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1.0 Introduction

1.1 Background

This latest edition of the American Public Transportation Association (APTA) Manual for the Development of Urban Rail Safety Program Plans (SSPP) is an update of the June 2001 APTA Manual for the Development of Rail Transit System Safety Program Plans. The Manual was originally commissioned in 1987 to place into action the practices identified in the book “Moving People Safely” APTA, 1973. Over the ensuing years, the “APTA Manual” as it has become known, has been refined and revised to remain effective in serving the industry as well as being incorporated by reference for the development of regulations in both the US and Canada. The Manual continues to provide guidance to passenger rail agencies on effective organization of their safety efforts to reduce operating risks, not merely to meet regulatory obligations but to continuously improve towards a state of safety excellence. (Practitioners should note that this new edition is a significant departure from the way the previous Manual was organized.)

This Manual can be used for the implementation of the Federal Transit Administration (FTA)’s MAP-21 required Public Transit Agency Safety Plan (PTASP).

For the purposes of this document, the term “urban rail” is meant to include all forms of rail mass transit including, but not limited to the following:

- Light Rail
- Regional Rail
- Subway
- Automated Guideways/Peoplemovers
- Trolley/Streetcar
- Cable car
- Funicular/Ropeways
- Monorail.

System safety is defined as the application of operating, technical and management techniques and principles to the safety aspects of a system throughout its life to reduce hazards to the lowest practical level through the most effective use of available resources (US DOT Mass Transit System Safety Glossary October 1995).

Urban rail transportation agencies are governed by regulations set forth by the Federal Transit Administration.
Other forms of passenger rail (part of the Federal Railroad Administration’s General System Tier I, II and III) including commuter rail, intercity rail (Amtrak), private passenger rail, maglev and high-speed rail, are not intended to be covered in this Urban Rail SSPP. The Federal Railroad Administration regulates these forms of passenger railroads and the May 2006 *APTA Manual for the Development of System Safety Program Plans for Commuter Railroads* is the better source document for these applications.

Updates for this Urban Rail SSPP have been generated based on the continual gathering of effective practices and the operating experience of urban rail agencies throughout the world. A comparison of this Urban Rail manual to the June 2001 *APTA Manual for the Development of System Safety Program Plans* is contained in Table 1 in Appendix A.

Many of the elements in this Manual directly correspond to the Code of Federal Regulations 49 CFR Part 659 requirements. A side-by-side comparison matrix between this Manual and 49 CFR Part 659 is contained in Table 2 in Appendix B.

This Manual provides guidance for incorporating the safety requirements of MAP-21, shown in Table 3 in Appendix C.

### 1.2 Safety Management Systems Approach to Transportation Safety

The primary purpose of an Urban Rail Agency is to transport people safely and provide safe facilities. Passenger rail operations are, by their very nature, complex in order to move millions of people per day. In moving its passengers as safely as possible, it is incumbent upon each Urban Rail Agency to establish a Safety Plan that identifies and prioritizes safety risks, desired outcomes, risk control strategies, performance indicators, all safety-related roles and responsibilities within the organization and provides the resources necessary to implement safety throughout the organization. An Urban Rail Agency also has the responsibility of maintaining oversight of its safety program to ensure that all individuals with safety responsibilities are trained, and that responsibilities are carried out and coordinated.

The System Safety Program Plan is a foundational document and one of the core components of the Urban Rail Agency’s Safety Management System. A Safety Management System (SMS) is defined as a coordinated, comprehensive set of processes designed to direct and control resources to optimally manage safety. Refer to APTA’s guidance document on Transportation Safety Management Systems (*APTA Safety Management System Guidelines for Public...*)
Passenger Transportation Systems, 2014) for information on other components of a SMS in addition to a written SSPP and policy statement.

