</sup> The CSO shall be responsible for the overall management of Internal Safety Audit.

**MBTA Management:** Responsible for effective implementation of all applicable Elements by their departments in order to achieve compliance to the MBTA Safety Plan, and provide documentation upon request by MBTA Safety during internal safety audits. They are also responsible for active participation in the internal safety audits, and familiarity with Internal Safety Audit procedures.

### References

*Documents listed within this element are incorporated by reference, and intended to comply with federal and state regulation requirements.*

Applicable MBTA Standard Operating Procedures, Rules, and Special Orders.

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<sup>31</sup> See Element 6, Hazard Risk Management, Hazard Notification to DPU.

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## ELEMENT 13: RULES COMPLIANCE

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### Purpose

The purpose of Rules Compliance is to ensure safety-related operating and maintenance rules at the MBTA are monitored for noncompliance, and that approaches to ensure compliant behavior are taken. Through effective safety management, Rules Compliance assists in the assurance of MBTA safety commitments by utilizing the industry's best practices to:

- Establish rules compliance oversight and verification of effective rule implementation;
- Continuously train employees on applicable rules;
- Ensure regular review and analysis of leading and lagging indicators, and other safety-related data found during rules compliance audits in order to identify, resolve, and track hazards related to rules compliance;
- Proactively communicate the purposes of safety-related rules and consequences of noncompliance to employees and contractors working on MBTA property; and
- Cultivate and enhance MBTA's safety culture through rules compliance measures.

The Rules Compliance process is documented in the MBTA Safety Rules Compliance Program (SRCP) and all other pertinent documents within, and as referenced below.

### Scope

Rules Compliance applies to MBTA operating and maintenance rules found in rulebooks, Standard Operating Procedures (SOPs), special orders, policies, and procedures identified by management as having a safety impact. MBTA employees involved in operations and maintenance activities are expected to strictly adhere to such rules, as applicable. These employees include, but are not limited to: MBTA Safety employees, employees in supervisory roles, vehicle operators, dispatchers, employees operating equipment, facilities personnel, track infrastructure maintenance personnel, vehicle maintenance personnel, ROW personnel, and other employees working in operations and maintenance capacities. Rules compliance also extends, as applicable, to contractors on or near ROWs, and contractors who work in operation or maintenance capacities.

### Regulatory Compliance

In accordance with 49 CFR 659.19(m), DPU is required to review and approve the Rules Compliance section of the MBTA Safety Plan. In response to 49 CFR 659, the Massachusetts state legislature promulgated 220 CMR 151.03(2)(m), which requires:

“A description of the process used by the Transportation Authority to develop, maintain, and ensure compliance with rules and procedures having a safety impact, including:

- (1) Identification of operating and maintenance rules and procedures, subject to review;
- (2) Techniques used to assess the implementation of operating and maintenance rules and procedures by employees, such as performance testing;
- (3) Techniques used to assess the effectiveness of supervision relating to the implementation of operating and maintenance rules; and
- (4) Process for documenting results and incorporating them into the hazard management program.”

**Responsibilities**

**Safety and Security Executive Review Committee (SSRC):** Responsible for overall oversight of rules and rule revisions. Their internal oversight provides assurance that the applicable rules are in compliance with existing guidelines and best practices. Acceptance by the SSRC will be based on recommendations from applicable SSWGs, MBTA Safety, and the SRCP Committee.

**System Safety Working Groups (SSWGs):** Responsible for supporting the SRCP Committee, as needed, by providing suggestions for SRCP improvement, monitoring progress, disseminating information, and verifying SRCP activities.

**Safety Rules Compliance Program Steering Committee (SRCP Committee):** Responsible for oversight and administration of the SRCP. The SRCP Committee is a joint effort comprised of management from various departments in Operations and Safety or their designees,<sup>32</sup> created to ensure consistent and comprehensive performance, record-keeping, and follow-up for critical inspection programs. The SRCP Committee determines the rules and procedures that will be subject to tests and observations under the program. The SRCP Committee stores and analyzes audit data, and provides that information to MBTA Safety on a monthly basis.

**Safety Rules Compliance Program (SRCP):** The SRCP outlines specific procedures to test and/or observe knowledge of, and compliance with, specific rules and procedures. Created through an SOP, the SRCP empowers the SRCP Committee to verify and enforce rules compliance through specific audit procedures.<sup>33</sup> The SRCP Committee also determines if and when changes or additions to the program are necessary. SRCP audit data are maintained in a database for analysis and distribution to MBTA management, as necessary.

**MBTA Safety:** Responsible for performing internal audits and reviews of Rules Compliance, including audits of the SRCP Committee and the SRCP; and performing root cause analyses as necessary.<sup>34</sup> Rule violations may serve as leading indicators during audits, data collection and analysis, or safety risk assessments, from which MBTA Safety may provide corrective recommendations to the SRCP and operations. MBTA Safety also serves on the SRCP Committee.

**MBTA Management:** Responsible for supervision of operating and maintenance safety rules compliance. This includes providing instruction on rules and procedures, monitoring employee compliance, administering retraining and/or discipline for non-compliance, and distributing/explaining new or updated rules and procedures.

**References**

*Documents listed within this element are incorporated by reference, and intended to comply with federal and state regulation requirements.*

MBTA Safety Rules Compliance Program (OPS-SOP 09-01.01 Rev.2) –effective 03/14/2009 (Rev.3 being drafted)

Applicable MBTA Standard Operating Procedures, Rules, and Special Orders

<sup>32</sup> See OPS-SOP 09-01.01 Rev. 2, MBTA Safety Rules Compliance Program § 2, Definitions, Safety Rules Compliance Steering Committee (definition which describes the management composition of the SRCP Committee).

<sup>33</sup> See Rules Compliance Procedures (RCP); e.g., RCP -013 Heavy Rail Carhouse Movement Procedures

<sup>34</sup> E.g. Root cause analysis of an accident investigation may determine a rule violation as a contributing cause of the accident or incident.

## ELEMENT 14: FACILITIES AND EQUIPMENT SAFETY INSPECTIONS

### Purpose

The purpose of Facilities and Equipment Safety Inspections is to ensure that the appropriate programs and procedures are in place to detect and correct unsafe conditions and deteriorating facilities and equipment.

The objectives of Facilities and Equipment Safety Inspections are to:

- Ensure the safe passage of transit vehicles;
- Ensure equipment and facilities are included in a regular inspection process, from which all safety-related findings are documented, tracked, and resolved;
- Enhance safety within the work environment for all MBTA employees, contractors, and visitors;
- Minimize unnecessary disruptions to revenue service; and
- Ensure and continuously monitor compliance with MBTA policies and procedures, federal and state regulations, and industry best practices.

### Scope

All MBTA infrastructure, facilities, and equipment are subject to safety inspections. Results of safety inspections must be accounted for in the safety risk management process. Facilities, infrastructure, and equipment subject to inspection include the following:

- **Facility Inspections:** Facility safety inspections are conducted in all facilities to identify and document hazards and/or safety issues, as well as to monitor system-wide compliance with established policies and procedures. Compliance with fire protection requirements is accomplished through emergency drills, fire/life safety inspections, incident investigations, and periodic testing of fire protection and fire suppression systems. Additionally, MBTA's insurance company (FM Global) employs loss control engineers who routinely and periodically inspect all of MBTA's insured facilities, and issue reports and recommendations for improvement with respect to attaining and maintaining Highly Protected Risks status.<sup>35</sup> Facilities subject to inspection include:
  - **Stations:** Transit stations, parking lots, and surrounding customer circulation routes are periodically inspected for cleanliness, safety, and customer service issues. This includes scheduled inspections of all station equipment, stairs, platforms, restrooms, dead-ends, escalators, and elevators; routine monitoring of lighting levels on platforms, stairways, concourses, restrooms, and station entrance ways; and inspections of Police/Customer call boxes.
  - **Maintenance Facilities:** Facility supervisors conduct inspections of environmentally sensitive areas and processes such as chemical storage areas, hazardous waste storage areas, chemical process areas, fuel dispensing areas, paint booths, spill containment, and personal protective equipment. These inspections also pertain to equipment maintenance facilities equipment, such as lifts and cranes.
- **Vehicle Equipment:** Safety inspections are regularly conducted for all vehicle equipment, including revenue and non-revenue vehicles, to identify and document hazards and/or safety issues, as well as to monitor system-wide compliance with established policies and procedures.

<sup>35</sup> See also [MBTA Safety Plan Element 18, Workplace Safety](#) (Occupational Health and Safety Programs).



- **Infrastructure:** MBTA-owned infrastructure and systems subject to routine inspections include the following:
  - **Bridge Inspection and Rating Program:** Routine inspections of bridges are performed at established cycles using approved guidelines. The Authority has developed the Railroad Operations Commuter Rail Design Standards Manual to ensure compliance with the inspection and rating guidelines established in the FRA’s “Statement of Agency Policy on the Safety of Railroad Bridges,” which also incorporates bridge inspection and rating requirements for transit. The Authority also uses the Federal Highway Administration (FHWA) Pontis bridge management software as well as MassDOT’s 4D database system that incorporates inspection forms for Authority-owned highway, transit, and railroad bridges; loadings for highway, transit, and railroad cars; and other relevant information pertaining to highway, transit, and railroad bridges.
  - **Signals and Communication Systems:** Inspections include but are not limited to train stop, car-borne Automatic Train Operation (ATO), two-way radio system, third rail heater system, and switch obstruction tests. DPU-required testing on vital relays is performed in-house on an ongoing basis. New signal installations undergo comprehensive verification testing prior to being placed into service. Signal engineers provide technical oversight for the testing program.
  - **Power Systems**
  - **Track:** Track inspections are regularly conducted in accordance with MBTA track standards manuals (listed below), which complies with DPU requirements in 220 CMR 151.11, Track Inspections.

## Regulatory Compliance

In accordance with 49 CFR 659.19(n), DPU is required to review and approve the Facilities and Equipment Safety Inspections section of the MBTA Safety Plan. In response to 49 CFR 659, the Massachusetts state legislature promulgated 220 CMR 151.03(n), which requires:

“A description of the process used for facilities and equipment safety inspections, including:

- (1) Identification of the facilities and equipment subject to regular safety-related inspection and testing;
- (2) Techniques used to conduct inspections and testing;
- (3) Inspection schedules and procedures; and
- (4) Description of how results are entered into the hazard management process.”

Additionally, 220 CMR 151.11 provides a description of the process used for track inspections.<sup>36</sup>

<sup>36</sup> See 220 CMR 151.11, Track Inspection; see also 49 CFR 213.233, Track Inspections.

## Responsibilities

**Safety and Security Executive Review Committee (SSRC):** Responsible for overall acceptance of facilities and equipment safety inspections. Their internal oversight provides assurance that the related facilities and equipment safety inspections elements are in compliance with applicable guidelines, and are properly integrated with existing MBTA standards for maintaining a safe and fully functional transit system.

**System Safety Working Groups (SSWGs):** Responsible for collaborating in the development, implementation, and improvement of inspection processes; evaluating findings; and assisting MBTA management in generating and implementing corrective recommendations.

**MBTA Safety:** Responsible for supporting MBTA management in monitoring the implementation and effectiveness of MBTA's facilities and equipment safety inspections and policies through internal auditing and oversight activities. MBTA Safety also provides technical guidance and support to various departments by researching and recommending industry best practices.

**Environmental Department:** Responsible for ensuring inspections of facilities, bridges, infrastructure, and equipment are performed in accordance to federal, state, and local environmental regulations. The department's field management is also responsible for conducting monthly inspections and audits of MBTA maintenance facilities, electrical facilities, and petroleum storage areas; ensuring maintenance facilities are conducting their own weekly facility inspections; and coordinating with third-party audits.

**MBTA Management:** Responsible for ensuring that inspections of MBTA's facilities, bridges, infrastructure, and equipment are performed to detect and correct unsafe conditions and deteriorating equipment conditions, in order to ensure safety and compliance with regulations and industry best practices. Inspection results shall be utilized as a data source for identification of hazards by the responsible departments, and incorporated in the safety risk management process.

## References

*Documents listed within this element are incorporated by reference, and intended to comply with federal and state regulation requirements.*

MBTA Maintenance of Way Division Track Maintenance and Safety Standards: Green Line – Light Rail Transit; Edition 2008.1

MBTA Maintenance of Way Division Track Maintenance and Safety Standards: Blue, Orange and Red Lines; Edition 2005.2

MBTA Railroad Operations Commuter Rail Design Standards Manual, Volume I Section I, Track and Roadway; Revision No. 1; April 19, 1996

MBTA Railroad Operations Commuter Rail Design Standards Manual, Volume I Section III, Bridges; March 2009

Applicable MBTA Standard Operating Procedures, Rules, and Special Orders



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## ELEMENT 15: MAINTENANCE AUDITS AND INSPECTIONS

### Purpose

The purpose of Maintenance Audits and Inspections is to ensure compliance with prescribed maintenance processes and procedures, as they relate to system safety.

The objectives of Maintenance Audits and Inspections are to:

- Ensure the safe passage of transit vehicles;
- Ensure that routine maintenance of vehicles, facilities and infrastructure is occurring at regular intervals as prescribed by manufacturer recommendations, industry best practices, and federal and state regulations;
- Enhance safety within the work environment for all MBTA employees, contractors, and visitors;
- Minimize unnecessary disruptions to revenue service;
- Ensure compliance with federal, state, and local environmental regulations; and
- Ensure and continuously monitor compliance with MBTA policies and procedures, federal and state regulations, and industry best practices.

### Scope

MBTA's Maintenance Audits and Inspections Program is comprised of a series of routine audits which serve to monitor and evaluate the overall safety of vehicle, facility and infrastructure maintenance practices, both preventive and corrective. These audits are used to evaluate:

- Compliance with safety requirements, standards, regulations and best practices;
- Knowledge and implementation of safety rules and procedures;
- Adherence to required routine maintenance schedules; and
- Effectiveness of established routine maintenance schedules.

Maintenance practices subject to regular inspection and monitoring include:

- **Vehicle Maintenance:** In order to ensure compliance with the prescribed vehicle maintenance for each subway revenue vehicle, the Quality Assurance/Quality Control Division (QA/QC) staff visit each line in Subway Operations once per month and audit the inspection reports of a randomly chosen list of vehicles. The compliance inspection focuses mainly on verifying that periodic safety inspections are done in accordance with the Equipment Engineering and Quality Assurance (EE&QA) Manual. Any potentially hazardous conditions discovered during inspections are reported to MBTA Safety.
- **Facility Maintenance:** Audits and inspections of both routine and corrective facility maintenance are conducted regularly by Engineering and Maintenance management and/or their contractors. Supervisors and forepersons ensure that maintenance to their facilities is completed successfully and documented, and that compliance with all applicable rules, regulations and best practices is achieved.
- **Infrastructure Maintenance:** Audits and inspections of infrastructure maintenance are conducted regularly by Engineering and Maintenance management and/or their contractors. Supervisors and forepersons ensure that maintenance to infrastructure is completed successfully and documented, and that compliance with all applicable rules, regulations and best practices is achieved.

## Regulatory Compliance

In accordance with 49 CFR 659.19(o), DPU is required to review and approve the Maintenance Audits and Inspections section of the MBTA Safety Plan. In response to 49 CFR 659, the Massachusetts state legislature promulgated 220 CMR 151.03(o), which requires:

“A description of the maintenance audits and inspections program, including identification of the affected facilities and equipment, maintenance cycles, documentation required, and the process for integrating identified problems into the hazard management process.”

## Responsibilities

**Safety and Security Executive Review Committee (SSRC):** Responsible for overall acceptance of maintenance audits and inspections. Oversight by the committee ensures that routine maintenance elements are in compliance with current guidelines and are properly integrated with existing MBTA standards for maintaining a safe and fully functional transit system.

**System Safety Working Groups (SSWGs):** Responsible for working collaboratively with MBTA Safety to: assist with audits and inspections; evaluate audit findings to help determine the root cause; respond to audit findings by developing and/or implementing corrective actions or recommendations; and provide suggestions on how to improve adherence to maintenance schedules and procedures.

**MBTA Safety:** Responsible for supporting MBTA management in monitoring the implementation and effectiveness of MBTA’s maintenance audits and inspections through oversight activities. MBTA Safety also provides guidance and support to various departments by researching and recommending industry best practices.

**MBTA Management:** Responsible for reviewing existing maintenance plans for effectiveness and ensuring adherence to the proper maintenance procedures through routine supervision, training, SLEs, toolbox talks, and regular inspections. They shall identify, evaluate, resolve and track hazards encountered through the maintenance audit and inspection program.

**QA/QC Division:** Responsible for utilizing objective monitoring means and methods to provide quality oversight and continually audit documented processes to minimize hazardous conditions and non-compliance.

## References

*Documents listed within this element are incorporated by reference, and intended to comply with federal and state regulation requirements.*

Equipment Engineering and Quality Assurance Manual

EE&QA Dwg#39309 (Mileage Maintenance/Inspection Schedule for Vehicles)

QAP-004 Mileage Inspection Audit Procedure

Vehicle Specific Mileage Inspection Checklists:

QAF-001 Orange Line No12 Inspection Audit Form (inclusive of RCP-021)

QAF-003 Red Line Mileage Inspection Audit Form Type 1 and Type 2 Car (inclusive of RCP-016)

QAF-004 Red Line Mileage Inspection Audit Form Type 3 Car (inclusive of RCP-017)

QAF-006 Blue Line Mileage Inspection Audit Form (inclusive of RCP-018)

QAF-008 Green Line Mileage Inspection Audit Form Type 7 Car (inclusive of RCP-022)

QAF-009 Green Line Mileage Inspection Audit Form Type 8 Car (inclusive of RCP-023)

QAF-010 Green Line Mileage Inspection Audit Form PCC Car (inclusive of RCP-024)

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## ELEMENT 16: TRAINING AND CERTIFICATION PROGRAM FOR EMPLOYEES AND CONTRACTORS

### Purpose

The purpose of the Training and Certification Program for Employees and Contractors (“Training and Certification Program”) is to prescribe responsibilities and direction in facilitating initial, refresher, and new training to all MBTA employees and contractors at a standard consistent with federal and state regulation as well as industry best practices.

The objectives of the Training and Certification Program are to:

- Ensure that system safety principles are integrated into MBTA training courses and programs;
- Ensure employees and contractors are trained to identify and report hazards, and respond to safety risks;
- Ensure that safety-related work incorporates the proper level of training and certification for employees and contractors;
- Ensure safety-related training is properly tracked and documented to verify compliance with training and certification requirements; and
- Ensure that affected outside response agencies, including affected fire and police departments, are prepared to respond to normal, abnormal, and emergency situations.

### Scope

Instruction in safe methods of operation and safety procedures is included in rulebooks, manuals, handbooks, and other documentation developed for the training and certification of operations and maintenance personnel. Training systems shall be developed, by each department, which include in-house classroom training, field training, on-the-job training, and testing. Each department is responsible for establishing and documenting safety training requirements for its employees.

Components of the Training and Certification Program include, but are not limited to:

- Documentation and maintenance of training records;
- Skills, qualifications, and certification requirements for job positions;
- Knowledge of system safety; and
- Knowledge of the MBTA Safety Plan.

### Regulatory Compliance

In accordance with 49 CFR 659.19(p), DPU is required to review and approve the Training and Certification Program section of the MBTA Safety Plan. In response to 49 CFR 659, the Massachusetts state legislature promulgated 220 CMR 151.03(p), which requires:

“A description of the training and certification program for employees and contractors, including:

- (1) Categories of safety-related work requiring training and certification;
- (2) A description of the training and certification program for employees and contractors in safety-related positions;
- (3) Process used to maintain and access employee and contractor training records; and
- (4) Process used to assess compliance with training and certification requirements.”

## Responsibilities

**Safety and Security Executive Review Committee (SSRC):** Responsible for the review and acceptance of MBTA programs, policies, and procedures in the areas that advance training and certification programs. Their internal oversight provides assurance that Authority initiatives are consistent and in compliance with applicable guidelines, and are properly integrated with existing MBTA standards for maintaining a safe and fully functional transit system.

**System Safety Working Groups (SSWGs):** Responsible for managing, coordinating, and verifying training and certification activities, including the development, review, and implementation of cross-departmental training initiatives, policies, and procedures.

**Unified Training System Safety Working Group (UT-SSWG):** Responsible for providing direction for determining the feasibility of creating a Unified Training Program for MBTA and ultimately all of MassDOT; and cyclically identifying, assessing, and properly mitigating safety risks that can be addressed with training, best practices, and lessons learned.