An example of Safety Management System Competencies and Risk Control Strategies (from TRACS WG 12-02 9-37-13) is as follows:

The Urban Rail Safety Plan involves implementation of a systems approach to safety management. A system consists of people, process, equipment and the environment. The heart of a systems approach to safety management is the ability of each Urban Rail Agency to employ a risk reduction methodology to identify hazards that will lead to the elimination, minimization, or control of risk, resulting in proactive identification of factors that contribute to unsafe events, and therefore prevent or minimize the likelihood of their occurrence.
The development of an agency safety plan in the form of a System Safety Program Plan formalizes these safety processes into a written document (the SSPP), which is implemented by a policy directive signed by the Chief Executive Officer or General Manager of the Urban Rail Agency.

1.3 Purpose of the Urban Rail Manual

APTA has produced this Manual for the Development of Urban Rail System Safety Program Plans to assist its members in developing and implementing a System Safety Program consistent with the philosophy of Safety Management Systems standards and US DOT regulations. This Manual also serves as the baseline criteria for the APTA Rail Safety Management Assessment Program. APTA contracts with the North American Transportation Services Association to provide independent third party reviews of member Urban Rail Agencies upon their request.

1.4 Goals of the Urban Rail Manual

The main goals of this Manual are to:

- Guide Urban Rail Agencies in preparing and revising their System Safety Program Plans in accordance with FTA MAP-21 requirements
- Assist Urban Rail Agencies in preparing for internal and external safety management assessments and reviews
- Provide the means by which an Urban Rail Agency can demonstrate diligence toward the safety of its operations
- Assist the Urban Rail Agency’s commitment to continuous improvement over the entire Urban Rail life cycle
- Assist Urban Rail Agencies in establishing a risk based process to evaluate hazards and mitigate the consequences to acceptable levels
- Give guidance to Urban Rail Agencies in building and developing a safety culture within their organization that includes a comprehensive corporate approach to safety, an effective organizational structure and tools, and a formal system for safety assurance.
2.0 How to Use This Manual

2.1 Organization and Summary

This Manual is organized by Safety Management System functions. These SMS functions correspond to the SMS functions stated in the recommendations for the Public Transit Agency Safety Plan (TRACS WG 12-02 9-27-13). Implementation of these functions will enable the Urban Rail Agency to achieve the System Safety Program goals listed in Section 1.3. The four general safety functions are:

- Safety Management and Administrative Control Requirements (Safety Policies and Procedures)
- Safety Engineering Techniques and Analysis (Safety Risk Management)
- Safety Change Management and System Verification (Safety Assurance)
- Safety Program Implementation (Safety Promotion).

Within these four safety functions are 22 elements that should be included in the Urban Rail System Safety Program Plan.

This Manual emphasizes continuous improvement within the Urban Rail Agency, using quantifiable objectives and accountability to achieve a positive safety culture within the Urban Rail Agency. It facilitates the implementation of the System Safety Program Plan as follows:

- Grouping of elements into safety categories makes the SMS easier to implement and fosters accountability
- The new format facilitates internal and external safety management reviews
- Safety tasks are more defined – i.e. public outreach programs, rail corridor safety programs
- The manual generally follows the W. E. Deming continuous improvement model of Plan, Do, Check, Act adopted by the International Organization for Standardization (ISO), International Labor Organization (ILO) and others.

Many Urban Rail Agencies already have an existing System Safety Program Plan. Much of the information in existing SSPPs can continue to be used to develop a System Safety Program Plan that follows the format stated in this Manual.
2.2 Element Categories

This Manual contains four groupings of elements that describe safety functions within the Urban Rail Agency. Each of these groupings relates to the continuous improvement model of Plan, Do, Check and Act.

2.2.1 Safety Management Administrative Control - Safety Policies and Procedures

Elements 1-6 constitute the planning phase of the System Safety Program in which the philosophy and strategic safety plan of the organization is developed from the mission, vision, and values of the organization. Starting with a policy statement and authority, the SSPP is developed to define goals, objectives, organizational context, administrative controls and inter-departmental coordination. These activities provide the framework for a positive safety culture and organizational factors that control the safety of operations.