**MBTA Safety:** Responsible for supporting MBTA management in developing and monitoring the implementation and effectiveness of MBTA's training and certification programs, through internal auditing, observation, and oversight activities. MBTA Safety provides guidance and support to various MBTA departments, including achieving conformance to industry standards and best practices.

**MBTA Management:** Responsible for developing and documenting training programs that identifies specific job classifications or tasks, including Instructors that require specific types of training, and safety-related hazards and challenges faced in their areas. These programs must also include the frequency and type of refresher courses required, and a process to review and analyze effectiveness of training programs. Through supervision and monitoring, management is responsible for ensuring employee and contractor compliance with all training and certification regulatory requirements, policies, and procedures. They are also responsible for maintaining up-to-date employee training records.

This includes, as applicable by job classification, the following training types:

- Safety and security;
- Human resources;
- Environmental;
- Transportation operations;
- Vehicle maintenance/engineering;
- General workplace;
- Emergency response; and
- Job-specific training.

**References:**

*Documents listed within this element are incorporated by reference, and intended to comply with federal and state regulation requirements.*

Applicable MBTA Standard Operating Procedures, Rules, and Special Orders

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## ELEMENT 17: CONFIGURATION MANAGEMENT

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### Purpose

The purpose of Configuration Management is to ensure effective control of a facility's as-built arrangement and operation. The Configuration Management process ensures compliance with approved and/or accepted technical requirements and other governing criteria. Control of the as-built configuration of facilities, systems, equipment, and vehicles begins during development of the final design and extends through construction, start-up, and operations, concluding with deactivation of the facility, system, equipment, or vehicle.

The Configuration Management process is documented through MBTA's Configuration Management Program and all other pertinent documents within, and as referenced below.

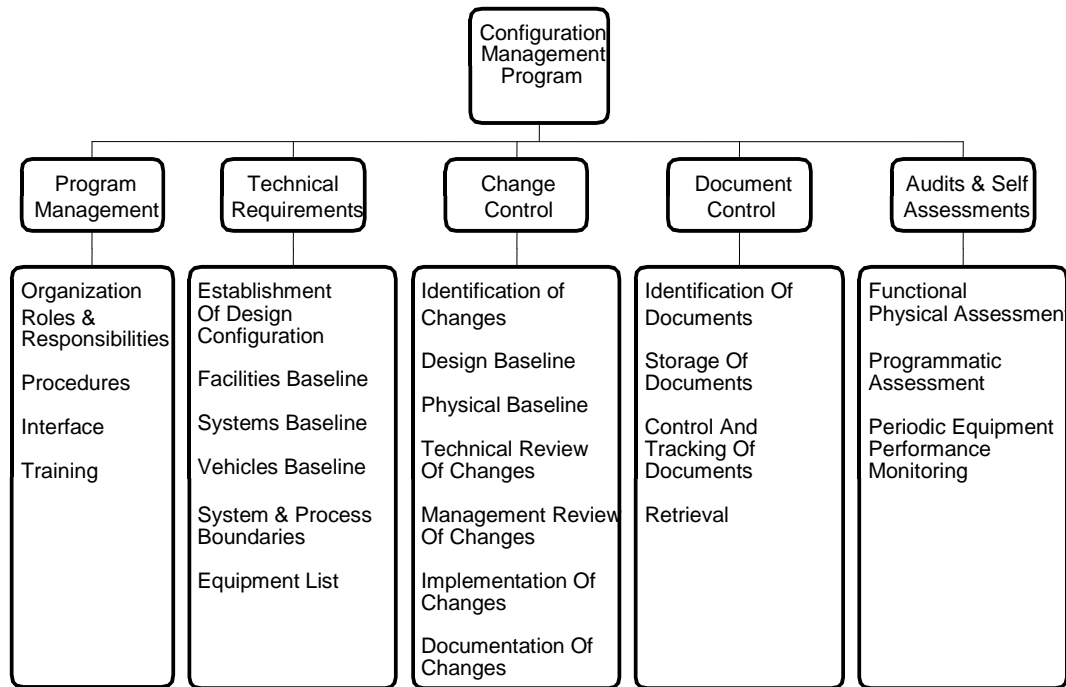
### Scope

The scope of the Configuration Management program includes those activities requiring Safety and Security Certification, such as major capital improvements and new vehicle procurements and acquisitions, as well as those covered by the Management of Change process.<sup>37</sup>

The five basic elements that comprise the Configuration Management Program are: program management, technical requirements, change control, document control, and audits and self-assessments. The engineering organization implements, throughout the life cycle of the transit infrastructure, the five program elements to maintain consistency among design requirements, design configuration, physical configuration, and facility's documentation. The Configuration Management Program requirements flow down into implementing procedures and other engineering documents that provide detailed directions and work instructions, as depicted in Figure 6 below.

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<sup>37</sup> See [MBTA Safety Plan Element 7, Management of Change](#); see also [Element 8, Safety and Security Certification](#)



**Figure 6: Configuration Management Program**

**Regulatory Compliance**

In accordance with 49 CFR 659.19(q), DPU is required to review and approve the Configuration Management section of the MBTA Safety Plan. In response to 49 CFR 659, the Massachusetts state legislature promulgated 220 CMR 151.03(2)(q), which requires:

“A description of the configuration management control process, including:

- (1) The authority to make configuration changes;
- (2) Process for making changes; and
- (3) Assurances necessary for formally notifying all involved departments.”

**Responsibilities**

**Safety and Security Executive Review Committee (SSRC):** Responsible for overall acceptance of the configuration management process. Their internal oversight providing assurance that safety- and security-related elements are in compliance with applicable guidelines, and are properly integrated with existing MBTA standards for maintaining a safe and fully functional transit system.

**System Safety Working Groups (SSWGs):** Responsible for providing support, and cross-departmental collaboration and communication of configuration management, management of change, and safety and security certification processes, including formal notification of system changes to involved departments.

**Capital Asset System Safety Working Group (CA-SSWG):** Responsible, in part or in whole, for the oversight of configuration management activities, including the review of proposed changes, test results,

and other documentation submitted. In addition, the CA-SSWG is responsible for recommending approval of various project elements to the SSRC before the elements enter revenue service. The multi-departmental members of the CA-SSWG include a wide range of expertise on the systems being installed, as well as their impact and integration into existing operations and maintenance.

**MBTA Safety:** Responsible for the development of the Configuration Management Program and monitoring its implementation and effectiveness.

**Design and Construction:** Responsible for MBTA’s capital improvements program, which includes the planning, design/engineering, and construction and closeout phases. In addition, Design and Construction, with its complete project team, plans, directs, and manages all tasks required to complete the project from preliminary engineering through construction and project closeout. Design and Construction is also responsible for compiling and maintaining as-built documentation for capital improvement projects.

**Vehicle Engineering:** Responsible for MBTA’s vehicle procurement program, which includes the planning, design/engineering, and acquisition and closeout phases. In addition, Vehicle Engineering, with its complete project team, plans, directs, and manages all tasks required to complete the procurement from preliminary engineering through acquisition and project closeout. Lastly, the project team is responsible for coordinating safety and security certification activities for procured vehicles, including compiling and maintaining as-built documentation.

**Vehicle Maintenance:** Responsible for proposing, designing, implementing, testing, documenting, and tracking MBTA’s vehicle modifications and changes.

**Engineering and Maintenance:** Responsible for proposing, designing, implementing, testing, documenting, and tracking modifications and changes to MBTA system infrastructure, including but not limited to track, signals, power systems, communications, and facilities.

**Operations:** Responsible for requesting, proposing, implementing, testing, and documenting modifications and changes to MBTA system infrastructure that will affect operations directly. In addition, Operations is responsible for the development and distribution of new and revised operating rules.

**References**

*Documents listed within this element are incorporated by reference, and intended to comply with federal and state regulation requirements.*

MBTA Configuration Management Program # SAF2.03.00 (presently being drafted)

Applicable MBTA Standard Operating Procedures, Rules, and Special Orders

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## ELEMENT 18: WORKPLACE SAFETY

### Purpose

The purpose of Workplace Safety is to ensure the safety of all MBTA employees, contractors, and visitors within the workplace. This element prescribes responsibilities and direction in order to facilitate compliance with safety standards and requirements consistent with federal, state, and local regulations, as well as industry best practices. As MBTA develops and improves its occupational health and safety programs, it will strive to achieve standards consistent with Occupational Safety and Health Administration (OSHA) as well as other industry professional organizations.<sup>38</sup>

### Scope

All MBTA employees and contractors must know, understand, and comply with all applicable federal, state, and local regulations, and MBTA policies related to workplace safety. Workplace safety requirements and programs include the following areas:

- **Occupational Health & Safety Programs:** MBTA utilizes OSHA and other industry standards as best practices for the development, implementation, and monitoring of internal workplace safety programs and requirements. Additionally, contractors working on MBTA property must adhere to all applicable OSHA regulations, MBTA policies and procedures, and other federal, state, and local regulations regarding occupational health and safety.
- **Personal Protective Equipment (PPE):** Specific work locations and job duties require the use of PPE to safeguard employees, contractors, and visitors against hazards or harmful workplace conditions. MBTA management, supported by MBTA Safety, evaluates the need for PPE given the hazard exposure associated with a task or location. MBTA management is responsible for providing necessary PPE to employees and monitoring their use of the equipment, in compliance with all applicable rules, regulations, and standards. It is MBTA's philosophy that PPE will be used as a last resort protection system, only after such remedies as engineering or administrative controls to eliminate a workplace hazard are determined to be infeasible or unable to fully protect employees from specific hazards in the workplace.
- **Right of Way (ROW) Safety:** All MBTA employees and contractors who work on or near MBTA's transit rail system receive ROW training, as prescribed by the Right of Way Safety Rulebook. Upon completion of the eight hour course, personnel are issued a ROW License, which is valid for two years, at which time a four hour refresher class is required every two years. All MBTA employees and contractors accessing the ROW are responsible for carrying their licenses and required PPE with them at all times while on the ROW, and for complying with all MBTA rules and regulations pertaining to ROW safety. MBTA Safety and management conduct periodic inspections of employee and contractor ROW work sites to assess knowledge of and compliance with the Right of Way Safety Rulebook and to check for ROW Licenses.
- **Hazard Communication/Right-to-Know:** MBTA is subject to the requirements of 454 CMR 21, the Massachusetts Right-to-Know Law. Right-to-Know requirements include the following: posted Right-to-Know workplace notices, Safety Data Sheets (SDS),<sup>39</sup> product labeling, and training of employees who work with chemicals and hazardous materials. Required training for

<sup>38</sup> E.g., American National Standards Institute (ANSI), and the National Fire Protection Association (NFPA).

<sup>39</sup> Formerly known as Material Safety Data Sheets (MSDS).

affected employees includes initial training within 30 days from date of hire, and annual refresher training.

- **Industrial Hygiene Studies:** MBTA Safety and management work collaboratively to ensure a safe and healthful work environment, including conducting industrial hygiene studies on an as-needed basis to evaluate the degree of employee, contractor, or customer exposure to chemical and physical agents encountered in a MBTA environment. Studies are performed based on hazard priority, which is established through evaluation of work processes, including type of work performed, types of chemicals or hazardous materials to which persons are exposed, frequency and duration of exposure, and number of employees or patrons exposed.
- **Safety Assessments and Reviews:** MBTA Safety works with management and Occupational Health Services to identify trends in employee injuries and investigate significant occupational accidents and incidents. As potential workplace safety hazards or concerns are identified, MBTA Safety may conduct safety assessments or reviews to determine risk and recommend corrective actions.
- **Contractor Construction Safety Management:** The Design and Construction Project Manager and Resident Engineer, in collaboration with MBTA Safety and the contractor, monitor construction safety as required by the MBTA Construction Safety Manual and contract specifications. These documents include requirements that the contractor must submit a Site Specific Healthy and Safety Plan and qualifications of contractor safety supervisors for MBTA Safety’s review and approval prior to the start of construction. Design and Construction and MBTA Safety conduct regular inspections of contractor worksites to assess contractor employee knowledge of and compliance with regulatory and contract requirements. Deficiencies are brought to the attention of contractor management for corrective action, and MBTA performs follow-up inspections to ensure implementation of corrective action.

**Regulatory Compliance**

In accordance with 49 CFR 659.19(r), DPU is required to review and approve the Local, State, and Federal Requirements section of the MBTA Safety Plan. In response to 49 CFR 659, the Massachusetts state legislature promulgated 220 CMR 151.03(r), which requires:

“A description of the safety program for employees and contractors that incorporates the applicable local, state and federal requirements, including:

- (1) Safety requirements that employees and contractors must follow when working on, or in close proximity to, rail transit agency property; and
- (2) Processes for ensuring the employees and contractors know and follow the requirements.”

Other regulations pertaining to workplace safety include:

- 29 CFR 1910 (et. seq.), Occupational Safety and Health Standards;<sup>40</sup>
- 29 CFR 1926 (et. seq.), Safety and Health Regulations for Construction;
- 454 CMR 6 (et. seq.), General Safety and Machinery Standards;
- 454 CMR 10 (et. seq.), Construction Industry Rules and Regulations; and
- 454 CMR 21 (et. seq.), “Right to Know” Law MGL c.111F.

<sup>40</sup> Although the MBTA is not governed by OSHA, OSHA standards are used as best practices in developing safety policies and programs.

## Responsibilities

**Safety and Security Executive Review Committee (SSRC):** Responsible for overall review and acceptance of MBTA programs, policies, and procedures related to workplace safety. Their internal oversight provides assurance that MBTA's workplace safety programs are in compliance with applicable regulations and industry standards, and are properly integrated with the existing MBTA system.

**System Safety Working Groups (SSWGs):** Responsible for evaluating identified workplace safety concerns that require management review and action. SSWGs are also responsible for developing, reviewing, and implementing cross-departmental workplace safety initiatives, policies, and procedures.

**Safety Committees:** Area/location Safety Committees are joint union/management and Safety teams that meet regularly and are responsible for addressing and tracking employee safety concerns within various MBTA locations, utilizing the hazard management process. If a Safety Committee cannot resolve a safety issue at the local level, it shall elevate the concern to the appropriate SSWG and/or the SSRC for higher level review and decision-making.

**MBTA Safety:** Responsible for supporting MBTA management in monitoring the implementation and effectiveness of MBTA's workplace safety programs and policies, through internal auditing and oversight activities. MBTA Safety provides technical guidance and support to various Authority departments in the realm of workplace safety, including in achieving conformance to OSHA, other industry standards, and best practices.

**MBTA Management:** Responsible for managing and implementing workplace safety programs within their areas. Through supervision, training, and monitoring, management is responsible for ensuring employee and contractor compliance with all workplace safety regulations, policies, and procedures. Management is responsible to utilize MBTA's established hazard management process, including its safety committee structure, to identify, assess, track, and resolve workplace safety concerns within their areas.

**Materials Management:** Responsible for ensuring that only MBTA Safety-approved PPE is purchased and stocked in inventories for employee use.

**Design & Construction:** Responsible for conducting construction worksite inspections and oversight activities to monitor contractor compliance with all safety requirements. They are also responsible for providing technical guidance on safety issues related to construction.

**Contractors:** All contractors working for MBTA, or on MBTA property, are responsible for knowing, understanding, and following all MBTA policies and federal, state, and local regulations.

## References

*Documents listed in this section are incorporated by reference and are intended to comply with federal and state regulation requirements.*

Right of Way (ROW) Safety Rulebook, 3<sup>rd</sup> Edition, effective July 1, 2014

MBTA Standard Specification 01568, Construction Safety, effective May 2013

Applicable MBTA Standard Operating Procedures, Rules, and Special Orders

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## ELEMENT 19: HAZARDOUS MATERIALS PROGRAM

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### Purpose

The purpose of the Hazardous Materials Program is to prescribe responsibilities and direction in facilitating the management and storage of hazardous materials, hazardous waste, universal waste, and chemical information at MBTA facilities at a standard consistent with federal and state regulation, as well as industry best practices.

The Hazardous Materials Program objectives are to:

- Ensure employees are trained and qualified in the proper handling of hazardous materials and waste, throughout the material's life cycle;
- Ensure measures and procedures are in place to prevent, respond to, and recover from a spill or other emergency event involving hazardous materials;
- Comply with all applicable health, safety, and environmental requirements; and
- Ensure public safety and environmental protection through proper use, storage, and disposal of hazardous materials.

### Scope

All MBTA facilities where hazardous materials are located are subject to policies and procedures dictating their correct procurement, handling, storage, and disposal. The MBTA's Hazardous Materials Program includes the following components:

- **Chemical Approval Process:** MBTA has developed a chemical approval procedure for the procurement of new chemical products. The individual or department responsible for purchasing the chemical must submit chemical information to MBTA Safety. The information then must be reviewed and approved by MBTA Safety, Environmental, and Materials Management departments before a purchase order is issued.
- **Safety Data Sheet (SDS)<sup>41</sup> Management:** In accordance with ENV-SOP-015, MBTA maintains Safety Data Sheets for all chemicals purchased, stored, or utilized at the Authority. SDSs are managed and maintained in a web-based searchable database system called Site Hawk.
- **Hazardous Materials Storage and Handling:** MBTA has established Best Management Practices (BMPs) for the proper handling and storage of hazardous materials, as outlined in ENV-SOP-013. Right-to-Know training is required for personnel working with or near hazardous materials.
- **Hazardous Waste Management:** MBTA has established BMPs for the proper handling, storage, and disposal of hazardous waste. MBTA has also established proper handling procedures for Universal Waste streams. These are prescribed in ENV-SOP-001 and ENV-SOP-014.
- **Spill Prevention Control and Countermeasures (SPCC) Plans:** MBTA has developed and maintains site specific SPCC plans for each facility, in accordance with 40 CFR 112. For facilities that store oil and/or oil products that do not meet the thresholds under 40 CFR 112, Oil Management Plans have been developed.

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<sup>41</sup> Formerly known as Material Safety Data Sheets (MSDS).

- **Facility Inspections:** MBTA maintenance facilities are required to perform, at minimum, weekly documented environmental inspections. In addition, the MBTA Department of Environmental Compliance conducts routine inspection audits to ensure compliance with federal, state, and local environmental regulations and MBTA procedures.

**Regulatory Compliance**

In accordance with 49 CFR 659.19(s), DPU is required to review and approve the Hazardous Materials Program section of the MBTA Safety Plan. In response to 49 CFR 659, the Massachusetts state legislature promulgated 220 CMR 151.03(s), which requires:

“A description of the hazardous materials program, including the process used to ensure knowledge of and compliance with program requirements.”

Other federal and state regulations governing Hazardous Materials Program requirements include:

- 40 CFR 112, Oil Pollution Prevention;
- 40 CFR 260, Hazardous Waste Management System: General;
- MGL c. 111F (et. seq.), Hazardous Substances Disclosure by Employers; and
- 454 CMR 21 (et. seq.), “Right to Know” Law MGL c.111F.

**Responsibilities**

**Safety and Security Executive Review Committee (SSRC):** Responsible for overall review and acceptance of MBTA programs, policies, and procedures related to hazardous materials management. Their internal oversight provides assurance that MBTA’s hazardous materials programs are in compliance with applicable regulations and industry standards, and are properly integrated with the existing MBTA system.

**System Safety Working Groups (SSWGs):** Responsible for developing, reviewing, and implementing cross-departmental hazardous materials program initiatives, policies, and procedures. As hazardous materials program issues arise that require resources or coordination beyond the issue department/location, relevant SSWGs are responsible for working collaboratively to assess associated hazards and recommend solutions.

**MBTA Safety:** Responsible for supporting MBTA management and the MBTA Department of Environmental Compliance in monitoring the implementation and effectiveness of MBTA’s hazardous materials programs and policies, through internal auditing and oversight activities. MBTA Safety also provides technical guidance to other departments in the area of hazardous materials management.

**MBTA Department of Environmental Compliance:** Responsible for developing Authority environmental compliance programs, and monitoring the implementation and effectiveness of MBTA’s environmental policies and practices through internal auditing and training activities. The department also provides technical guidance and support to other Authority departments in the areas of environmental compliance, environmental assessments, and relevant industry best practices.

**Materials Management:** Responsible for complying with MBTA’s established chemical approval process and purchasing only approved chemicals.

**Engineering and Maintenance:** Responsible for maintaining the infrastructure of the Authority’s aboveground storage tanks and management of disposal contracts.