The elements contained in the planning phase of the System Safety Program are as follows:

- Element 1 - System Safety Program Plan Development and Communication
- Element 2 - Policy Statement and Authority for the System Safety Program Plan
- Element 3 - Purpose and Scope of the System Safety Program Plan
- Element 4 - Goals for the System Safety Program
- Element 5 - Identifiable and Obtainable Objectives
- Element 6 - Strategic Planning, System Safety Program Plan Implementation, Control and Update

2.2.2 Safety Engineering Techniques and Analysis - Safety Risk Management

Elements 7-8 constitute the measurement and checking phase of the System Safety Program and provide evaluation and analysis functions against the Plan’s performance goals and objectives. The programmatic processes described in Elements 7-8 help identify and control hazards and manage risk to the organization.

The elements contained in the measurement and checking phase of the System Safety Program are as follows:
• Element 7-Hazard Management Program
• Element 8-Accident/Incident Reporting and Investigation

2.2.3 Safety Change Management and System Verification—Safety Assurance

Elements 9-12 constitute the evaluation and corrective action phase of the System Safety Program. The Urban Rail Agency should use internal and external safety management reviews to determine if the Plan and controls are functioning as intended. Opportunities for improvement are identified and reported back to the Safety Administrative phase to enable adjustments to existing programs, or the creation of new programs. These improvements are inputs to the Urban Rail Agency’s Strategic Plan that enriches and improves the System Safety Program. The Strategic Plan should also identify the criteria for management review.

Safety Change Management and System Verification Elements are as follows:

• Element 9- Safety Data Acquisition and Analysis (Safety Performance Targets/Measures)
• Element 10- Configuration Management
• Element 11- Safety and Security Certification
• Element 12- Safety Assessment.
2.2.4 Safety Program Implementation– Safety Promotion

Elements 13-21 constitute the implementation phase of the System Safety Program and cover all of the essential tasks that should be in place to effectively manage Urban Rail safety efforts. Many of these tasks are associated with APTA standards or FTA requirements.

The elements contained in Safety Program implementation are as follows:

- Element 13-Infrastructure Maintenance and Inspection
- Element 14-Vehicle Maintenance, Inspection and Repair
- Element 15-Rules and Procedures Review
- Element 16-Training and Certification
- Element 17-Emergency Planning and Response
- Element 18-Workplace Safety Program
- Element 19-Contractor Requirements for Safety
- Element 20- Procurement and Stores
- Element 21-Passenger and Public Safety Programs
- Element 22-Rail Corridor Operational Safety.

3.0 Safety Management Administrative Control Requirements
Safety Policies and Procedures

This section of the SSPP discusses the organizational factors that shape the direction and establish priorities for safety. The essential functions are for the Urban Rail Agency General Manager/Chief Executive Officer to define the value of safety within the organization and then develop a strategic planning and review process for ensuring that safety expectations are being achieved through programmatic processes. Good management practice for administration of safety programmatic processes within the organization includes development of general safety policies; distribution of authority and accountability for the safety program throughout the organization; a description of how system safety is designed to operate within the organization; setting the organization’s mission, vision and values to emphasize safety goals and objectives; and creating the plans and procedures for controlling and updating the SSPP.

3.1 Element 1: System Safety Program Plan Development and Communication

The objectives of this section are to define the Urban Rail Agency’s organizational context, structure and approach to safety. In addition to the
legal, financial, social, political, legislative, regulatory and organizational constraints that form the boundaries for management decisions, the operating environment, and unique physical characteristics, including service and performance parameters, should also be described.

3.1.1 **System Description**

This section should briefly describe the Urban Rail Agency characteristics. The information presented should be sufficient to allow non-technical persons to understand the system and its basic operations. The following components should be included in the system description: history, scope of service, maintenance, operations, physical plant and system requirements.