**MBTA Management:** Responsible for ensuring compliance with environmental policies, procedures, and SOPs. In accordance with applicable regulations and policies, management responds to and investigates environmental incidents, reports violations, and tracks and resolves hazards. They are also responsible for overseeing the proper handling, storage, and removal of hazardous materials, hazardous waste, and universal waste within their areas/facilities, in accordance with applicable SOPs. They are responsible for supervising and monitoring employees within their departments to ensure adherence to relevant environmental policies, procedures, and SOPs.

**MBTA Resource Coordinators/Chemical Requesters:** Personnel requesting to purchase a chemical or material that has not previously been approved by MBTA are responsible for submitting a written request and required chemical information to MBTA Safety, and following the established chemical approval process.

## References

*Documents listed in this section are incorporated by reference and are intended to comply with federal and state regulation requirements.*

ENV-SOP-001, “Universal Waste Handling and Disposal of Fluorescent Light Bulbs”

ENV-SOP-013, “Hazardous Materials Management”

ENV-SOP-014, “Hazardous Waste Management”

ENV-SOP-015, “Material Safety Data Sheet Management”

ENV-SOP-020, “Disposal of Waste Aerosol Cans”

Applicable MBTA Standard Operating Procedures, Rules, and Special Orders

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## ELEMENT 20: HUMAN FACTORS

### Purpose

The purpose of Human Factors is to ensure MBTA has comprehensive programs, policies, and procedures in place to address human factors that could potentially pose a risk to the safety and well being of MBTA's employees, contractors, and customers. The overall objective is to ensure that any hazards associated with human elements of MBTA's operations are adequately recognized, mitigated, and monitored through processes that are consistent with federal and state regulations and industry best practices.

### Scope

Safety critical aspects of the operation that involve human factors present an inherent risk for human error. MBTA addresses the potential risks by instituting policies and procedures related to human factors, including the following:

- **Drug & Alcohol Program:** The MBTA's Drug & Alcohol Program is documented in the MBTA Drug & Alcohol Policy. The program employs four guiding principles to achieve its goal of providing a service and workplace free from the effects of drug and alcohol misuse:
  - Deterrence: Training and educating field management and employees on the effects of substance abuse on the individual and in the workplace to prevent misuse.
  - Treatment and rehabilitation: Utilizing the dedicated Employee Assistance Program to help employees seek treatment and rehabilitation before jeopardizing their jobs.
  - Detection: Methods to identify and resolve drug and alcohol misuse, including strong drug and alcohol testing procedures.
  - Enforcement: Violation of drug and alcohol policies is grounds for discipline, up to and including termination.
- **Fitness for Duty:** The Authority defines an employee as fit for duty when he/she is unequivocally able to perform his/her job duties. This involves being ready for work and free of alcohol and all prohibited drugs (including prescription and over-the-counter medications), as outlined in the MBTA Drug & Alcohol Policy. MBTA also has a return to work program to clear employees who have been out for an extended period of time, had a work related injury or illness, or left the property in an ambulance.
- **Hours of Service:** MBTA's Hours of Service policy is intended to limit work hours in order to prevent exhaustion and fatigue among employees who perform specific safety-critical job duties. Operations Special Orders #14-013 and #14-014 describe requirements for employees and supervisors in regard to maximum work and shift times, and minimum time off between shifts.
- **Fatigue Management:** MBTA's fatigue management initiatives, in addition to Hours of Service, include fatigue awareness education and sleep disorder screening and awareness.
- **Distraction:** In order to minimize employee distractions while operating Authority buses and trains, MBTA has a strict policy for operators' possession or use of cell phones and other electronic devices while on duty and in their assigned revenue vehicles, as outlined in Operations Special Order #14-052. Operations rulebooks also prohibit employees from eating, drinking, or reading newspapers or other printed materials while operating Authority vehicles.
- **Stress/Well-Being:** MBTA's Employee Assistance Program (EAP) provides MBTA employees and their dependents with confidential counseling services, referrals, and support for issues in

areas including: personal well-being (stress, emotional/psychological issues, and family/relationship issues), critical incident stress management, and drug and alcohol addiction.

### Regulatory Compliance

In accordance with 49 CFR 659.19(t), DPU is required to review and approve the Drug and Alcohol section of the MBTA Safety Plan. In response to 49 CFR 659, the Massachusetts state legislature promulgated 220 CMR 151.03(2)(t), which requires:

“A description of the drug and alcohol program and the process used to ensure knowledge of and compliance with program requirements.”

Other federal regulations governing drug and alcohol requirements include:

- 49 CFR 40, “Procedures for Transportation Workplace Drug and Alcohol Testing Programs”;
- 49 CFR 655, “Prevention of Alcohol Misuse and Prohibited Drug Use in Transit Operations”;
- P.L. 100-690, Title V, Subtitle D, “Drug-Free Workplace Act of 1988”; and
- P.L. 102-143, Title V, “Omnibus Transportation Employee Testing Act of 1991.”

Regulations pertaining to hours of service include:

- DPU Order 19810 – Rail
- 220 CMR 155.02(12) – Bus

### Responsibilities

**Safety and Security Executive Review Committee (SSRC):** Responsible for the review and acceptance of MBTA programs, policies, and procedures in the areas of human factors. Their internal oversight provides assurance that MBTA’s human factors programs are in compliance with applicable regulations and industry standards, and are properly integrated with the existing MBTA system.

**Occupational Health Services:** Responsible for administration of the Drug & Alcohol Policy, including revisions to the document as required, policy communication to employees, drug and alcohol training, and periodic review of all safety-sensitive positions designated for testing. Occupational Health Services manages the specimen collection process and oversees the contract for laboratory testing, ensuring that the provider meets all requirements, certifications, and standards. The department maintains drug and alcohol testing records in a secure and confidential manner, and provides relevant test result data and medical history information to the NTSB as needed for official accident/incident investigations. In addition, Occupational Health Services manages the Employee Assistance Program and provides employee education and support in the areas of drug and alcohol addiction, fatigue, sleep disorders, stress, and personal well-being.

**MBTA Management:** Responsible for monitoring employees within respective departments to ensure compliance with all drug and alcohol, fatigue, hours of service, and fitness for duty requirements. In accordance with applicable regulations and policies, management reports violations and reinstructs or disciplines employees.

**MBTA Safety:** Responsible for supporting MBTA management in monitoring the implementation and effectiveness of MBTA’s human factors programs and policies, through internal auditing and oversight activities. MBTA Safety also provides support to various departments in the area of human factors, including by performing hazard analyses and system safety assessments, and gathering and recommending industry best practices.

**References**

*Documents listed within this element are incorporated by reference, and intended to comply with federal and state regulation requirements.*

MBTA Drug & Alcohol Policy (February 24, 2014)

MBTA Operations Special Order #14-013 “Limitation of Work Hours” (All Bus & Subway Supervisory Personnel)

MBTA Operations Special Order #14-014 “Limitation of Work Hours” (All Operating Personnel)

MBTA Operations Special Order #14-052 “Possession and Use of Cellular Phones and Other Prohibited Electronic Devices”

Applicable MBTA Standard Operating Procedures, Rules, and Special Orders

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## ELEMENT 21: PROCUREMENT

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### Purpose

The purpose of Procurement is to ensure that the process of obtaining vehicles, rolling stock, systems, equipment, and other materials are systematically reviewed for compliance with safety requirements and verified prior to purchase, implementation, and use.

The objectives of Procurement are to:

- Ensure a formalized process that takes into account and evaluates the safety effects on operations and services;
- Ensure that basic safety user requirements are included in procurement specifications and drawings and are coordinated with the appropriate departments;
- Ensure procurement decisions are made collaboratively by appropriate management and committees;
- Ensure safety design reviews are an integral part of all acquisition processes for system facilities and equipment;
- Ensure acceptance testing is documented and verifies compliance with the requirements of the procurement specifications; and
- Ensure configuration management is properly tracked and documented to verify the design integrity of MBTA's transit system.

The Procurement process is documented through the MBTA Procurement Manual and all other pertinent documents within, and as referenced below.

### Scope

To achieve the objectives outlined above, MBTA has developed procurement procedures and processes for the following categories:

- **Acquisitions:** These include large scale purchases such as trains, a fleet of maintenance vehicles, or an entire signal system. Because purchases on this scale incorporate numerous sub-components and have the potential to introduce multiple hazards to the system, the acquisition process requires the consideration and management of the entire life cycle of each acquisition. This life cycle involves the research, development, testing, and procurement of each major purchase. System safety mechanisms have been incorporated into the acquisition process to ensure that elements of the system function effectively and safely. Safety design reviews are conducted by MBTA Safety and end-user departments.
- **Procurement of Materials:** This includes smaller and/or routine purchases. Safety considerations are integrated through the following inspection and verification processes:
  - Incorporation of fail-safe principles and mechanisms;
  - Hazard mitigation through design, safety devices, selection of parts/materials, and location of components;
  - Designs that minimize the severity of injury or damage in the event of an accident;
  - Provision of warnings, instructions, and protections for personnel operating, maintaining, assembling, or repairing equipment; and
  - Proper training and certification programs for the procured equipment and materials.

- **Chemical Procurements:** For the procurement of chemicals, MBTA utilizes a third-party software service (Site Hawk) which stores, tracks, and retrieves Safety Data Sheet (SDS) information. This system allows the Authority to house and access up-to-date technical information regarding a product's constituent components and any associated hazards or safeguards. Prior to procurement of new chemical, a request must be submitted to and approved by MBTA Safety and the Department of Environmental Compliance.
- **Configuration Management and Control:** Requirements are established to ensure the design integrity of MBTA's transit system. All configuration changes associated with procurements and acquisitions are reviewed, approved, documented, and implemented by MBTA. Configuration management and control in the procurement process are consistent with the requirements described in [Element 17, Configuration Management](#).
- **Quality Assurance Process:** Procurements pursuant to an MBTA specification typically require the manufacturer to submit a pre-production sample for quality assurance testing. The purchase order is coded as "Inspection Required" and receivers cannot enter these items into inventory until the prototype has been tested and approved by qualified personnel. Random sample inspections of components and materials coded in a purchase order for quality inspection are also routinely conducted.
- **Emergency Procurements:** There may be emergency conditions that necessitate the immediate procurement of materials or services in order to maintain the safety of MBTA operations and services. Examples of such events include severe weather conditions, terrorist attacks, emergency response to accidents/incidents, and equipment failures and malfunctions. Any other immediate threat to public health, welfare, or safety as declared by the General Manager is justification for emergency procurement. An emergency may allow MBTA to expedite the procurement process in order to restore services in a timely manner.

## Regulatory Compliance

In accordance with 49 CFR Part 659.19(u), DPU is required to review and approve the Procurement section of the MBTA Safety Plan. In response to 49 CFR 659, the Massachusetts state legislature promulgated 220 CMR 151.03(2)(u) which requires:

“A description of the measures, controls, and assurances in place to ensure that safety principles, requirements and representatives are included in the rail transit agency's procurement process.”

## Responsibilities

**Safety and Security Executive Review Committee (SSRC):** Responsible for overall internal oversight and to provide assurance that safety is an integral part of MBTA's procurement process. Their internal oversight provides assurance that procurement processes are in compliance with applicable guidelines, and are properly integrated with existing MBTA standards.

**System Safety Working Groups (SSWGs):** These groups, comprised of a cross-section of MBTA management and Safety, are tasked as needed with ensuring that safety is incorporated into procurement processes and procedures.

**MBTA Safety:** Responsible for providing oversight of the established procurement processes and procedures and monitoring their implementation and effectiveness. In addition, MBTA Safety co-chairs SSWGs, as well as the SSRC, supporting Materials Management, Design and Construction, Vehicle Engineering and MBTA management in developing appropriate procurement processes.

**Procurement Task Group:** Comprised of representatives from Materials Management, Safety, and end-user departments. The team meets to establish or review processes to ensure that the objectives of this element are met.

**Materials Management:** Responsible for procuring equipment, materials, and services to be used by all departments throughout the Authority. Materials Management is also responsible for coordinating with MBTA Safety to ensure that safety is an integral element of all procurement processes and activities and for maintaining an inventory of materials. Materials Management works with MBTA Safety and end user organizations to control the purchase of chemicals and hazardous materials and to ensure that safety requirements are included in MBTA vendor, service, and construction contracts.

**Design and Construction:** Design and Construction, with its complete project team, plans, directs, and manages all tasks required to procure and complete projects from preliminary engineering through construction and project closeout. The project team is also responsible for coordinating safety and security certification activities.

**Vehicle Engineering:** Responsible for MBTA’s vehicle procurement program, which includes the planning, design/engineering, acquisition, testing and acceptance, and closeout phases. In addition, Vehicle Engineering, with its complete project team, plans, directs, and manages all tasks required to complete the procurement, from preliminary engineering and specification development through acquisition and project closeout. Lastly, the project team is responsible for coordinating safety and security activities for procured vehicles.

**Engineering and Maintenance:** Responsible for developing specifications for the procurement of materials and equipment needed to support MBTA operations. E&M monitors and oversees equipment installation and testing to ensure safe and reliable use.

**References**

*Documents listed within this element are incorporated by reference, and intended to comply with federal and state regulation requirements.*

MBTA Procurement Manual

MBTA Configuration Management Program, # SAF2.03.00, August 2014

Applicable MBTA Standard Operating Procedures, Rules, and Special Orders

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## **CLOSING STATEMENT**

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This document is designed to provide information and guidance for the continued safe operation of the transit systems operated by the Massachusetts Bay Transportation Authority. It expresses the Authority's commitment to transit passenger and employee safety.

MBTA Safety Plan is meant to serve MBTA as a guideline to hazard management. This document should not be interpreted as imposing any legal obligations upon MBTA or providing the basis for liability in any legal action against MBTA.

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## ADDITIONAL RESOURCES

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2. American Public Transportation Association. *Safety Management System Guidelines: Public Passenger Transportation Systems*. Washington, D.C.: American Public Transit Association, 2013. Draft.
3. American National Standards Institute, Inc. *Occupational Health and Safety Management Systems*. ANSI/AIHA Z110-2012. Washington, D.C.: American National Standards Institute, 2012.
4. Bahr, Nicholas J. *System Safety Engineering and Risk Assessment: A Practical Approach*. New York: Taylor and Francis, 1997. Print.
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6. Manuele, Fred A. *Advanced Safety Management Focusing on Z10 and Serious Injury Prevention*. New Jersey: John Wiley & Sons, 2008. Print.
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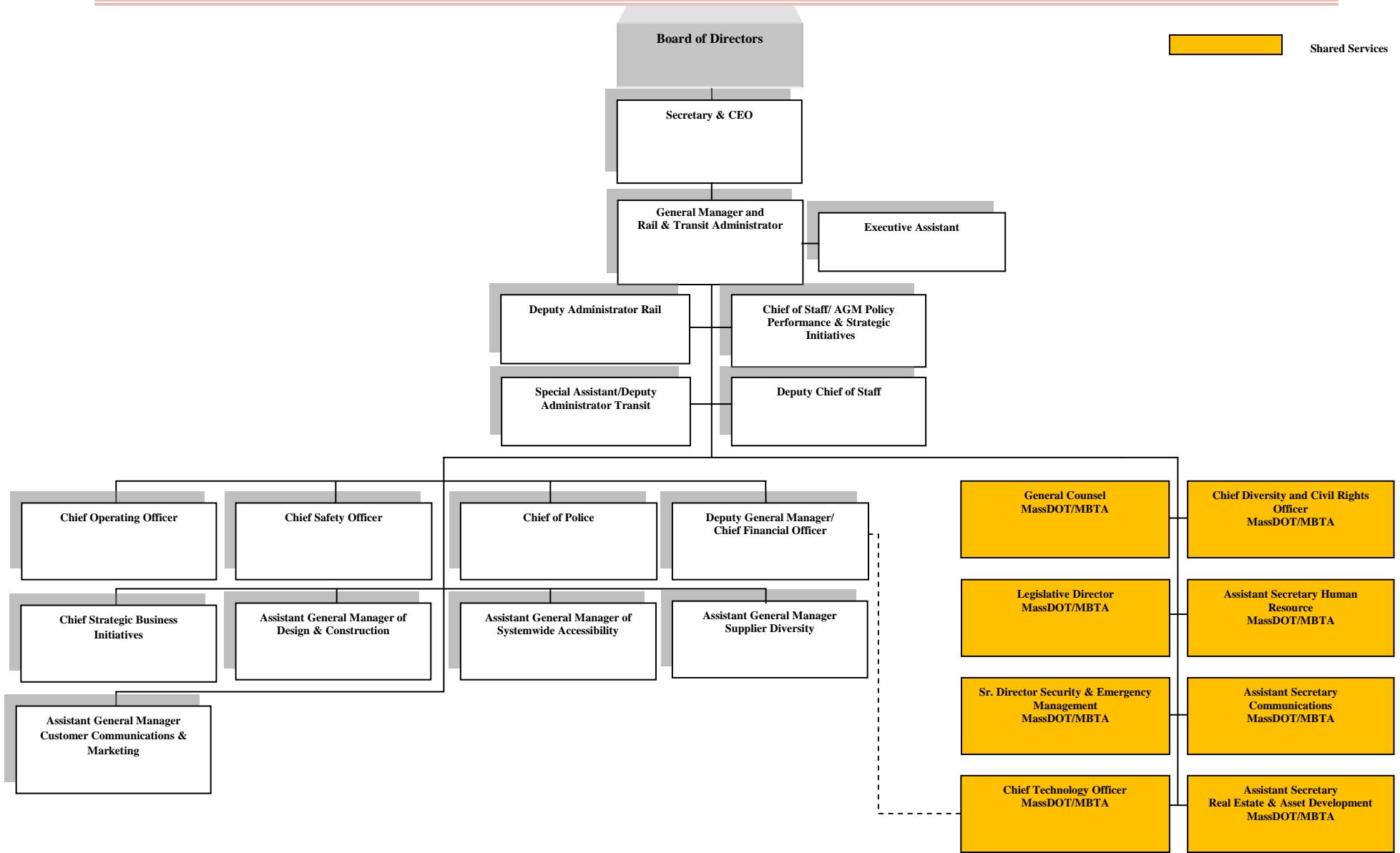
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## APPENDICES

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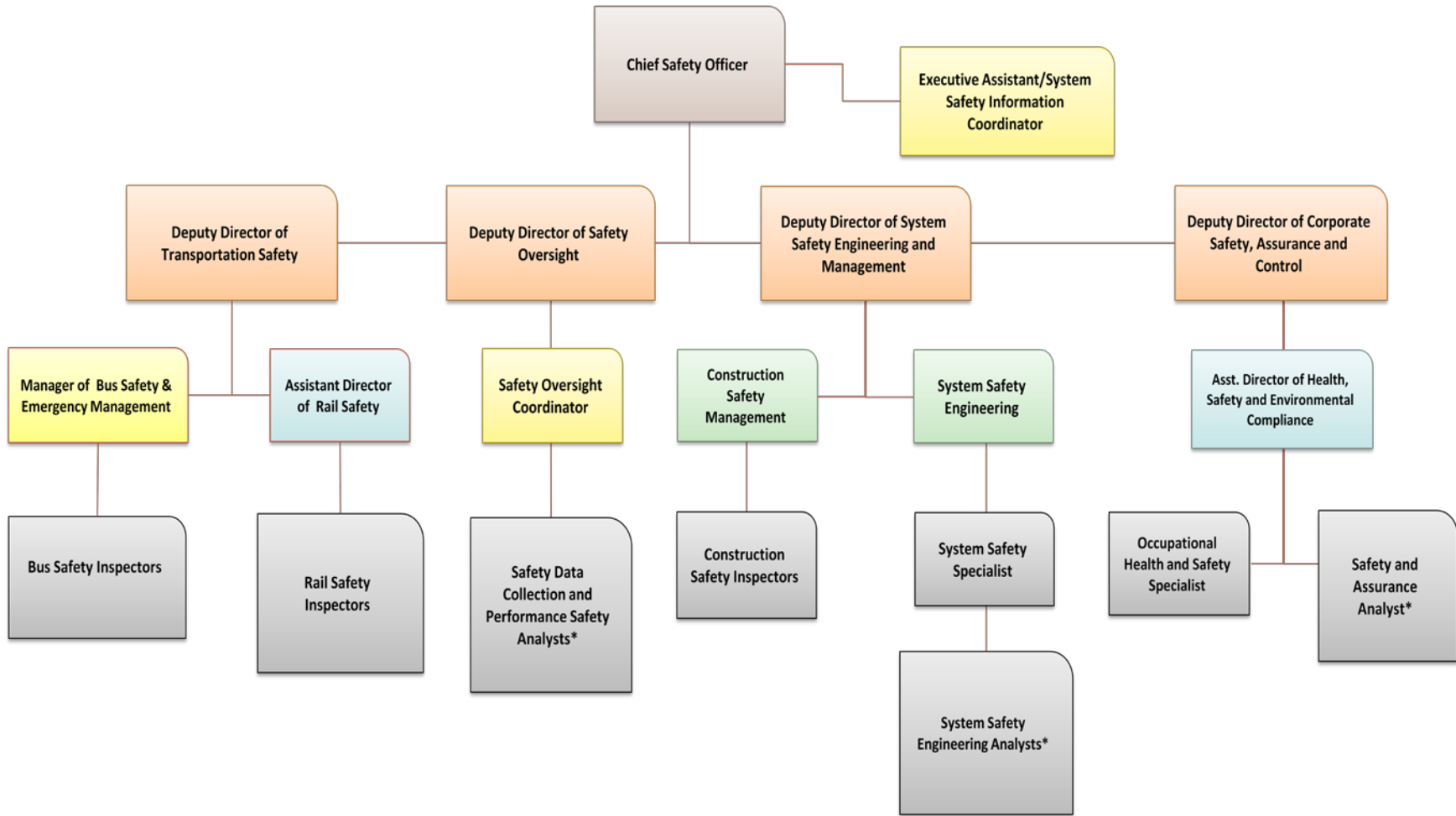
## APPENDIX A: MBTA ORGANIZATIONAL CHART