3.1.2 **Organizational Structure**

The description of the organizational structure of the Urban Rail Agency should contain detailed organizational diagrams that identify the key positions, showing the titles of persons responsible at each level; and should describe the functions and responsibilities of units within the organization. The organizational structure should delineate the safety unit within the organization and should also identify the lines of authority used to manage safety issues. The safety unit should be independent of operations and should report to the highest level within the Urban Rail Agency. The FTA’s MAP-21 legislation states (for all recipients of FTA funding) that there must be “an adequately trained safety officer to report directly to the general manager, or equivalent.” A sample matrix of safety responsibilities is contained in Appendix D.

3.1.3 **Organizational Context Requirements for Safety**

All applicable legislative and regulatory requirements relating to rail safety should be identified. The Urban Rail Agency is obligated to observe all legislative and regulatory requirements and satisfy any important financial, social or political mandates. Since these contextual issues drive policy, good management practice is to address these issues at the top management level within the Urban Rail Agency, perhaps with an Executive Safety Committee reporting to the Board of Directors, or with an equally high level management convention, that monitors the organization’s performance and adjusts the strategic plan to achieve continuous improvement (see section 3.6.1).

3.1.4 **System Safety Program Plan Development and Communication**

This section identifies stakeholders who have been tasked with responsibilities as contributors, those signatory to its provisions, or those who
will be guided by the SSPP requirements, including permanent and temporary staff and contractors. Also included in this section of the SSPP is the method by which safety critical information will be approved, communicated and distributed, both electronically and in hard copies. Urban Rail Agencies should establish the System Safety Program Plan as a controlled operating document that has been prepared for and approved by the Urban Rail Agency top management.

3.2 **Element 2: Policy Statement and Authority for the System Safety Program Plan**

This section of the SSPP addresses the safety policy statement, signed by top management; and the authority by which the Urban Rail Agency has been established, as well as the authority for the System Safety Program.

3.2.1 **Policy Statement**

The Plan should include a Safety Policy, signed by the Chief Executive Officer or General Manager. The SSPP sets forth the Urban Rail Agency’s safety philosophy and culture.

The Safety Policy should include:

- A commitment to implement and maintain the System Safety Program Plan
- A commitment to continuous improvement in safety
- A commitment to the management of safety risk
- An expectation that employees will report safety issues and, where possible, provide proposals for solutions/safety improvements
- Responsibilities and accountabilities of management and employees with respect to the System Safety Program.

3.2.2 **Authority**

The body empowered to develop the Urban Rail Agency should be identified by its legal name. Any authorizing and implementing legislation that may have been required to establish that body should be cited. This information should include federal, state, and local statutes enacted to establish the Urban Rail Agency as the operating and/or developing entity for the rail transportation system or systems in the area. If the area served has multiple political jurisdictions, the interface responsibilities among these jurisdictions should be defined.
The Authority statement in the SSPP should define as clearly as possible the authority for the establishment and implementation of the System Safety Program and how the System Safety Program is connected to the organization’s mission, vision and values. The Board of Directors, or equivalent entity, should approve the System Safety Program Plan and any updates to the Plan. Any authority that has been delegated through the organization and to contractors acting on behalf of the Urban Rail Agency should be clearly defined and transparent. Lines of authority used to manage safety issues should be clearly delineated. Details of the authority for SSPP implementation should be provided for all plan participants.

3.3 Element 3: Purpose and Scope of the System Safety Program Plan

The System Safety Program Plan provides a written plan and guidelines to assist executives and managers in establishing a System Safety Program within the Urban Rail Agency. Good management practice establishes safety as a core value within the organization and top management with the task of overseeing the establishment of organizational factors necessary to achieve improved safety and to lead others in the effective implementation within the Urban Rail Agency.