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**APPENDIX A-2: MBTA SAFETY ORGANIZATIONAL CHART**



\*Analysts are shared resources across all groups

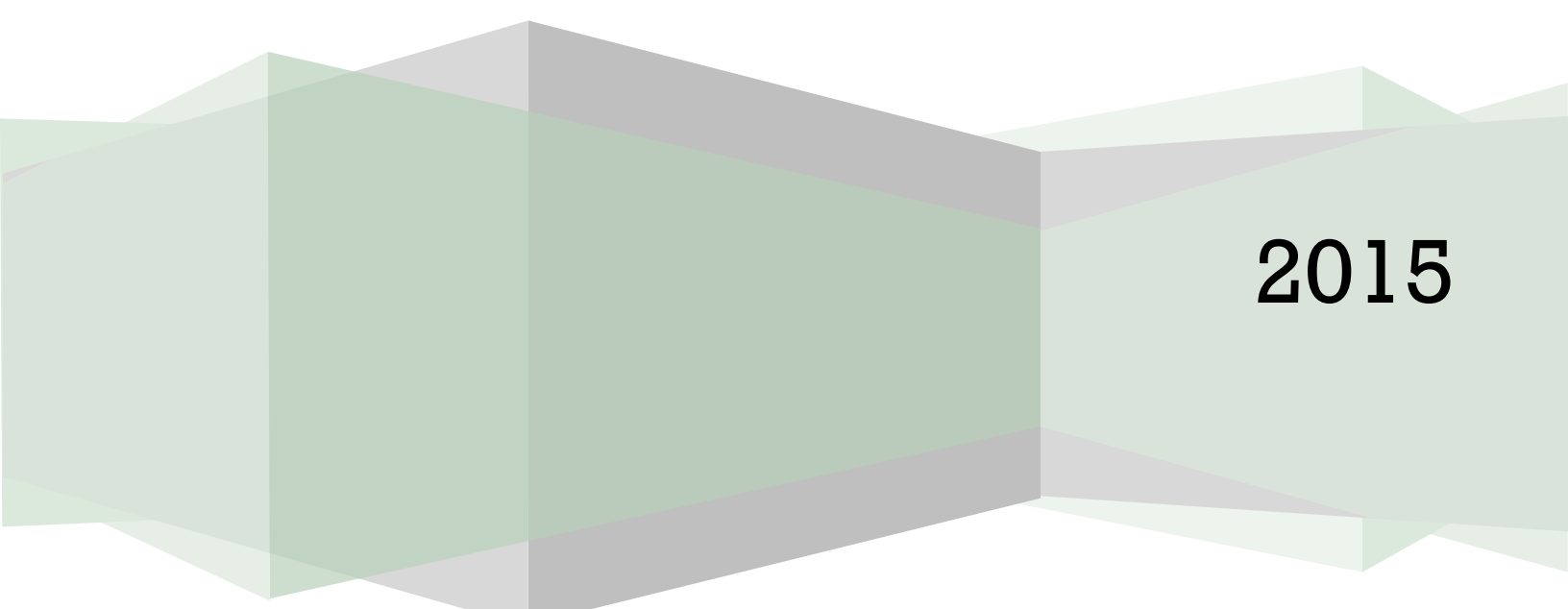
# MBTA Configuration Management and Control Safety Program

**Document Control Number: SAFE1.10.00**

**Prepared by: MBTA Safety**

**Document Controlled by: Steven V. Culp**

**Directed and Approved by: Ronald W. Nickle  
Chief Safety Officer**



**2015**

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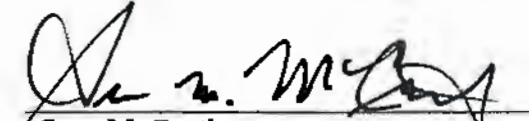
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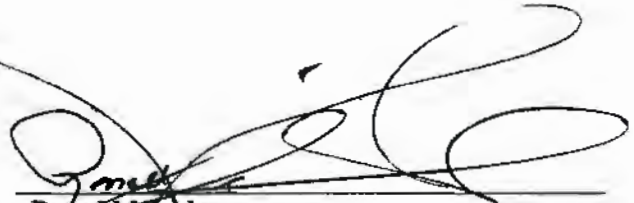
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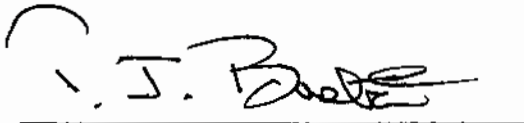
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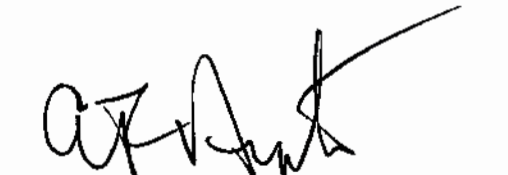
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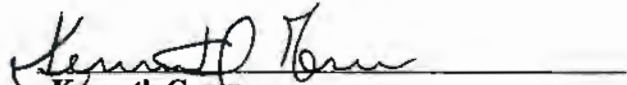
  
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Chair*

  
**Ronald Nickle**  
*Chief Safety Officer and SSRC Co-Chair*

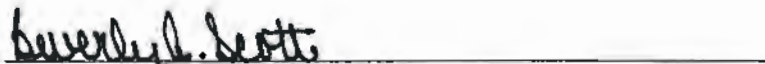
  
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*Chief of Strategic Business Initiatives*

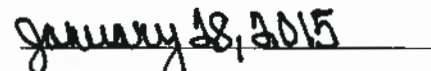
  
**Jonathan Davis**  
*Deputy General Manager/Chief Financial  
Officer*

  
**Edmond Hunter**  
*Assistant General Manager of Design &  
Construction*

  
**Kenneth Green**  
*Acting Transit Police Chief*

**General Manager's Concurrence**

  
**Beverly A. Scott, PhD, MBTA General Manager and Rail  
and Transit Administrator, do fully authorize and endorse  
MBTA's Configuration Management and Control Program.**

  
**January 28, 2015**  
*Dated*

## 1.0 PURPOSE:

The purpose of this program is to establish a Configuration Management and Control process to evaluate and approve proposed changes, as well as document and analyze the efficacy of implemented changes to system safety and/or safety critical aspects of the MBTA's System including: operations, processes, administrative policies and procedures, rules, infrastructure, vehicles<sup>1</sup> and training. The Configuration Management and Control Safety Program is the governing program for all system safety related MBTA System changes vetted for system safety affect through the System Modification Safety Program, or Safety Certification Program.

**Configuration Management and Control** has four (4) basic elements:

**Configuration Identification:** Defining a system's operations, processes, administrative policies and procedures, rules, infrastructure, vehicles and training.

**Change Management:** Controlling changes to the system's operations, processes, administrative policies and procedures, rules, infrastructure, vehicles and training.

**Configuration Status Accounting:** Documenting the present status of the system's operations, processes, administrative policies and procedures, rules, infrastructure, vehicles and training, as well as maintaining records of previous configurations.

**Configuration Auditing:** Verifying the consistency of configuration documentation against the present configuration of the system's operations, processes, administrative policies and procedures, rules, infrastructure, vehicles and training.

## 2.0 SCOPE:

This Program applies to all proposed changes to the MBTA System, including: operations, processes, administrative policies and procedures, rules, infrastructure, vehicles and training that are expected to have an impact on system safety.

This program seeks to establish a protocol for accomplishing the following key tasks:

- Use consistent procedures for determining when a proposed change is to be managed using the System Modification Safety Program, or Safety Certification Program.
- Use consistent criteria for determining what equipment and facilities are subject to configuration management.
- Use consistent procedures to document all changes.
- Use consistent procedures to disseminate pertinent information due to changes.
- Use a consistent process to review changes for safety impacts to personnel, customers, property, equipment and/or procedures.
- Developing an efficient and consistently applied process for the distribution, safe storage and quick retrieval of all applicable documents.
- Comply with Federal, State and local regulations and conform to the MBTA Safety Plan; MBTA Controlled Safety Policies; MBTA Management Rules Policies and

<sup>1</sup> Excludes non-modified, original equipment manufacturer (OEM) non-revenue vehicles for business use only.

Procedures; Industry Best Practices; and Industry Standards, where applicable.

### 3.0 REFERENCES:

- 49 CFR 659: Rail Fixed Guideway Systems; State Safety Oversight; Final Rule
- 220 CMR 151.00: Rail Fixed Guideway System: System Safety/Security Program Standard
- MBTA Controlled Safety Documents (See Appendix A)
- Industry Best Practices and Industry Standards

### 4.0 DEFINITIONS AND ABBREVIATIONS:

**As-Built Configuration:** A fixed infrastructure or vehicle system that has previously been “Safety Certified” and/or formally accepted by the Authority.

**As-Built Documentation:** The documents (plans, specifications, manuals) that represent the actual constructed/fabricated fixed infrastructure or vehicle system which have been modified from the documents used to procure the fixed infrastructure or vehicle system.

**Changes:** System changes to Authority operations, rules, policies, procedures, plans, infrastructure, vehicles, training and/or administrative changes that meet a minimum of one of the following:

- May affect the safety of the system.
- Potentially increases risk of injury to passengers and/or employees.
- Changes and/or modifications to one system which may affect another system.
- Any changes and/or modifications to an “as built” configuration.

**Configuration Management:** Refers to the systematic control, monitoring and documenting of all changes and/or modifications of a system’s physical and operational features throughout its life cycle to ensure that the system and its various components reflect the current documentation.

**Management:** Members of the MBTA’s SSRC, System Safety Working Groups (SSWG) or designated executive level representatives.

**MBTA Controlled Safety Documents:** (*See Appendix A*) MBTA documents that are related to the safety of MBTA’s Operations and System Safety. Each of these documents has been assigned an MBTA Safety Document Number by MBTA Safety, regardless of authorship.

**Modification Safety Review Board (MSRB):** A group of individuals/departments convened to review and approve/disapprove proposed changes through the System Modification Safety Program.

**Present Configuration:** The configuration of a fixed infrastructure or vehicle system that has been modified from the “As-Built” Configuration through the MBTA’s System Modification Program or through major rehabilitation that has been “Safety Certified”.

Appropriate documentation shall be developed and maintained to document the present configuration.

**Rulebook Review Committee:** A committee formed and convened for the purpose of performing regular reviews and proposing changes and/or modifications to the Authority's rulebooks. In addition, the Rulebook Review Committee will document and suggest proposed rulebook changes for Management approval.

**Safety Critical:** Elements of a system where the failure of that element can cause:

- Loss of life
- Serious injury
- Major service disruption of 8 or more hours
- Significant environmental impact
- Property damage of \$100,000 or more

**System Modification Safety Program:** The process undertaken by the Authority to ensure the control of changes to MBTA owned and operated equipment and/or facilities which pose an impact on Safety. This process will ensure that changes pertaining to the Safety of equipment and facilities have been systematically planned, evaluated and approved by all appropriate departments and/or personnel for compliance with MBTA standards, as well as all federal, state, and local regulations. The intent for the system modification process is that it will be used for changes that are minor in nature.

**Safety Certification Program:** The process undertaken by the MBTA to ensure that safety concerns and hazards are adequately addressed prior to the initiation of passenger operations for capital projects that extend, rehabilitate or modify an existing system or to replace vehicles and equipment. This formal process includes the following:

- Identification of specific safety and security requirements;
- Verification of compliance with safety and security requirements; and
- Identification and resolution of non-compliance (open items).

## 5.0 RESPONSIBILITIES:

### 5.1 Management

- a. MBTA Management shall be responsible for the adoption of this Program.
- b. Ensure the appropriate level of authority proposes configuration changes to safety critical MBTA operations, rules, policies, procedures, plans, infrastructure, vehicles, training and/or administrative changes.
- c. Determine whether a proposed change is evaluated through the System Modification Safety Program, or Safety Certification Program.
- d. Ensure that all proposed changes are reviewed by the appropriate program.

### 5.2 MBTA Safety

- a. Ensure that this Program complies with Federal, State and local regulations and conforms to the MBTA Safety Plan; MBTA Controlled Safety Policies; MBTA Management Rules Policies and Procedures; Industry Best Practices;

- and Industry Standards, where applicable.
- b. Maintain and periodically review an indexed library of MBTA Controlled Safety Documents, including those authored by MBTA Safety and authored by others. MBTA Safety will assign a document control number for configuration management and control tracking.
- c. Participate in the review of proposed changes to identify system safety/safety critical elements as well as potential safety hazards and make recommendation along with Management for change management via System Modification Safety Program, or Safety Certification Program.
- d. Conduct safety audits, inspections, observations and record reviews of the implementation of the Configuration Management and Control Safety Program, and issue findings, recommendations, observations, or suggestions.
- e. Verify closure of all audit findings through corrective action reports.
- f. Perform an audit on the written Configuration Management and Control Safety Program and coordinate/facilitate updates with affected departments/employees.

### **5.3 MBTA Operations:**

- a. Responsible for implementing and enforcing this Program with MBTA Safety oversight.
- b. Appropriately implement, document and track changes to MBTA Rulebooks (e.g. Right of Way, Light Rail, Heavy Rail, or Bus), Special Order's and other documents that are considered Safety Critical.
- c. Monitor all changes and/or modifications of the system's physical and operational features or Authority rules and document the affect on system safety.

### **5.4 Vehicle Maintenance:**

- a. Responsible for implementing and enforcing this Program with MBTA Safety oversight.
- b. Ensuring appropriate documentation is updated when system safety or safety critical changes are made to a vehicle and/or its systems.
- c. Verifying the consistency of configuration documentation against the present configuration of the system's operations, processes, administrative policies and procedures, rules, infrastructure, vehicles and training.

### **5.5 MBTA Engineering and Maintenance:**

- a. Responsible for implementing and enforcing this Program with MBTA Safety oversight.
- b. Ensuring appropriate documentation is updated when system safety or safety critical changes are made to the Authority's infrastructure or facilities
- c. Verifying the consistency of configuration documentation against the present configuration of the system's operations, processes, administrative policies and procedures, rules, infrastructure, vehicles and training.
- d. Ensure that the Safety Certification or System Modification process is appropriately administered after the change.
- e. Ensure that all proposed changes, and the process for implementing changes



comply with all federal, state, and local regulations as well as MBTA standards.

- f. Participate in the review of proposed changes to make recommendation along with Management for change management via System Modification Safety Program, or Safety Certification Program.

## **5.6 Design & Construction/Vehicle Engineering**

- a. Ensure that proper as-built configuration documentation is obtained at the completion of facility/system construction or vehicle procurement<sup>2</sup> for use as a base line for Configuration Management and Control.
- b. Ensure that the Safety Certification or System Modification process is appropriately administered before, during, and after changes.
- c. Ensure that all proposed changes and the process for implementing changes comply with all federal, state, and local regulations, as well as MBTA standards.
- d. Participate in the review of proposed changes to make recommendation along with Management for change management via System Modification Safety Program, or Safety Certification Program.

## **5.7 MBTA/MassDOT Security Department**

- a. Responsible for implementing and enforcing this Program with MBTA Safety oversight.
- b. Ensuring appropriate documentation is updated when system safety or safety critical changes are made to security systems.
- c. Verifying the consistency of configuration documentation against the present configuration of the system's operations, processes, administrative policies and procedures, rules, infrastructure, vehicles and training.

## **5.8 MBTA/MassDOT Information Technology Department**

- a. Responsible for implementing and enforcing this Program with MBTA Safety oversight.
- b. Ensuring appropriate documentation is updated when system safety or safety critical changes are made to information technology systems.
- c. Verifying the consistency of configuration documentation against the present configuration of the system's operations, processes, administrative policies and procedures, rules, infrastructure, vehicles and training.

## **6.0 PROCEDURES:**

### **6.1 MBTA Operations/Vehicle Maintenance/Engineering & Maintenance**

- a. When new operations, processes, administrative policies and procedures, rules, and training are proposed and implemented, the department shall

---

<sup>2</sup> Except in the event of intellectual property infringement or when prohibited by the OEM while using other transit agencies' available procurement options.

ensure proper system safety and/or safety critical documentation is catalogued and maintained via the department's document control process for the distribution, safe storage and quick retrieval of all applicable documents.

- b. When modifications/changes are made to existing operations, processes, administrative policies and procedures, rules, infrastructure, vehicles and training are proposed and implemented, the department shall ensure proper system safety and/or safety critical documentation is updated and maintained via the department's document control process for the distribution, safe storage and quick retrieval of all applicable documents.
- c. Periodically audit their systems and documentation to verifying the consistency of configuration documentation against the present configuration of the system's operations, processes, administrative policies and procedures, rules, infrastructure, vehicles and training.

## 6.2 MBTA/MassDOT Security Department

- a. Ensure that proper as-built configuration documentation is obtained at the completion of security systems installations for use as a base line for Configuration Management and Control.
- b. Ensure that the Safety Certification or System Modification process is appropriately administered before, during, and after changes.
- c. Ensure that all proposed changes and the process for implementing changes comply with all federal, state, and local regulations, as well as MBTA standards.
- d. Participate in the review of proposed changes to make recommendation along with Management for change management via System Modification Safety Program, or Safety Certification Program.

## 6.3 MBTA/MassDOT Information Technology Department

- a. Ensure that proper as-built configuration documentation is obtained at the completion of information technology system installations for use as a base line for Configuration Management and Control.
- b. Ensure that the Safety Certification or System Modification process is appropriately administered before, during, and after changes.
- c. Ensure that all proposed changes and the process for implementing changes comply with all federal, state, and local regulations, as well as MBTA standards.
- d. Ensure that all proposed changes to information technology systems will not have an adverse affect to MBTA safety critical systems (e.g., SCADA, OCC system etc.)
- e. Participate in the review of proposed changes to make recommendation along with Management for change management via System Modification Safety Program, or Safety Certification Program.

## 6.4 Design & Construction

- a. When new facilities or infrastructure are constructed or when major upgrades are made, Design and Construction shall ensure proper system safety and/or safety critical documentation is catalogued and/or updated and maintained

via the department's document control process for the distribution, safe storage and quick retrieval of all applicable documents.

#### **6.5 MBTA Vehicle Engineering**

- a. When new vehicles or rolling stock is procured or undergoes a major overhaul, Vehicle Engineering shall ensure proper system safety and/or safety critical documentation is catalogued and/or updated and maintained via the department's document control process for the distribution, safe storage and quick retrieval of all applicable documents.

#### **6.6 MBTA Safety**

- a. Create and maintain and periodically review an indexed library of MBTA Controlled Safety Documents, including those authored by MBTA Safety and authored by others. MBTA Safety will assign a document control number for configuration management and control tracking. This list will continually evolve to reflect system safety advances, changes, or modifications to tasks, activities, and processes.
- b. Participate in the review of proposed changes to identify system safety/safety critical elements as well as potential safety hazards and make recommendation along with Management for change management via System Modification Safety Program, or Safety Certification Program.
- c. Conduct safety audits, inspections, observations and record reviews of the implementation of the Configuration Management and Control Program, and issue findings, recommendations, observations, or suggestions.
- d. Verify closure of audit findings through corrective action reports.
- e. Perform an audit on the written Configuration Management and Control Safety Program and coordinate/facilitate updates with affected departments/employees.

### **7.0 DISCLAIMER:**

This Configuration Management and Control Program is intended to be implemented in concert with the MBTA's Safety Certification Program and System Safety Modification Program.

### **8.0 DOCUMENTATION:**

Appendix A: MBTA Controlled Safety Documents Matrix

### **9.0 REVISION HISTORY:**

The MBTA Configuration Management and Control Program continually evolves to reflect system safety advances, changes, or modifications to tasks, activities, and processes. As such, the MBTA Configuration Management and Control Program is analyzed, reviewed, and/or revised annually and as needed in the event of significant transformations. The MBTA Configuration Management and Control Program revision and update process is subject but not limited to:

- DPU standards, regulations, and orders;
- Federal, state, and local regulations;
- NTSB recommendations, as applicable;
- Industry best practices, circulars, and guidance, as applicable;
- Capital improvements, modifications, and expansions;
- MBTA Safety Plan policy changes;
- Identification, addition, refinement, and improvement of the MBTA Safety Plan processes, tasks and activities; and
- Organizational changes in safety management systems.

<b>Originated By:</b>	Chief Safety Officer	Ronald W. Nickle	<b>Date:</b>	12/15/2014	<b>Document Control Number:</b>	SAFE1.10.00
<b>Document Controlled by:</b>	MBTA Safety	Steven V. Culp				
<b>SSWG Approval Date:</b>	December 17, 2014					
<b>SSRC Approval Date:</b>						
<b>Revisions: N/A</b>						
<b>Revised By:</b>		<b>Date:</b>		<b>Reason:</b>		
<b>Revised By:</b>		<b>Date:</b>		<b>Reason:</b>		
<b>Revised By:</b>		<b>Date:</b>		<b>Reason:</b>		

## **Appendix A**

### **MBTA Controlled Safety Documents Matrix**

**MBTA Controlled Safety Documents:**

The following matrix identifies MBTA documents that are related to the safety of MBTA's Operations and System Safety. Each of these documents has been assigned an MBTA Safety Document Number by MBTA Safety. As revisions to these documents are made, the MBTA Safety Document Number will be changed accordingly.

MBTA Safety Document Numbers are generated in the following format:

SAFE1.Document ID.Revision Number

Document ID is the consecutive number assigned by MBTA Safety

Revision Number is the latest revision, starting at 00

<b><u>Document Name</u></b>	<b><u>MBTA Safety Document No.</u></b>	<b><u>Last Revision Date</u></b>
MBTA Safety Plan	SAFE1.01.00	September 30, 2014
MBTA Accident Investigation Manual	SAFE1.02.00	August 15, 2014
Right of Way Rule Book	SAFE1.03.00	July 1, 2014
Safety Rules Compliance Program	SAFE1.04.00	November 5, 2013
Rules for Streetcar Motorpersons, Station Personnel, and Other Employees of the Light Rail Lines	SAFE1.05.00	July 1, 2009
Rules for Streetcar Motorpersons, Station Personnel, and Other Employees of the Heavy Rail Lines	SAFE1.06.00	August 1, 2010
Rules for Operators and Other Employees of Bus Operations	SAFE1.07.00	January 1, 2013
MBTA System Modification Safety Program	SAFE1.08.00	January 1, 2015
MBTA Safety Certification Program	SAFE1.09.00	January 1, 2015
MBTA Configuration Management and Control Safety Program	SAFE1.10.00	January 1, 2015

# MBTA Safety Certification Program

**Document Control Number: SAFE1.09.00**

**Prepared by:**

**Document Control:**

**Directed and Approved by:**

**MBTA Safety**

**Steven V. Culp**

**Ronald W. Nickle**

**Chief Safety Officer**



**2015**

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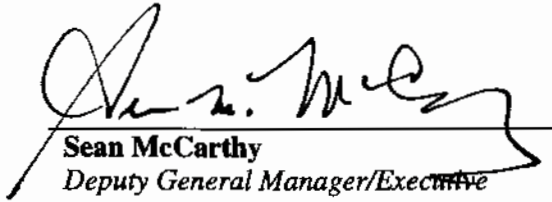
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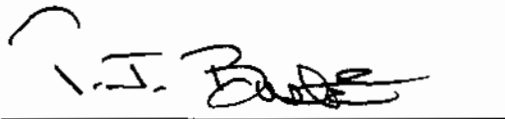
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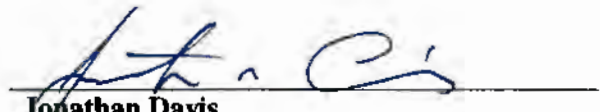
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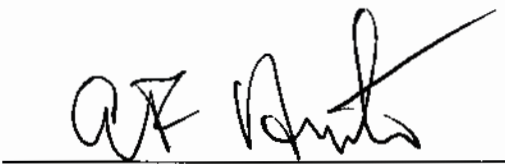
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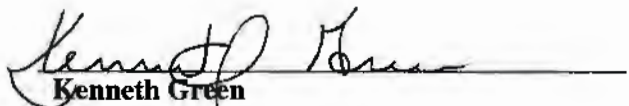
  
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Chair*

  
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*Chief Safety Officer and SSRC Co-Chair*

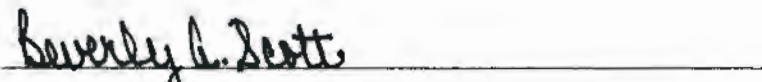
  
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*Chief of Strategic Business Initiatives*

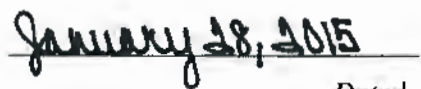
  
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*Deputy General Manager/Chief Financial  
Officer*

  
**Edmond Hunter**  
*Assistant General Manager of Design &  
Construction*

  
**Kenneth Green**  
*Acting Transit Police Chief*

**General Manager's Concurrence**

  
**Beverly A. Scott**  
*I, Beverly A. Scott, PhD, MBTA General Manager and Rail  
and Transit Administrator, do fully authorize and endorse  
MBTA's Safety Certification Program.*

  
**January 28, 2015**  
*Dated*

**ACRONYMS**

AGM D&C	Assistant General Manager of Design and Construction
ALARP	As Low As Reasonably Practical
ANSI	American National Standards Institute
APE	Advanced Preliminary Engineering
APTA	American Public Transportation Association
ATO	Automatic Train Operations
BMP	Best Management Practice
CAP	Corrective Action Plan
CEL	Certifiable Elements List
CFR	Code of Federal Regulations
CIL	Certifiable Items List
CMR	Code of Massachusetts Regulations
COO	Chief Operating Officer
COOP	Continuity of Operations Plan
CSO	Chief Safety Officer
D&C	Design and Construction Department
DC	Design Consultant
DCM	Design Criteria Manual
DPU	Massachusetts Department of Public Utilities
E&M	Engineering and Maintenance
EMP	Emergency Management Plan
FD	Final Design
FLSC	Fire Life Safety Committee
FMEA	Failure Modes and Effect Analyses
FMECA	Failure Modes Effects and Criticality Analysis
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
FTHA	Fault Tree Hazard Analyses
GM	General Manager
MAP-21	Moving Ahead for Progress in the 21st Century
MassDOT	Massachusetts Department of Transportation
MassDPU	Massachusetts Department of Public Utilities
MBTA	Massachusetts Bay Transportation Authority
MIL-STD	Military Standard
NFPA	National Fire Protection Association
NTSB	National Transportation Safety Board
OCC	Operations Control Center
OHA	Operating Hazard Analyses
OHS	Occupational Health and Safety
OSHA	Occupational Safety and Health Administration
PHA	Preliminary Hazard Analysis
PPE	Personal Protective Equipment
QA/QC	Quality Assurance/Quality Control
RAC	Rail Activation Committee
ROW	Right of Way
RWP	Roadway Worker Protection
SCP	Safety Certification Program
SHA	System Hazard Analysis
SITT	System Integration & Testing Team

SMS	Safety Management Systems
SOP	Standard Operating Procedure
SP	Safety Plan
SSCP	Safety Certification Plan
SSEPP	System Security Emergency Preparedness Plan
SSWG	Safety Certification Working Group
SSRC	Safety and Security Executive Review Committee
TPD	Transit Police Department
TS	Technical Specifications
TVA	Threat and Vulnerability Assessment
USC	United States Code
USDOT	United States Department of Transportation

## 1.0 PURPOSE

The purpose of the Safety Certification Program is to ensure that major capital projects that; rehabilitate, replace, extend, or modify infrastructure, systems, vehicles<sup>1</sup>, and equipment are safe, and that safety concerns or hazards are adequately addressed prior to use.

## 2.0 SCOPE

The scope of the Safety Certification Program (SCP) is to define how to incorporate the MBTA Safety Plan, and system safety processes into MBTA's major capital projects, primarily performed by Design and Construction and Vehicle Engineering. All other projects will follow the **MBTA System Modification Safety Program** (*see Appendix A*).

## 3.0 REFERENCES

- 49 CFR 659: Rail Fixed Guideway Systems; State Safety Oversight; Final Rule
- 220 CMR 151.00: Rail Fixed Guideway System: System Safety/Security Program Standard
- MBTA Safety Plan (SP)
- FTA Circular C5800.1 – Safety And Security Management Guidance For Major Capital Projects
- FTA Report – FTA-MA-90-5006-02-01 – Handbook for Transit Safety and Security Certification
- MBTA Controlled Safety Documents, Federal, State and local codes, regulations and Industry Standards, where applicable See Appendix A.

## 4.0 DEFINITIONS

**As-Built Configuration:** A fixed infrastructure or vehicle system that has been “Safety Certified” and/or formally accepted by the Authority.

**As-Built Documentation:** The documents (plans, specifications, manuals) that represent the actual constructed/fabricated fixed infrastructure or vehicle system which have been modified from the documents used to procure the fixed infrastructure or vehicle system.

**Capital Infrastructure Projects:** Projects that include the development, fabrication, and building of an engineered design. The MBTA has adopted a two (2) tier system for the Safety Certification Program for Capital Infrastructure Projects. Many capital infrastructure projects are smaller in scope (<\$100,000,000), therefore the level of effort for the certification of these projects can be limited. New Starts and Larger scale projects require a higher level of effort. In both cases, development of project specific CELs/CILs are required. An example of typical CELs can be found in Appendix B, Sample Certifiable Element/Sub-Element Lists.

- **Tier 1 Certifications:** Projects requiring a Tier 1 Certification are those that are larger in scope, such as those with a contract value greater than \$100,000,000, or New Starts construction (e.g., Green Line Extension Project), or projects as determined by MBTA to have substantial safety, integration, system, complexity or other viable impacts.
- **Tier 2 Certifications:** Tier 2 Certifications are for smaller projects, contract value less

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<sup>1</sup> Excludes non-modified, original equipment manufacturer (OEM) non-revenue vehicles for business use only.

than \$100,000,000. This would include the construction of new stations on an existing line or the reconstruction of existing stations or facilities.

**Certifiable Elements:** Project elements that can affect the safety of transit agency passengers, employees, contractors, public safety personnel or the general public (see Appendix B, e.g., Stations).

**Certifiable Sub-Elements:** Sub-Elements that can affect the safety of transit agency passengers, employees, contractors, public safety personnel or the general public (see Appendix B, e.g., Platforms).

**Certifiable Items:** Individual items/components which make up the certifiable elements. Each item of a certifiable element must be verified before the element as a whole can be verified (e.g., Tac-Tile).

**Certifiable Elements List:** List of Certifiable Elements

**Certifiable Items List:** List of Certifiable Items

**Changes:** Changes to Authority operations, rules, policies, procedures, plans, infrastructure, vehicles, training and/or administrative changes that meet a minimum of one of the following:

- May affect the safety or security of the system.
- Potentially increases risk of injury to passengers and/or employees.
- Potentially increases risk of damage to MBTA property or major service disruption
- Changes and/or modifications to one system which may affect another system.
- Any changes and/or modifications to an “as built” configuration.

**Configuration Management:** Refers to the systematic control, monitoring and documenting of all changes and/or modifications of a system’s physical and operational features throughout its life cycle to ensure that the system and its various components reflect the current documentation.

**Final Acceptance:** An action by an authorized representative of the MBTA by which the Authority assumes full or partial ownership of the delivered project as complete or partial performance of a contract. **Safety Certification is NOT final acceptance.**

**Construction:** The project phase that begins with the development, fabrication, or building of an engineered design and concludes with the delivery of the completed project. This phase includes the inspection, review, and testing of the delivered project and concludes with the determination that the delivered project meets the design specification.

**Contract Documents:** A contractual document containing the design criteria and standards required to be followed for of all elements of a project.

**Contractor:** The entity that performs the physical tasks as specified under the approved contract for the project.

**Design Consultant:** The entity that produces the contract documents consisting of plans and specifications to be used by the Contractor to build the project.

**Design Criteria:** Criteria intended to provide guidance to the design team to support the definition of systems, sub-systems, and components, the development of performance requirements, and the final specification of the designed system.

**Final Acceptance:** An action by an authorized representative of the MBTA by which the Authority assumes full or partial ownership of the delivered project as complete or partial performance of a contract. Safety Certification is NOT final acceptance.

**Fire/Life Safety Committee:** The committee that serves as a liaison between the MBTA and the fire jurisdictions and public safety agencies (local fire department, Department of Public Safety, police, local emergency medical services, etc.) throughout the project.

**Fixed Guideway:** A public transportation facility not regulated by the Federal Railroad Administration –

- a) Using and occupying a separate right-of-way for the exclusive use of public transportation;
- b) Using rail;
- c) Using a fixed catenary system;
- d) For a passenger ferry system; or
- e) For a bus rapid transit system.

**Hazard:** Any real or potential condition that can cause injury, illness, or death; damage to or loss of a system, equipment, or property; or damage to the environment.

**Hazard Analysis:** The formal analysis performed to identify and classify hazards for the purpose of their elimination or control. Examples include preliminary hazard analysis (PHA), systems hazard analysis (SHA), and a variety of reliability analyses, including Failure Modes Effects and Criticality Analysis (FMECA).

**Hazard Resolution:** The action taken to reduce the consequences associated with an identified hazard, to a level As Low As Reasonably Practical (ALARP).

**Integrated Testing:** Activities typically performed as part of construction to identify, plan, and conduct tests to evaluate integration of the delivered and accepted project into planned revenue operations. This phase concludes with verified documentation of compatibility between system elements.

**Management:** Members of the MBTA's Safety & Security Executive Review Committee (SSRC), System Safety Working Groups (SSWG) or designated executive level representatives.

**MBTA Controlled Safety Documents:** (*See Appendix A*) MBTA documents that are related to the safety of MBTA's Operations and System Safety. Each of these documents has been assigned an MBTA Safety Document Number by MBTA Safety, regardless of authorship.

**MBTA Safety Plan:** Formally known as the System Safety Program Plan (SSPP). A document authored by MBTA Safety, describing the MBTA's safety policies, objectives, responsibilities, and procedures while in revenue service.

**Passenger:** A person who is on board, boarding, or alighting from/to a transit vehicle for the purpose of travel.

**Pre-revenue Operations:** Activities typically performed at the conclusion of construction to verify the functional capability and readiness of the system as a whole and includes the performance of tests, drills, exercises, and audits. It concludes with verified documentation of readiness for revenue operations.



**Present Configuration:** The configuration of a fixed infrastructure or vehicle system that has been modified from the “As-Built” Configuration through the MBTA’s System Modification Program or through major rehabilitation that has been “Safety Certified”. Appropriate documentation shall be developed and maintained to document the present configuration.

**Project:** A piece of planned work or an activity that is finished over period of time and intended to achieve a particular outcome. (e.g., facility/infrastructure construction or vehicle procurement)

**Revenue Service:** The transportation of fare-paying passengers.

**Safety:** Freedom from harm resulting from unintentional acts or circumstances.

**Safety Operations Review Committee:** The committee responsible for overseeing commissioning activities, including systems integration testing, start-up, activation, final safety certification, and operations and maintenance demonstration.

**Safety Certification Working Group:** The committee that oversees the accomplishment of the safety objectives for each project development phase; this committee will receive the final Safety Certification.

**Safety Certification Plan:** The document that describes the process used to verify that safety related requirements are incorporated into a project, thereby demonstrating that it is operationally ready for revenue service and safe and secure for passengers, employees, public safety agencies, and the general public.

**Safety Critical:** Elements of a system where the failure of that element can cause:

- Loss of life
- Serious injury
- Major service disruption of 8 or more hours
- Significant environmental impact
- Property damage of \$100,000 or more

**Security:** Freedom from harm resulting from intentional acts or circumstances.

**System:** A composite of people (employees, passengers, others), property (facilities and equipment), environment (physical, social, institutional), and procedures (standard operating, emergency operating, and training) which are integrated to perform a specific operational function in a specific environment.

**System Safety:** The application of engineering and management principles, criteria, and techniques to optimize safety within constraints of operational effectiveness, time, and cost throughout all phases of the system life cycle.

**System Security:** The application of operating, technical, and management techniques and principles to the security aspects of a system throughout its life to reduce threats and vulnerabilities to most practical level through the most effective use of available resources.

**System Safety Certification Program:** The process undertaken by the MBTA to ensure that safety concerns and hazards are adequately addressed prior to the initiation of passenger operations for major capital projects that extend, replace, rehabilitate or modify an existing

system or to procure and replace vehicles and equipment. This formal process includes the following:

- Identification of specific safety requirements
- Verification of compliance with the MBTA Safety Plan (SP), appropriate codes, guidelines, standards, and safety-related design criteria and technical provisions
- Identification and resolution of non-compliances (open items)

**Safety Verification:** The process used to ensure the project is safe and secure for passengers, employees, public safety personnel, and the general public, including the individual certificates the recipient will issue for each of the specific elements to be verified. Elements of Safety Verification include:

- a. **Design Criteria Verification Process:** Describes the process to verify that the technical specifications, drawings, and contract documents for the project conform to the MBTA's Safety requirements and design criteria.
- b. **Construction Specification Conformance Process:** Describes the process to verify that elements of the project provided under construction, procurement, and installation contracts conform to the safety components of the MBTA's technical specifications, drawings, and contract documents.
- c. **Testing/Inspection Verification:** Describes the process to verify that the as-built (or delivered) configuration contains the safety related requirements identified in the MBTA's technical specifications, drawings, and contract documents. Includes programs for contractual testing, systems integration testing, and pre-revenue operations testing.
- d. **Hazard and Vulnerability Resolution Verification:** Describes the process to verify that project personnel and contractors have appropriately identified, categorized, and resolved hazards and vulnerabilities to a level acceptable by management.
- e. **Operational Readiness Verification:** Describes the process to verify that project personnel and contractors developed plans, rules, procedures, manuals, and training and qualification programs in conformance with the recipient's safety requirements. This must also explain its process for ensuring the qualification and readiness of operations and maintenance personnel.

**Vulnerability:** The characteristics of passengers, employees, vehicles, and/or facilities that increase the probability of a security event.

**Vulnerability Analysis:** A systematic analysis performed to identify vulnerabilities and make recommendations for their elimination or mitigation during operation.

**Work Around:** An action taken to allow a project to safely enter into revenue service prior to completion. This action shall be temporary and tracked for closure until final acceptance.

## 5.0 RESPONSIBILITIES

### 5.1 Management

- a. MBTA Management shall be responsible for the adoption of this Program.
- b. To the extent defined and required by the project, MBTA Management shall participate in the review and approval of proposed plans and specifications. Such approvals shall:
  - Ensure proposed project does not adversely impact the Authority's systems.
  - Ensure that proposed project is properly evaluated prior to implementation, including installation, training, certification, operations, inspections, and testing.
  - Ensure proper notification of all affected departments, including training.
- c. Develop, implement and effectively manage safety management and safety engineering processes, controls, verifications and assurances.
- d. Ensure the appropriate level of authority proposes configuration changes to safety critical MBTA operations, rules, policies, procedures, plans, infrastructure, vehicles, training and/or administrative changes.
- e. For any system modification or change that will affect a class, craft, or group of employees, notify labor and invite them to participate in the Safety Certification process.

### 5.2 MBTA Safety

- a. Ensure that this Program complies with Federal, State and local regulations and conforms to the MBTA Safety Plan; MBTA Controlled Safety Policies; MBTA Management Rules Policies and Procedures; Industry Best Practices; and Industry Standards, where applicable.
- b. Participate in Project/New Vehicle Procurement Review Committees when projects are being developed to employ system safety and assess potential risk of injury to passengers, employees, and or MBTA property.
- c. MBTA Safety is responsible for the overall coordination and control of the specific tasks associated with the Safety Certification Program.
- d. For Capital Infrastructure Projects: Develop, implement and effectively manage safety management and safety engineering processes, controls, verifications and assurances.
- e. For New Revenue Vehicle Procurements: Develop, implement and effectively oversee and manage safety management and safety engineering processes, controls, verifications and assurances.
- f. Participate in the development of Certifiable Element Lists (CELs), and subsequently, the Certifiable Items Lists (CILs).
- g. Ensure CILs conform to MBTA Design Criteria, plans and specifications, and applicable codes, standards and regulations.
- h. Verify documentation that CILs have been completed prior to revenue service and maintain an open items log, with work around, for all items not completed.
- i. Document, in writing, the certification of the project/procurement.
- j. Perform an audit on the written MBTA Safety Certification Program and communicate any updates to affected department/employees.
- k. Conduct safety audits, inspections, observations, investigations, assessments, and records review of MBTA projects.
- l. MBTA Safety can issue findings, recommendations, observations, or suggestions based on completed audits, inspections, observations and records reviews.
- m. Verify closure of all audit findings through corrective action reports.

- n. On an annual basis, provide a matrix to management, the General Manager, and Board that describes all system modifications and changes within the calendar year.

### **5.3 Design & Construction:**

- a. Responsible for implementing and enforcing this Program with MBTA Safety oversight.
- b. Responsible for the procurement, management and oversight of all major design and construction projects for the Authority, in accordance with internal processes, standards, procedures, and controls as defined in internal D&C project manuals, contract specific plans and specifications, and applicable codes, standards and regulations.
- c. Work collaboratively with all MBTA departments including Safety to ensure that the Safety Certification process is initiated at the onset of the project and that a critical path is established to ensure that all elements of the Safety Certification are brought to closure before the project is complete or turned over to Operations to begin revenue service. All safety critical issues identified by MBTA Safety must be resolved through a documented and approved mitigation plan.
- d. Ensure that Safety Certification activities and requirements are considered and included in the project budget and timeline from the beginning
- e. Initiate Project Review Committees when projects are being developed to assess the effect to system safety and potential risk of injury to passengers and/or employees.
- f. Ensure that MBTA Safety and other key departments/stakeholders such Operations, System Wide Accessibility, Engineering and Maintenance, MBTA/MassDOT Security and the MBTA Police are incorporated into the Safety Certification process.
- g. Initiate the development of Certifiable Element Lists (CELs), and subsequently, the Certifiable Items Lists (CILs).
- h. Develop and maintain MBTA Design Criteria, and update it to include lessons learned from previous project experience
- i. Ensure CILs conform to MBTA Design Criteria, plans and specifications, and applicable codes, standards and regulations.
- j. Coordinate final Safety Certification walkthroughs for acceptance of the certifiable items.
- k. Ensure that documents such as the Project Managers Manual and the individual contracts specific to a particular project contain all appropriate language to provide a framework that outlines the specific responsibilities of all parties regarding Safety Certification.
- l. Ensure the timely resolution of all safety critical elements identified through the Safety Certification process. If, for any reason, critical issues cannot be resolved prior to completion of a project or the transfer of a facility to Operations, all outstanding items will be tracked until resolution.
- m. Maintain final project documents, including but not limited to: as-built drawings, submittals, affidavits, permits, inspection reports and certificates, etc. These documents will be utilized as the base line of future modifications and changes, as part of the Configuration Control and Management program.

### **5.4 MBTA Vehicle Engineering:**

- a) Responsible for implementing and enforcing this Program with MBTA Safety oversight.
- b) Responsible for all new vehicle design and procurement projects and oversight for the Authority.
- c) Work collaboratively with MBTA Safety to ensure that the Safety Certification process is initiated at the onset of the project and that a critical path is established to

ensure that all elements of the Safety Certification are addressed or brought to closure before the vehicles are complete or turned over to Operations to begin revenue service. All safety critical issues identified by MBTA Safety must be resolved through a documented and approved mitigation plan.

- d) Ensure that, with collaboration with MBTA Safety, Safety Certification activities and requirements are considered and included in the project budget and timeline from the beginning
- e) Initiate project review meetings when vehicle programs are being developed to assess the effect to system safety and potential risk of injury to equipment, passengers and/or employees.
- f) Ensure, with collaboration from MBTA Safety, that other key departments/stakeholders such as Operations, System Wide Accessibility, Engineering and Maintenance, MBTA/MassDOT Security and the MBTA Police are incorporated into the Safety Certification process.
- g) Develop, implement and effectively oversee and manage safety management and safety engineering processes, controls, verifications and assurances.
- h) Initiate the development of Certifiable Element Lists (CELs), and any other subsequent items, either internally or with the assistance of the contractor and/or Design Consultant.
- i) Develops and maintains the Technical Specifications (TS), and updates it to include lessons learned from previous Safety Certification/project experience, as applicable ensure CELs conform to the TS, and applicable codes, standards and regulations.
- j) Coordinate final Safety Certification acceptance of the certifiable elements and major sub-elements.
- k) Ensure that documents, such as the contract, contain all appropriate language to provide a framework that outlines the specific responsibilities of all parties regarding Safety Certification.
- l) Ensure the timely resolution of all safety critical elements identified through the Safety Certification process. If, for any reason, critical issues cannot be resolved prior to completion of a project or the transfer of a vehicle to Operations, all outstanding items will be tracked until resolution.
- m) Compile final project documents, including but not limited to: as-built drawings, submittals, affidavits, acceptance reports and certificates, etc. These documents will be utilized as the base line of future modifications and changes, as part of the Configuration Control and Management program.

#### **5.5 MBTA Operations (Incl. Engineering & Maintenance and Vehicle Maintenance):**

- a) Responsible for participating in this Program with MBTA Safety oversight.
- b) Participate in the certification process of new facilities, infrastructure and equipment that is being constructed or purchased by the MBTA and introduced into the system. The Design and Construction or Vehicle Engineering project manager will act as a liaison with MBTA Operations to ensure tasks are being completed and appropriate documentation in place and reviewed to verify compliance with the Safety Certification Program.
- c) Participate in the Rail Activation Committee, including Pre-Revenue Operational Readiness; Training; Emergency Management/Preparedness; Rule Procedures. Etc. Reviews Verification Checklists and accepts Safety Work Around(s).

**5.6 MBTA Police Department:**

- a. Ensure the security of our patrons, employees, facilities and vehicles by participating in the certification process. Towards this end, the MBTA Police Department will designate respective representatives to provide a security review of all plans and specifications, prioritize recommendations, and work with the project team to incorporate appropriate security enhancements.

**5.7 MassDOT/MBTA Security:**

- a. Participate in the certification process of new facilities, infrastructure and equipment that is being constructed or purchased by the MBTA and introduced into the system. The Design and Construction or Vehicle Engineering project manager will act as a liaison with MBTA Operations to ensure tasks are being completed and appropriate documentation in place and reviewed to verify compliance with the Safety Certification Program.
- b. Ensure the security of our patrons, employees, facilities and vehicles by participating in the certification process. Towards this end, the MassDOT/MBTA Security department will designate respective representatives to provide a security review of all plans and specifications, prioritize recommendations, and work with the project team to incorporate appropriate security enhancements.
- c. Participate in Project/New Vehicle Procurement Review Committees when projects are being developed to employ system safety and assess potential risk of injury to passengers, employees, and or MBTA property.
- d. Participate in the development of Certifiable Element Lists (CELs), and subsequently, the Certifiable Items Lists (CILs).
- e. Ensure CILs conform to MBTA Design Criteria, plans and specifications, and applicable codes, standards and regulations.

**5.8 Massachusetts Department of Public Utilities (MassDPU):**

- a) Responsible for safety oversight of the transit system, including the review of start-ups, modifications and system expansions within the MBTA. A representative of MassDPU participates in System Safety Working Group activities in an oversight capacity.

**6.0 SAFETY CERTIFICATION PROCESS**

Many transit agencies self-certify the safety of their operations, subsequent extensions and safety-significant modifications, prior to the initiation of revenue service. This process is typically part of the agency's existing program for system safety, and is integrated into major projects through a Safety Certification Program.

In certain instances, transit agencies have received benefits from the Safety Certification Program during engineering and design. Safety Certification activities support analysis that reduces the need for expensive retrofitting to correct hazards or vulnerabilities after the system is placed in revenue service. Certification also typically supports improved integration of operational considerations into project design, which offers the following opportunities:

- Improved functionality of system design
- Promotion of effective and efficient use of resources
- Reduction in work-arounds and change orders during construction
- Reduction in hazards in service and maintenance activities



In the event that accidents or major security incidents do occur, certification offers the following benefits, which may be useful in legal and insurance proceedings:

- Hazards and vulnerabilities are identified and assessed, and documented action is taken to resolve identified critical and catastrophic hazards as soon as possible.
- Appropriate codes, guidelines, and standards are reviewed to provide a basis for safety and security consideration in the design criteria and specifications, and drawings are in conformance with the design criteria.
- Facilities, systems, and equipment are designed, constructed, built, inspected, and tested in accordance with applicable codes, standards, criteria, and specifications.
- Necessary verification tests, safety plans, security plans, operating procedures, and rule books are developed for operations.
- Personnel are trained and qualified to respond to emergencies, and emergency response organizations are familiar with the transit systems and its emergency procedures.

The Safety Certification Program is intended to be incorporated into the comprehensive management and progressive decision making process that is required for the successful introduction of any transit project into revenue service.

## **7.0 PROCEDURES – General:**

The procedures for Safety Certification have been separated into individual sections as follows:

Section 8.0	Capital Infrastructure Projects – Tier 1 Certifications
Section 9.0	Capital Infrastructure Projects – Tier 2 Certifications
Section 10.0	New Revenue Vehicle Procurements

## **8.0 CAPITAL INFRASTRUCTURE PROJECTS – Tier 1 Certification Process**

### **8.1 Document Control**

Document Control has been established in the Design and Construction Department to ensure all project documentation is captured, tracked, updated, distributed, reported and retrievable. The operations of Document Control are the responsibility of the Design and Construction Project Manager. The Project Manager is responsible for maintaining the official project document files. All documentation that is generated for the project is forwarded to Project Manager at Design and Construction, which is responsible for processing all project correspondences and documentation through central files including logging, copying, routing and distribution to designated project personnel.

### **8.2 Committees/Working Groups**

Due to the complexity of Tier 1 projects, the MBTA will incorporate the following committees and/or working groups. Additional committees, such as a Fire/Life Safety Committee, will also be formed.

- a. MBTA Safety and Security Executive Review Committee (SSRC)

The SSRC, a standing MBTA executive safety committee, is responsible for overall acceptance and certification of the Project safety elements. Their internal oversight

provides assurance that the related safety elements are in compliance with applicable guidelines, and are properly integrated with existing MBTA standards for maintaining a safe and fully functional transit system. Acceptance by the SSRC will be based on recommendations from the SSWG.

SSRC members include:

- MBTA Chief Safety Officer (Chair)
- Deputy GM, Operations and Capital Program Implementation/Executive Chief Operating Officer
- Assistant General Manager of MBTA Design and Construction
- Chief, MBTA Transit Police
- Deputy GM & Administration/Executive Chief Financial Officer
- Chief of Strategic Business Initiatives

b. Safety Certification Working Group (SSWG)

The SSWG is a project-specific multi-disciplined group comprised of project and MBTA managers as well as staff having specific expertise in systems engineering, facilities engineering, maintenance engineering, construction management, operations, systems integration, and system safety. The SSWG is responsible for verifying project safety, and recommending approval of various project elements to the SSRC before the elements enter revenue service. The members of the SSWG include a wide range of expertise on the systems being installed, as well as their impact and integration into the existing MBTA infrastructure and fleets. Members of the SSWG will have the opportunity to recommend a disposition for each safety element through a voting process. SSWG Members may include, but are not limited to:

- MBTA Deputy Director of System Safety Engineering and Management or Designee (Chair)
- Design and Construction Project Manager
- MBTA Operations (Executive Level)
- MBTA Engineering and Maintenance (Executive Level)
- Design Consultant Project Manager
- MBTA Deputy Chief Transit Police
- MBTA Deputy Director of Security and Emergency Management
- MBTA Senior Director Vehicle Maintenance
- Deputy Director of System-wide Accessibility

A representative of MassDPU participates in SSWG activities in an oversight capacity.

The SSWG is responsible for managing and coordinating all safety certification activities including review of safety-related test results, and other documentation submitted. The SSWG chairperson or designee prepares and issues SSWG meeting minutes that includes a list of safety certification open items.

c. Fire Life Safety Committee (FLSC)

FLSC will evaluate and resolve potential project related fire and life safety issues, monitor compliance with fire/life safety requirements, support hazardous analysis efforts, and serve as liaison between MBTA and local Fire Departments, as appropriate, on project related issues.



d. Rail Activation Committee (RAC)

The RAC reports to Safety Certification Working Group. Meets regular as project goes through Pre-Revenue Operational Readiness; Training; Emergency Management/Preparedness; Rule Procedures. Etc. Reviews Verification Checklists and accepts Safety Work Around(s).

e. System Integration & Testing Team (SITT)

The SITT reports to Safety Certification Working Group. Reviews, participates in system integration and testing activities that have a potential safety impact.

### **8.3 Development of Safety Certification Plan**

The Design Consultant (DC) shall be delegated the responsibility for development of the Safety Certification Plan (SCP). The MBTA will provide support to the DC in this effort. The SSWG has review responsibility for the SCP. The MBTA SSRC has approval responsibility for the SCP.

### **8.4 Hazard and Vulnerability Assessment and Resolution**

The DC has primary responsibility for hazard and vulnerability assessment and resolution. See Section 11.0 – Hazard and Vulnerability Management.

### **8.5 Design Criteria and Design Review**

The Design and Construction Department has Design Criteria, typically conforming to the various design codes, standards, guidelines, and MBTA and/or industry standards used by DCs.

Design reviews will be conducted by MBTA, and other impacted parties (such as MassDOT) as appropriate at each stage of design.

In addition, design submittals will be reviewed for elements included in the Certifiable Elements and Sub-Elements List. Design related issues, including potential hazards and vulnerabilities, will be identified, discussed, resolved and documented as part of the design review process.

### **8.6 Develop Safety Certifiable Elements List**

The DC will prepare and maintain a Safety Certifiable Elements and Sub-Elements List identifying the system and fire/life safety items and security requirements in technical provisions, plans and procedures that will be subject to the safety certification process. Within each safety certifiable element listed, the sub-elements that must be evaluated for safety will be identified and listed.

As additional system and fire/life safety provisions are identified, the Certifiable Elements and Sub-Elements List will be revised to include the new element or provision and its sub-elements.

The SSWG has review responsibility for the Certifiable Elements and Sub-Elements List. The MBTA SSRC has approval authority for the Safety Certifiable Elements and Sub-Elements List.

**8.7 Evaluate and Resolve Fire/Life Safety Issues and Monitor Fire/Life Compliance**

The Fire/Life Safety Committee (FLSC) will evaluate and recommend resolution for potential project related fire and life safety issues, monitor compliance with fire/life safety requirements, support hazardous analysis efforts, and serve as liaison between MBTA and Authorities Having Jurisdiction (AHJs) and Local Fire Departments as appropriate on project related issues.

The FLSC includes:

- Representative of MBTA Safety
- Representative of the Design and Construction Department
- Representative of MBTA Transit Police
- Representative of Security & Emergency Management
- Representative of the Design Consultant
- Representative of Engineering and Maintenance
- Representative of any other affected departments
- Any and all regulatory agencies will be invited to participate in the committee as needed.

**8.8 Develop Criteria Conformance Review Checklists**

The DC will develop Criteria Conformance Review Checklists for each certifiable element that identifies safety related requirements from applicable codes and standards. The purpose of these checklists is to verify that the technical provisions, drawings and other contract documents comply with the safety requirements.

The designer/design team shall initially review and sign-off on the checklist verifying that design elements comply with requirements. Once complete, the SSWG has review responsibility for the checklists developed, and the SSRC has approval for the completed checklists. See Appendix C for an example Criteria Conformance Review Checklist.

**8.9 Evaluate Security Provisions Incorporated in System Elements**

The DC, in conjunction with MBTA/MassDOT Security, has the responsibility of evaluating physical security provisions incorporated into system elements for adequacy and system safety. The SSRC and SSWG shall review the evaluation.

**8.10 Manage Safety Open Items List**

The SSWG is responsible for managing and coordinating all safety certification activities including review of safety-related test results, and other documentation submitted. The SSWG chairperson or designee prepares and issues SSWG meeting minutes that includes a list of safety certification open items. Table 8-1 provides a sample format for documenting SSWG open items.

Table 8-1 SSWG OPEN ITEM SUMMARY

Open Item No.	Responsibility	Status	Due Date/ Date Closed	Description

### **8.11 Develop Safety Verification Checklists**

The DC will develop the Safety Verification Checklists. The purpose of the checklists is to verify that all safety-related documentation have been accounted for. In most cases, record documents are not part of the checklists, as the timing of their submittal may conflict with the need to complete the checklists prior to initiation of service. The DC is responsible for developing the project checklists to meet the safety requirements and verify the design is adequate. The SSRC has approval authority for the checklists developed. To ensure proper verification (and/or management), this activity must occur well in advance of the contractor activities that are to be verified. See Appendix D, for an example Tier 1 – Safety Certification - Certifiable Items Verification Checklist.

### **8.12 Complete Safety Verification Checklist Process**

The Contractor will be required to implement the designs in their entirety. The Design and Construction Department has primary responsibility for completing any Safety Verification Checklists developed by the DC. Through these checklists, the Contractor will verify that safety-related documentation has been provided. The DC and the Design and Construction Department will support this effort. The SSWG will review the completed checklists. The MBTA SSRC will approve the completed checklists.

### **8.13 Develop and Implement Test Plans and Procedures**

The Contractor will be responsible for developing and implementing test plans and procedures for all safety-related tests required in their respective technical provisions. The DC reviews and approves the safety-related test plans and procedures submitted by the Contractor. The Design and Construction Department will monitor and verify their implementation in accordance with contract requirements.

### **8.14 Test Reports/Results**

The Contractor will have primary responsibility for properly documenting, reporting and submitting their required test reports/results. The DC will review the Contractor's test reports/results submitted for conformance with Contract Documents. The Design and Construction Department will approve test reports submitted. For safety purposes these test reports/results will be used as evidence for specific items on the verification checklists. See Appendix E for an example Safety & Security Test Program Checklist.

### **8.15 Develop Integrated Test Plans and Procedures**

The DC has the responsibility of reviewing Contractor's submittals, identifying tests, and developing integrated test plans and design checklists for tests. The DC will provide general support to the Design and Construction Department. The Design and Construction Department will have the authority to approve the integrated test plans and procedures developed by the DC.

### **8.16 Manage Integrated Test Program**

The Design and Construction Department will have primary responsibility for managing the integrated test program. The Design and Construction Department will oversee and monitor the Contractor's Integration Test Program.

**8.17 Integrated Test Reports/Results**

The Contractor will be responsible for collecting and developing the test reports. The Design and Construction Department will oversee and monitor the Contractor's Systems Sub-Contractor in this task. The DC and the Design and Construction Department will review and approve the test reports/results.

Systems Integration tests will be performed for each systems element, verifying compatibility with project systems and with MBTA existing rail systems. Systems Integration checklists will be used to verify and track test results. See Appendix F for an example of a System Integration Tests Checklist.

**8.18 Develop Operations and Maintenance Procedures and Training Plan and Program**

The Contractor will be responsible for developing operations and maintenance procedures and training plan and program. Depending on the procedure, plan or program submitted, the DC and/or the Design and Construction Department will review the submittal for conformance with Contract Documents.

**8.19 Assess Existing MBTA Operations and Maintenance Procedures and Training Plans and Program for Adequacy and Safety**

The Design and Construction Department, in conjunction with other MBTA departments, will perform an assessment of existing operations and maintenance procedures and training plans and programs for adequacy, safety as it relates to the incorporation of the project. The DC will support the Design and Construction Department with this task. The SSWG may review the assessment.

As a result of this assessment, new documents may be developed or revisions made, as deemed necessary, to existing operations and maintenance procedures and training plans and programs. The new/revised procedures/plans/programs will be distributed, implemented, and trained provided.

**8.20 Issuance of Safety Certification**

Safety Certification for the Project is to be implemented as a four- step process that includes:

- The DC certifying that each contract design is in conformance with the design criteria.
- The Design and Construction Department certifying that the work was completed in accordance with the contract requirements. The Design and Construction Department verifying that safety-related documentation has been accounted for.
- The Design and Construction Department, in cooperation with appropriate departments, verifying that MBTA existing and new plans and procedures support safe operations and maintenance activities as it relates to the incorporation of the project.
- The MBTA SSRC verifying that the Project has conformed to the Safety Certification process following verification of the design and construction documentation, new operations and maintenance procedures, and the integrated testing and training records.

Upon successful completion of the above steps, the Safety Certification will be issued by the SSRC.

## 9.0 CAPITAL INFRASTRUCTURE PROJECTS –Tier 2 Certification Process

The program tasks described in this section comprise the structure for the Safety Certification process for Tier 2 projects. Tier 2 projects, as previously defined, are smaller projects with a contract value less than \$100,000,000. This would include the construction of new stations on an existing line or the reconstruction of existing stations or facilities. The procedures, methodologies, checklists, schedules and other documentation necessary for the implementation, review and completion of tasks are similar, but require smaller resource commitments.

### 9.1 Document Control

Document Control has been established in the Design and Construction Department to ensure all project documentation is captured, tracked, updated, distributed, reported and retrievable. The operations of Document Control are the responsibility of the Design and Construction Project Manager. The Project Manager is responsible for maintaining the official project document files. All documentation that is generated for the project is forwarded to Project Manager at Design and Construction, which is responsible for processing all project correspondences and documentation through central files including logging, copying, routing and distribution to designated project personnel.

### 9.2 Safety Certification Working Group

The SSWG for a Tier 2 project will be comprised of the MBTA Design and Construction project manager, MBTA Safety, Operations and the Design Consultant (DC). In addition, the input from other MBTA departments will be solicited on an as needed basis. These Departments include Engineering and Maintenance (Signals, Buildings and Structures, Track and Power), Communications, Vehicle Engineering and Maintenance, System-Wide Accessibility and Security/TPD. The SSWG is responsible for verifying project safety, and recommending approval of various project elements for revenue service.

### 9.3 Development of Safety Certification Plan

The DC shall be delegated the responsibility for development of the SSCP. The MBTA will provide support to the DC in this effort. The SSWG has review responsibility for the SSCP.

### 9.4 Identification and Documentation of Safety Requirements

The DC, in conjunction with the SSWG, will be responsible for the identification, compilation and documentation of safety requirements applicable to the facility and system elements. Source documentation for the identification of safety requirements will include:

1. The technical specification for MBTA contract(s).
2. MBTA design and performance criteria.
3. Safety studies and analyses conducted by the MBTA or consultants.
4. Pertinent safety criteria and studies from other rail transit systems or similar projects.
5. Applicable codes, standards, and regulations.

All safety requirements extracted from the technical specifications for equipment/facility element contracts will be documented on Safety Certification documents. Safety requirements extracted from source documentation, other than contract or technical specifications, will be documented on the Tier 2 – Safety Certification Form (See Appendix G).

Primary emphasis will be given to identifying those safety elements that are "safety critical". Safety critical elements, as defined earlier, are those items assessed as needed to eliminate, minimize, or control hazards, which under consideration of the potentially worst critical mishap, could result in death, severe injury, or major system or public property damage. However, safety codes and standards not falling within the above "safety critical" category will be included in the program so that non-critical safety elements can be verified. Safety critical elements will be shown in "bold type" when producing a list of certifiable elements.

### **9.5 Verification of Facility and System Elements**

This task will be applicable to construction and installation contracts appropriate to the equipment/facility being constructed. It will involve the completion of the Safety Certification elements listed in Paragraph 9.4 – Identification and Documentation of Safety Requirements, to verify that contractors have complied with safety requirements. If non-compliance with a safety requirement is identified, it will be logged as an "open item" and tracked for resolution as described under Paragraph 9.9 – Safety Certification.

### **9.6 Verification of Procedural System Elements**

Safety review and verification of MBTA operational rules and procedures and personnel training documentation will be conducted to ensure that procedural documents display contributions to certifiable levels of safety for the operational system. This task will be verified by the MBTA Safety.

A Safety Certification Procedures Review Log will be prepared and used to document the results. Where non-compliance with established safety requirements are found, or where new requirements are identified during reviews, they will be logged as an "open item" and tracked for resolution.

### **9.7 Verification of Personnel Training and Qualifications**

Verification of personnel training and qualification for operations, maintenance, and emergency response personnel will be conducted by review of personnel certification documentation provided and approved by Operations and Design and Construction. Verification under this task will be conditional, pending final verification under Paragraph 9.8 – Verification of System Integration.

### **9.8 Verification of System Integration**

9.8.1 This task will consist of safety review and verification of:

- Integrated Test Procedures
- Integrated Test Reports
- Pre-Revenue Operations Test Procedures, including Emergency Response Scenarios
- Pre-Revenue Test Reports



- 9.8.2 Integrated testing is conducted to verify the physical and/or the functional operations of equipment/facility elements that are integrated with the system subsequent to, or as part of, Acceptance Tests for individual equipment/facility elements. Integrated Test Procedures identified as required to verify the safety of operations, or the integrity of emergency response communications will be reviewed to:
- a. Verify the incorporation of safety requirements
  - b. Verify that the procedural content, including test pre-requisites, is sufficiently consistent with the stated purpose(s) or objective(s) of the test.

Safety requirements will be extracted from pertinent source documentation listed in Paragraph 9.4 – Identification and Documentation of Safety Requirements. Integrated test reports and any separate quality surveillance reports will be reviewed to verify that the safety requirements and parameters established by the approved test procedure have been met, and that any test non-compliance issues have been resolved.

- 9.8.3 Pre-revenue operations testing is conducted subsequent to the completion of integrated tests, to verify the operational readiness of conditionally qualified operational personnel, emergency response personnel, and/or procedures, through simulated revenue service. Normal and abnormal operations are conducted, including emergency response scenarios.

Pre-revenue operation test procedures will be reviewed to verify the stated purpose(s) of the simulated revenue service, and the overall procedural content, are of sufficient scope and depth to display the overall operational safety status. Along with others, MBTA Safety personnel will monitor and report on the conduct of pre-revenue operations tests to:

- a. Assess the effectiveness and the need for additions to, or revisions of, operational rules and procedures, or retraining of personnel.
- b. Assess the effectiveness of emergency response scenarios and response activities.

Pre-revenue operations test reports, safety assessment reports and any other reports will be reviewed to verify that a certifiable level of operational safety has been demonstrated during the conduct of pre-revenue operations. Where such reports display deficiencies in operational rules or procedures, or in compliance with rules and procedures, or in the effectiveness of the conduct of emergency response procedures, each deficiency will be logged as an "open item" and tracked for resolution as described under Paragraph 9.9 – Safety Certification.

- 9.8.4 Pre-revenue operations tests must be completed as soon as possible, but prior to opening for revenue service.

## **9.9 Safety Certification**

Safety Certification for the Project is to be implemented as a four- step process that includes:

- The DC certifying that each contract design is in conformance with the design criteria.

- The Design and Construction Department certifying that the work was completed in accordance with the contract requirements. The Design and Construction Department verifying that safety-related documentation has been accounted for.
- MBTA Safety, in conjunction with Design and Construction and E&M, will prepare an Open Item Status Log which will be used to track and document the resolution of all open items identified during the execution of the Safety Certification process, until they are closed out. The Open Items Status Log must contain a safe and acceptable workaround for all open items.
- The Design and Construction Department, in cooperation with appropriate departments, verifying that MBTA existing and new plans and procedures support safe operations and maintenance activities as it relates to the incorporation of the project.

### **9.10 Issuance of Safety Certification**

A Safety Certification Letter will be submitted to the General Manager and the SSRC. This letter will be prepared by the MBTA Safety Department showing all initial finding(s), conclusion(s), and recommendation(s). In addition, a copy of the Open Items Status Log shall be attached. See Appendix H for a sample Safety Certification Letter.

## **10.0 NEW REVENUE VEHICLE PROCUREMENTS**

### **10.1 Document Control**

Document Control has been established in the Vehicle Engineering Department to ensure all project documentation is captured, tracked, updated, distributed, reported and retrievable. The operations of Document Control are the responsibility of the Vehicle Engineering Project Manager. The Project Manager is responsible for maintaining the official project document files. All documentation that is generated for the project is forwarded to Project Manager at Vehicle Engineering, which is responsible for processing all project correspondences and documentation through central files including logging, copying, routing and distribution to designated project personnel.

### **10.2 Safety Certification Working Group (SSWG)**

The SSWG for new revenue vehicle procurements will be project specific and comprised of the MBTA Vehicle Engineering project manager, MBTA Safety, Operations and the Design Consultant (DC). In addition, the input from other MBTA departments will be solicited on an as needed basis. These Departments include Engineering and Maintenance (Signals, Track and Power), Communications, Vehicle Maintenance, System-Wide Accessibility and Security/TPD. The SSWG is responsible for verifying project safety, and recommending approval of various project elements for revenue service.

### **10.3 Development of Safety Certification Plan**

Per MBTA Vehicle Engineering Technical Specifications, the Contractor shall be responsible for development of the SSCP. The DC will provide support in this effort. The SSWG has review responsibility for the SSCP.



#### **10.4 Hazard and Vulnerability Assessment and Resolution**

The Contractor has primary responsibility for hazard and vulnerability assessment and resolution. The review and approval of this task is as assigned in Section 8.0 – Hazard and Vulnerability Management.

#### **10.5 Technical Specification and Design Review**

The Vehicle Engineering Department has developed the Technical Specifications (TS) for review and use by DCs. Criteria related issues are identified, discussed and resolved. The DCM includes criteria for the design of all system elements, including fire/life, and safety requirements, and all criteria are based on codes, guidelines, MBTA and/or industry standards.

In addition, design submittals will be reviewed for elements included in the Certifiable Elements and Sub-Elements List. Design related issues, including potential hazards and vulnerabilities, will be identified, discussed, resolved and documented as part of the design review process.

#### **10.6 Develop Safety Certifiable Elements List**

The DC, in conjunction with MBTA Safety and Vehicle Engineering, will prepare and maintain a Safety Certifiable Elements List identifying the system and fire/life safety items and security requirements in technical provisions, plans and procedures that will be subject to the safety certification process. Within each safety certifiable element listed, the sub-elements that must be evaluated for safety will be identified and listed.

As additional system and fire/life safety provisions are identified, the Certifiable Elements List will be revised to include the new element or provision.

The SSWG has review responsibility for the Certifiable Elements and Sub-Elements List.

#### **10.7 Evaluate and Resolve Fire/Life Safety Issues and Monitor Fire/Life Compliance**

The DC, in conjunction with MBTA Safety and Vehicle Engineering, shall ensure that materials meet flammability, smoke emission, and toxicity requirements presented in the Technical Specifications.

In addition to meeting those requirements, the Contractor shall:

- Include written procedures for the inspection, testing and maintenance of fire safety systems and fire safety equipment in the maintenance manuals.
- Perform an Emergency Egress Demonstration for Passenger Areas, Restroom, and Cab. The Contractor shall demonstrate emergency egress via all train emergency exits, emergency access provisions for emergency responders, and compliance with emergency design provisions of the Technical Specifications.

#### **10.8 Evaluate Security Provisions Incorporated in System Elements**

The DC has the responsibility of evaluating physical security provisions incorporated into system elements for adequacy and system security. The SSWG shall review the evaluation.

### **10.9 Manage Safety Open Items List**

Vehicle Engineering is responsible for managing and coordinating all safety certification activities including review of safety-related test results, and other documentation submitted. The Vehicle Engineering Project Manager or designee with the assistance of MBTA Safety prepares and issues meeting minutes that includes a list of safety certification open items. An exception report will be generated by MBTA Safety for safety critical Open Items documenting the Item, its resolution and closure date. In addition, Vehicle Engineering will maintain an Open Items log cataloging the items, resolutions and a monitoring program for closed items to ensure proper resolution.

### **10.10 Safety Verification Checklists**

The DC will develop and complete the Safety Verification Checklists. The purpose of the checklists is to verify that all safety-related documentation have been accounted for. In most cases, record documents are not part of the checklists, as the timing of their submittal may conflict with the need to complete the checklists prior to initiation of service. The DC is responsible for developing the checklists.

### **10.11 Develop and Implement Test Plans and Procedures**

The Contractor will be responsible for developing and implementing test plans and procedures for all safety-related tests required in their respective technical provisions, including integration tests to ensure the vehicles are compatible with the present configuration of the system. The DC reviews and approves the safety-related test plans and procedures submitted by the Contractor. The Vehicle Engineering Department will monitor and verify their implementation in accordance with contract requirements.

The Contractor will have primary responsibility for properly documenting, reporting and submitting their required test reports/results. The DC and/or the Vehicle Engineering Department will review the Contractor's test reports/results submitted for conformance with Contract Documents. The Vehicle Engineering Department will approve test reports submitted. For safety purposes these test reports/results will be used as evidence for specific items on the verification checklists.

### **10.12 Develop Operations and Maintenance Procedures and Training Plan and Program**

The Contractor will be responsible for developing operations and maintenance procedures and training plan and program. Depending on the procedure, plan or program submitted, the DC and/or the Vehicle Engineering Department will review the submittal for conformance with Contract Documents.

### **10.13 MBTA Operations and Maintenance Procedures and Training Plans and Program for Adequacy and Safety**

The Vehicle Engineering Department and the DC shall ensure that the Contractor provides operations and maintenance procedures and training plans and programs and will coordinate with all relevant departments to verify adequacy, safety as it relates to the incorporation of the project. The DC will support the Vehicle Engineering Department with this task. The SSWG may review the assessment.

As a result of this assessment, new documents may be developed or revisions made as deemed necessary to existing operations and maintenance procedures and training plans

and programs. The new/revised procedures/plans/programs will be distributed, implemented, and trained provided.

#### 10.14 Issuance of Safety Certification

Safety Certification for the Project is to be implemented as a four- step process that includes:

- The DC certifying that each contract design is in conformance with the technical specification.
- The Vehicle Engineering Department certifying that the work was completed in accordance with the contract requirements. The Vehicle Engineering Department and/or the Design Consultant verifying that safety-related documentation has been accounted for.
- The Vehicle Engineering Department, in coordination with other appropriate departments, verifying that MBTA plans and procedures support safe operations and maintenance activities as it relates to the incorporation of new vehicles.
- Vehicle Engineering and MBTA Safety verifying that the Project has conformed to the Safety Certification process following verification of the Vehicle Engineering documentation, new operations and maintenance procedures, and the integrated testing and training records.

Upon successful completion of the above steps, the Safety Certification will be issued by MBTA Safety.

### 11.0 HAZARD AND VULNERABILITY MANAGEMENT

#### 11.1 General

Application of safety certification promotes an informed management decision-making process in project design, construction, testing, and initiation into revenue service. The system safety discipline manages hazards and vulnerabilities throughout the life cycle of a project, program, or activity through a committed approach to risk management, where:

- a hazard is a condition or circumstance that could lead to an unplanned or undesired event;
- a vulnerability is a characteristic of the system that increases the probability of occurrence of a security incident; and
- risk is an expression of the impact of an undesired event or security incident in terms of severity and probability.

#### 11.2 Hazard Assessment and Resolution

To ensure that the MBTA's system continues to provide safe and reliable transportation services, the MBTA has established a process by which project hazards are identified, analyzed for potential impact on the operating system, and resolved in a manner acceptable to the MBTA and applicable regulatory agencies.

The MBTA is required to implement high standards of safety and system assurance throughout the design, construction, testing, and operational phases of MBTA projects. Hazards, which cannot be eliminated in the design, are to be controlled by safety devices, warning devices, and training, and/or written procedures.

Formal hazard analyses will be performed in the Project Development phase of a project. The DC, Contractor or Contractor will prepare the Preliminary Hazard Analysis (PHA) which includes two (2) primary steps as described below:

- Step 1: DC identifies/describes possible hazards associated with the project, along with potential causes, effects on the system, severity, probability and recommended corrective actions/controlling measures
- Step 2: DC conducts a workshop with project discipline leads and selected MBTA Department leads (i.e. Safety, Operations, Maintenance, Engineering, Security Department, Police, etc.) to determine which of the recommended corrective actions/controlling measures will actually be incorporated into the project.

Additional analyses may also be performed including Failure Modes and Effect Analyses (FMEA), Fault Tree Hazard Analyses (FTHA), and Operating Hazard Analyses (OHA). Formal analyses prepared and submitted will include appropriate support documentation used in the development of the analyses including but not limited to the following:

- Schematics, drawings, block diagrams
- System description including modes of operation and tasks
- Documented reliability, maintainability, and safety data including failure rate data obtained from service use in identical or manifestly similar equipment in similar environment
- Documented reliability, maintainability, and safety data obtained from formal test results, conducted in similar applications
- Documented reliability, maintainability, and safety data obtained from formal analyses, conducted for equipment in similar applications

Safety analysis requirements, included in design and procurement activities include:

- Identification of potential hazards
- Assessment of the severity and probability of occurrence of each potential hazard
- Timely awareness of hazards for those who must resolve them
- Traceability and control of hazards through all phases of the project's life cycle

Methods used to identify hazards include:

- Design reviews, conducted as part of the design process
- Preliminary field observations, during project construction and testing
- Operating experience

The methodology used for the Hazard Analysis is described in the MBTA Safety Plan.

### **11.3 Security Threat and Vulnerability Assessment and Resolution**

To ensure that all applicable security requirements are addressed appropriately, the project team will take a proactive approach to security issues through the use of preventive design measures to eliminate or minimize known vulnerabilities and provide a method for assessing and resolving other security concerns in its preparation of drawings and specifications.

The DC is primarily responsible for preparing the Project Threat and Vulnerability Assessment (TVA). Resolution activity during the final design efforts of the project will also be managed by the DC and supported by all project participants. The methodology to be used by the DC to assess and resolve security threats and vulnerabilities is based on

the Federal Transit Administration (FTA) Office of Safety and Security Threat and Vulnerability Guidelines. The DC, MBTA and Project Team will determine on a case-by-case basis those threats and vulnerabilities for which a formal risk analysis must be prepared, and will also prepare a formal Threat and Vulnerability Assessment Report as part of the safety certification process. MBTA Transit Police and MBTA/MassDOT Security & Emergency Management also participates in the process.

The threat and vulnerability assessment and resolution process outlined in the FTA Guidelines takes a systems approach to security and includes the following activities:

- Defining the physical and functional characteristics of the system to protect
- Identifying the threats to the system
- Assessing the vulnerabilities of the system
- Resolving the vulnerabilities

Each identified threat and corresponding vulnerability will be assessed in qualitative terms of severity and probability of loss to support management decision-making activities as detailed in a project Threat and Vulnerability Assessment Report.

The DC will prepare the TVA utilizing two (2) primary steps as described below:

- Step 1: DC identifies/describes possible threats and vulnerabilities associated with the project, along with potential causes, effects on the system, severity, probability and recommended corrective actions/controlling measures.
- Step 2: DC conducts a workshop with project discipline leads and selected MBTA Department leads (i.e. Safety, Operations, Maintenance, Engineering, Security Department, Police, etc.) to determine which of the recommended corrective actions/controlling measures will actually be incorporated into the project.

## **12.0 DISCLAIMER**

This Safety Certification Program is intended to be implemented in concert with the MBTA's System Safety Modification Program and Configuration Management and Control Program.

## **13.0 DOCUMENTATION**

### **13.1 Responsibilities**

Project staff and contractors/vendors/manufacturers will provide documentation including checklists and other documentation based on testing, plan review and specification review verifying that system elements have been determined safe for patrons, employees, emergency service personnel, property and the general public.

All documentation that is generated for the project is forwarded to the Project Manager or designee for inclusion in the document control system. The Project Manager is responsible for processing all project correspondence including logging, copying, routing and distribution to designated personnel.

### **13.2 System Safety Certification Activity Documents**

Documents pertaining to system safety certification activities include:

- Safety Certification Plan
- Certifiable Elements and Sub-Elements List (as applicable)
- Minutes and agendas of SSRC and SSWG meetings

- System safety certification related reports and correspondence
- Completed Checklists
- Notice of Safety Verification Reports
- System Safety Certification of a Project

All reports, correspondence and related documentation will be uploaded to the document control system by project control staff upon receipt.

System safety documentation will be maintained for the duration of the project by the project safety consultants. When a project enters revenue operations, the documentation will be appropriately packaged and submitted to the MBTA's Design and Construction or Vehicle Engineering Department's Document Control office as permanent records.

Appendix A:	MBTA Controlled Safety Documents Matrix
Appendix B:	Sample Certifiable Element/Sub-Element Lists
Appendix C:	Criteria Conformance Review Checklist
Appendix D:	Tier 1 – Safety Certification - Certifiable Items Verification Checklist
Appendix E:	Safety & Security Test Program Checklist
Appendix F:	System Integration Tests Checklist
Appendix G:	Tier 2 – Safety Certification Form
Appendix H:	Safety Certification Letter

**14.0 REVISION HISTORY**

<b>Originated By:</b>	Chief Safety Officer	Ronald W. Nickle	<b>Date:</b>	12/08/14	<b>Document Control Number:</b>	SAFE1.09.00
<b>Document Controlled by:</b>	MBTA Safety	Steven V. Culp				
<b>SSWG Approval Date:</b>	TBD					
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<b>Revised By:</b>		<b>Date:</b>		<b>Reason:</b>		
<b>Revised By:</b>		<b>Date:</b>		<b>Reason:</b>		

## **Appendix A: MBTA Controlled Safety Documents Matrix**



**MBTA Controlled Safety Documents:**

The following matrix identifies MBTA documents that are related to the safety of MBTA's Operations and System Safety. Each of these documents has been assigned an MBTA Safety Document Number by MBTA Safety. As revisions to these documents are made, the MBTA Safety Document Number will be changed accordingly.

MBTA Safety Document Numbers are generated in the following format:

SAFE1.Document ID.Revision Number

Document ID is the consecutive number assigned by MBTA Safety

Revision Number is the latest revision, starting at 00

<b><u>Document Name</u></b>	<b><u>MBTA Safety Document No.</u></b>	<b><u>Last Revision Date</u></b>
MBTA Safety Plan	SAFE1.01.00	September 30, 2014
MBTA Accident Investigation Manual	SAFE1.02.00	August 15, 2014
Right of Way Rule Book	SAFE1.03.00	July 1, 2014
Safety Rules Compliance Program	SAFE1.04.00	November 5, 2013
Rules for Streetcar Motoropersons, Station Personnel, and Other Employees of the Light Rail Lines	SAFE1.05.00	July 1, 2009
Rules for Streetcar Motoropersons, Station Personnel, and Other Employees of the Heavy Rail Lines	SAFE1.06.00	August 1, 2010
Rules for Operators and Other Employees of Bus Operations	SAFE1.07.00	January 1, 2013
MBTA System Modification Safety Program	SAFE1.08.00	January 1, 2015
MBTA Safety Certification Program	SAFE1.09.00	January 1, 2015
MBTA Configuration Management and Control Safety Program	SAFE1.10.00	January 1, 2015

In addition to MBTA Controlled Safety Documents, the following are utilized as design element-specific references:

1. The latest edition, including revisions, amendments and supplements, of the following publications:
  - National Fire Protection Association Manual (including all applicable code sections)
  - Massachusetts State Building Code 780 CMR and all referenced codes
  - Massachusetts State Elevator Code 524 CMR
  - Massachusetts Architectural Access Board 521 CMR
  - ASME A17.1 Safety Code for Elevators and Escalators
  - MBTA Guidelines & Standards, 1977
  - MBTA Standard Contract Specifications (to be used as baseline documents for project specific specifications)
  - MBTA Guide to Access, 1990
  - APTA Guidelines (American Public Transportation Association)
  - ADA and ABA Accessibility Guidelines for Buildings and Facilities
  - Transit Capacity and Quality of Service Manual, Transit Cooperative Research Program (TCRP) Report 100
  - Pedestrian Planning and Design, Dr. John Fruin
  - Boston Center for Independent Living Agreement (BCIL)
  - Association of American Railroads (AAR)
  - Public Rights-of-Way Access Advisory Committee (PROWAAC)
  
2. Standards, guidelines, circulars, policies, and procedures of the following organizations:
  - Federal Railroad Administration (FRA)
  - Federal Highway Administration (FHWA)
  - Federal Transit Administration (FTA)
  - American Association of State Highway and Transportation Officials (AASHTO)
  - American Concrete Institute (ACI) all applicable sections
  - American Institute of Steel Construction (AISC) all applicable sections
  - Transportation Research Board (TRB)
  - United States Access Board
  - American Nursery and Landscape Association (ANLA)
  - American Railway Engineering and Maintenance-of-Way Association (AREMA)
  - American Society of Testing Materials (ASTM) International

## **Appendix B: Sample Certifiable Element/Sub-Element Lists**

**SAMPLE CERTIFIABLE ELEMENTS AND SUB-ELEMENTS LIST**

**SYSTEMS**

**VEHICLE**

- Carbody
- Coupler
- Doors, Door Operators and Controls
- Trucks and Suspension
- Propulsion
- Braking
- Operator’s Cab and Controls
- Communication Equipment
- Mobility Lift
- Lighting
- HVAC
- Fire/Flammability/Smoke Emissions

**SIGNALS**

- Interlocking Circuits/Equipment
- Mainline Controls and Indications
- Grade Crossing Warning Devices
- Yard/Mainline Interface
- Track Signals
- LRT Signals
- Signal Indications
- Train Protection

**COMMUNICATIONS AND SECURITY SYSTEMS**

- Radio System
- Operations Control Center
- SCADA
- Emergency Call Boxes
- Fire Department Communications
- Security Communications
- Security Systems
- Fire Systems
- Public Address Systems

**TRACTION POWER SYSTEMS**

- Enclosures
- High Voltage Switchgear
- AC to DC Conversion
- DC Switchgear
- Batteries and Accessories
- Catenary
- Stray Current Protection

**CIVIL INSTALLATIONS**

**TRACK AND STRUCTURES**

- Right of Way
- Track
- Aerial
- At-grade
- Underground
- Barriers and Warnings

**YARD AND SHOP**

- Electrical Safety Provisions
- Vehicle Movement Provisions
- Track and Appliances
- Building (Occupancy)
- Fire System
- Lifts/Elevator

**STATIONS/PARKING LOTS**

- Platforms
- Handicapped Access Provisions
- Elevators and Escalators
- Illumination
- Electrical Grounding

**SIGNAGE**

**PROCURED ITEMS**

- Traffic Signal Controllers
- Mobility Impaired Lifts
- Traction Power Substations
- Ticket Vending Equipment

**PLANS, PROCEDURES AND TRAINING**



**TEST PLANS**

- Acceptance Tests
- Integrated Tests
- Pre-Revenue Tests

**OPERATING AND MAINTENANCE PROGRAM**

- Standard Operating Procedures (SOPs)
- Emergency Operating Procedures (EOPs)
- Manuals and Rulebooks
- Training and Certification (if applicable)
- Local Responder Training
- Emergency Preparedness


## Appendix C: Sample Criteria Conformance Review Checklist

 Massachusetts Department of Transportation Rail & Transit Division 		SAMPLE CRITERIA CONFORMANCE REVIEW CHECKLIST					
CHECKLIST DEVELOPMENT				VERIFICATION OF COMPLIANCE			
Revision:		Date:		Date Checklist Completed:			
Prepared By:				SSWG Review:			
				SSRC Approval:			
Element Sub-element	Item No.	Review Reference Description	Reference Section(s)	Evidence Document Reference	Status	Date	Last Name (Print Initials)

Element:							
Element:							
Element:							
Element:							

## **Appendix D: SAMPLE Tier 1 – Safety Certification**

### Certifiable Items Verification Checklist

 Certifiable Element:  Sub-Element:	<b>Safety and Security Certification</b>  <b>Certifiable Items Checklist</b>	Verification:  Date:
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Information		Means of Verification (MOV)							Status			
Discipline: Contract No.: Site/Area:		<u>Construction</u> S = Submittals CN/CO = Change Notice/Order CM = Measurement			CT = Test CV = Visual Inspection CC = Certificate			<u>Commissioning</u> T = Test V = Visual Inspection R = Review			C = Closed O = Open O/W = Open with Identified Workaround	
Item No.	Certifiable Item Description	Construction Verification			Construction Verification			Commissioning Verification			Status & Workarounds	
		Reference Documentation	Date	MOV	Initial	Date	MOV	Initial	Date	MOV	Initial	Status

Safety and Security Certification  
 Certifiable Items List  
 Rev 0.0

NOTE: Only List Items Which Are Safety and/or Security Critical



## **Appendix E: SAMPLE SAFETY & SECURITY TEST PROGRAM CHECKLIST**




MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

SAMPLE SAFETY & SECURITY TEST PROGRAM CHECKLIST

Contract Title:	Page: ___ of ___
Contract No:	Date:
Secondary Contract Title:	Revision:
Secondary Contract No:	Prepared By:
Certifiable Element:	Approved By:
Certifiable Sub-Element	

Element No.	Test Plan Reference	Test Description Title	Spec Reference	Evidence						
				Verification Responsibility	Test Procedure Reference	Verification		Comment	Results	
						Date	By		Accept	Reject

## **Appendix F: SAMPLE SYSTEM INTEGRATION TESTS CHECKLIST**

		MASSACHUSETTS BAY TRANSPORTATION AUTHORITY (SAMPLE ONLY) - SYSTEM INTEGRATION TESTS CHECKLIST							
CHECKLIST DEVELOPMENT					VERIFICATION OF COMPLIANCE				
Contract: Train Systems					Date Checklist Completed:				
Contract No. 000					Date SSWG Review:				
Prepared By: John Doe				Date: 00/00/0000	SSCS Approval:				
Item No.	Test Title	Spec Section & Paragraph	Test Procedure Disposition	Submittal No.	Test Start Date	Pass (P) or Fail (F)	Retest Start Date	Date Completed	Evidence Verified By

## **Appendix G: SAMPLE Tier 2 – Safety Certification Form**



**SAMPLE TIER 2 - MBTA SYSTEM SAFETY CERTIFICATION CHECKLIST**

Project Title (Include location and scope):

MBTA Representative:

Date Certification Started:

Date Certification Completed:

**MBTA SYSTEM SAFETY CERTIFICATION CHECKLIST INSTRUCTIONS**

1. Certifiable Element – Transit station equipment that needs to be certified in accordance with MBTA Safety rules and procedures
2. Standard – Guideline that the design of the station equipment was based on
3. Technical Requirement – The documentation/certificate/inspection required in order to sign-off of each certifiable element
4. Authorized Signature – Individual identified by MBTA Safety as being authorized to sign-off the certifiable element
5. Completion Date – The date the certifiable element has been accepted by MBTA Safety
6. Remarks – Comments related to open certifiable items

#	Certifiable Element	Standard	Technical Requirements	Authorized Signature	Completion Date	Remarks
1	Walking Surfaces – Interior	Mass. Building Code Section 10 MBTA SWA Requirements	2 % Max Walkway Cross-Slope 5% Max Walkway Slope 8% Max Ramps Approval from General Contractor			

#	Certifiable Element	Standard	Technical Requirements	Authorized Signature	Completion Date	Remarks
2	Walking Surfaces – Exterior	Mass. Building Code Section 10 Mass Architectural Access Board MBTA SWA Requirements	2 % Max Cross-Slope 5% Max Walkway Slope 8% Max Ramps Approval from General Contractor			
3	Stairways	Mass Building Code Section 10	Riser Height 4” to 7” Tread Width 11” Min. Min. Stairway Width 48” Variation in Height +/- 3/16” Approval from General Contractor			
4	Handrails	Mass. Building Code Section 10	34” Minimum 38” Maximum 1 ½” From Wall Minimum Approval from General Contractor			
5	Egress and Access	Mass. Building Code Section 10	Access and Egress ways Clear of Obstructions Approval from MBTA Safety			
6	Emergency Egress	Mass. Building Code Section 10	Walkway Protrusions 4” Maximum Approval from General Contractor			

#	Certifiable Element	Standard	Technical Requirements	Authorized Signature	Completion Date	Remarks
7	Passenger Control – Hazardous Areas	MBTA Operations Support and MBTA Subway Operations Requirements	Approval from MBTA Operations (Mechanical Rooms) and MBTA Subway Operations (Level 1 Areas)			
8	Electrical	Mass. Building Code Section 27	Approval from DPS Electrical Inspector			
9	HVAC	Mass. Building Code Section 28	Approval from State Sheet Metal Inspector			
10	Security	MBTA Security Requirements	Door Locks Installed Cameras Installed Key Control Approval from MBTA Security			
11	State Building Permit	Mass. DPS Requirement	Approval from DPS Building Inspector			
12	Doors – Fire Resistance	Mass Building Code Section 7	Permanent Fire Rated Labels on Doors Approval from MBTA Safety			



#	Certifiable Element	Standard	Technical Requirements	Authorized Signature	Completion Date	Remarks
13	Sprayed Fire Proofing	Mass. Building Code Section 7	Approval from Independent Testing Agency hired by the General Contractor			
14	Signage – Directional	MBTA Graphics	Approval from MBTA Graphics			
15	Signage – Emergency Egress	Mass Building Code Section 1011 Exit Signs	Approval from General Contractor			
16	Signage – Informational	MBTA Graphics	Approval from MBTA Graphics			
17	Elevators	Dept of Public Safety – Elevator Division	Approval from DPS Elevator			
18	Escalators	Dept of Public Safety – Escalator Division	Approval from DPS Escalator			

#	Certifiable Element	Standard	Technical Requirements	Authorized Signature	Completion Date	Remarks
19	Plumbing System	Mass. Plumbing Board	Approval from State Plumbing Inspector			
20	Fire Protection – Portable Fire Extinguishers	Mass. Building Code Section 9	Approval from MBTA Safety			
21	Fire Protection – Dry Standpipe System	Mass. Building Code Section 9	Approval from Boston Fire Department			
22	Fire Protection – Clean Agent System	Mass. Building Code Section 9	Approval from Boston Fire Department			
23	Fire Protection – Sprinkler System	Mass. Building Code Section 9	Approval from Boston Fire Department			
24	Fire Alarm and Detection System	Boston Fire Department	Approval from Boston Fire Department			

#	Certifiable Element	Standard	Technical Requirements	Authorized Signature	Completion Date	Remarks
25	Lighting – Interior	Mass Building Code Section 10	Approval from MBTA Electrical			
26	Lighting – Exterior	Mass. Building Code Section 10	Approval from MBTA Electrical			
27	Lighting - Emergency	Mass Building Code Section 10	Approval from MBTA Electrical			
28	Emergency Generator	Mass Department of Public Safety	Approval from BFD, State Plumbing Inspector and MBTA Safety			
29	Communications Room	MBTA Communications Requirements	Approval from MBTA Communications			
30	Security – Alarm System and CCTV	MBTA Security Requirements	Approval from MBTA Security			

#	Certifiable Element	Standard	Technical Requirements	Authorized Signature	Completion Date	Remarks
31	Signal Systems	MBTA Signal Requirements	Approval from MBTA Signals			
32	Traction Power System	MBTA Power Requirements	Approval from MBTA Power			
33	Communication System Call Boxes/Phones	MBTA Communication Requirements	Approval from MBTA Communications			
34	Track Department	MBTA Track Requirements	Approval from MBTA Track			
35	Operations Support Department	MBTA Operations Support Requirements	Approval from MBTA Physical Infrastructure			
36	Station Cleaning	MBTA Clean Maintenance Requirements	Approval from MBTA Clean Maintenance			
37	Automatic Fare Collection	MBTA AFC Requirements	Approval from MBTA AFC			
38	Generator Ventilation System	Mass DPS	Approval from Mechanical Sub-Contractor			

#	Certiifiable Element	Standard	Technical Requirements	Authorized Signature	Completion Date	Remarks
39	Generator Emergency Response Training	Contract Requirements	Contractor training of MBTA personnel completed			

## **Appendix H: SAMPLE Safety Certification Letter**

## SAMPLE

December 9, 2014

Beverly A. Scott, Ph.D.  
General Manager and Rail & Transit Administrator  
Massachusetts Bay Transportation Authority  
10 Park Plaza, Third Floor  
Boston, MA 02116

Subject: PROJECT NAME Safety Certification

Dear Dr. Scott:

In accordance with system safety industry best practice, MBTA Safety, Design & Construction, Security, Engineering & Maintenance, System-Wide Accessibility, Training, and Operations collaboratively performed a Safety Certification for the PROJECT NAME.

Safety Certification involves verification, testing, inspection, training, and other preparatory certification activities to ensure that safety concerns and hazards are adequately addressed prior to the initiation of passenger and/or system operations.

The Safety Certification Team certifies that the PROJECT NAME and DESCRIPTION are safe for operation and that safety concerns and hazards have been adequately addressed prior to system implementation, except as declared on the attached Appendix A: "Safety Exceptions Tracking Log" (Tracking Log).

Exceptions represent outstanding safety items, concerns, or restrictions that require timely action in order to remove the specified limitations or enhance safety as detailed in the Tracking Log, and do not impact the commencement of system operations.

Once an exception has been remediated, it will be removed from the Tracking Log, and the outstanding safety item is considered closed. When all exceptions have been finalized, a Safety Certification letter will be submitted, detailing that all exceptions have been addressed.

Should you have any questions or concerns, please contact me at 617-222-6547, or [rmickle@mbta.com](mailto:rmickle@mbta.com).

Very truly yours,

Ronald W. Nickle  
Chief Safety Officer

Enclosure: Appendix A: "Safety Exceptions Tracking Log"

cc: Sean McCarthy, Deputy General Manager/Executive Director of Operations  
Jonathan Davis, Deputy General Manager & Chief Financial Officer  
Kenneth Green, Acting Chief, Transit Police  
Edmond Hunter, Assistant General Manager for Design & Construction  
Laura Brelsford, Assistant General Manager for System Wide Accessibility  
Ted Basta, Chief of Strategic Business Initiatives  
Brian Cristy, Director – Massachusetts Department of Public Utilities



**GREEN LINE Trolley/Trolley Critical Accidents - Jan 2005 - Dec 2010**

Rte.	Location	Accident Date	Accident Time	Injuries	DPU Report #	Summary	Damage
881	APPROACHING ARLINGTON STATION	7/7/2005	9:23 AM	3	05-22	Train #3658/3652 traveling eastbound from Copley to Arlington collided with train #3715/3716/3689 also traveling eastbound. The front of #3658 struck the rear of #3689 causing the front truck of #3658 to derail. The location of contact was approximately 300 feet before the Arlington Station inbound platform (between Signals #809 and #811). Three injuries (employees) reported and transported. Approximately 275 passengers were on board and were safely evacuated with no reported injuries.	Not reported
880	BOYLSTON	12/13/2007	8:15 AM	6	07-42	Train #3624/3810 was entering Boylston Street Station, while train #3613/3620 was berthed at the station. Train #3624/3810 failed to stop in time and struck the rear of #3620, causing coupler damage to #3624 and #3620. Two (2) passengers and four (4) employees were transported to the hospital. Speed at the time of collision was 10 MPH. According to Trolley #3810's event recorder: Train consist #3624/3810 slowed to 6 mph at the double yellow signal, but did not stop. After passing through the signal, it resumed the posted speed of 10 mph and entered the station. The emergency brake was applied one second prior to impact.	Not reported
852	APPROACHING WOODLAND BETWEEN WABAN & WOODLAND	5/28/2008	5:55 PM	8 - Inj. 1 - Fatality	08-53	Operator operating Train #3667/3708 was traveling about 38 MPH when she struck the rear of westbound #3681/3703. Train 3681/3703 had just stopped for a red signal when the collision occurred. Each train consisted of 2 cars and carried 2 crew members. The operator of the striking train was killed, while the other 3 crew members sustained minor injuries. 185 to 200 passengers were estimated to be onboard the 2 trains. Of these, four (4) passengers sustained minor injuries and one (1) sustained a major injury.  The National Transportation Safety Board determined that the probable cause of the collision was the failure of the operator of the striking train to comply with the controlling signal indication, likely as a result of becoming disengaged from her environment consistent with experiencing an episode of micro-sleep.	\$8.6 million
852	BOYLSTON / CHARLES STORAGE	11/14/2008	8:45 AM	10	08-161	Train #3707/3710 collided with the rear of #3849/3630 which was stopped on the eastbound tracks just before Boylston Station. Five (5) passengers and two (2) employees sustained minor injuries and were transported by ambulance. Three (3) additional passengers indicated injuries but sought their own medical attention. The cause of the collision was human error in that the motorperson failed to obey the red signal and failed to stop prior to the collision. The speed at the time of impact was approximately 10 MPH. It was determined that the emergency brake had been applied just before impact.	Not reported
852	GOVT.CTR	5/8/2009	7:15 PM	50	Unknown	Leaving Government Center Station, approaching Signal #744 westbound, Train #3612/3636 passed two green signal lights and a yellow signal light and then proceeded through a red signal light. The train travelled approximately 80 feet past the red signal at the posted speed limit of 25 MPH, before striking Train #3808/3637, which was stopped. All passengers and crew were evacuated via the subway tunnel and injured were either treated at the scene or transported.	Greater than \$10 million