3.3.1 Scope of the SSPP

The System Safety Program Plan encompasses all system elements of the Urban Rail Agency, including employees, contractors and relationships with external agencies. All departments involved in safety tasks should have a clear definition of their individual responsibilities relative to the System Safety Program. The relationship of the safety unit to operations should be clearly defined (see section 3.1.2). It is often good practice to create a matrix of Primary and Support duties and responsibilities that display the importance that each person or department has in the proper functioning of the safety effort within the organization. An example of a safety responsibility matrix is shown in Table 1 of Appendix B.

System safety definitions or a glossary of safety terms applicable to the Urban Rail Agency should be provided or referenced, as appropriate (see APTA website apta.com for a glossary of safety terms).

3.3.2 Safety Culture

There has to be top management commitment to defining and implementing a positive safety culture within the Urban Rail Agency. There are many
definitions of safety culture for various organizations. Perhaps the definition that best fits transit is the following:

- **Safety culture is the product of individual and group values, attitudes, perceptions, competencies and patterns of behavior that can determine the commitment to, style and proficiency of the Urban Rail Agency’s Safety Program.**

The System Safety Program Plan should include methods of implementing a healthy safety culture accompanied by means and frequency for measuring the organization for effectiveness. Many organizations that have successfully implemented safety culture follow a maturity model for safety program development.

1. A plan is needed to define safety within the organization
2. Safety is based on rules and regulations
3. Safety is an organizational value having measurable goals and objectives.
4. Safety can always be improved to try to achieve continuous improvement
5. To ensure a positive safety culture, be mindful of risks and vigilant for weakness in areas where things can fail

Organizations with a positive safety culture are characterized by communications among employees, their representatives and management based on mutual trust, a shared perception of the importance and value of safety, and vigilance in identifying and resolving safety issues. In describing the Urban Rail Agency’s programs or processes that promote a safety culture the following elements developed by Reason and Hudson (Safety Culture Models as the Basis for Improvement) as guidance:

- **Informed culture** where employees understand that there will always be hazards and risks in their areas of operation; employees are provided with the necessary training and resources; leading indicators of safety performance are collected, analyzed and disseminated; and there is a strong emphasis on communications.
- **Just culture** where employees know and agree on what is acceptable and unacceptable behavior; employees are held accountable for reckless or deliberate actions, but they are not unduly punished for unintentional errors.
- **Reporting culture** where employees are encouraged to voice safety concerns and to report errors and close calls without the threat of punitive action; and reported safety concerns are analyzed and appropriate action is taken.
• **Learning culture** where safety issues and pertinent lessons learned are communicated throughout the organization; processes and practices are changed as a result of safety trends or incidents; outstanding safety issues are resolved; and transferring knowledge and learning from others inside and outside the organization is valued.

• **Flexible culture** where the organization is resilient and can adapt in an effective manner to changing demands on the system.

### 3.3.3 Safety Culture Assessment

Once the Urban Rail Agency has established a safety culture, it is important to continually assess its effectiveness on overall safety. Since safety culture is not “visible”, assessment is not simple. Types of assessment instruments include the following:

- Surveys of employee attitudes, opinions and perceptions
- Written questionnaires
- Face to face interviews
- Focus group interviews
- Ability of the organization to focus on long term performance
- How the organization handles conflicts
- How the organization views errors and mistakes
- Ability of the organization to focus on improving safety defenses instead of assigning blame
- The organization’s proactive stance toward safety.

### 3.4 Element 4: Goals for the System Safety Program

The overall goal of the System Safety Program is to identify, eliminate, minimize and/or control safety hazards and their attendant operational risks by establishing control requirements, lines of authority, levels of responsibility and accountability, and methods of documentation for the organization. Safety goals and safety policies should be aligned with the Urban Rail Agency’s mission. Top management should ensure that these safety goals and safety policies are implemented within the Urban Rail Agency.

#### 3.4.1 Top Down Approach

An Urban Rail Agency should begin with the general goal (stated in section 3.4) and then develop system specific goals, tailored to the individual needs of the Urban Rail system. They should be clearly stated and supported by the use of objectives (see section 3.5).

#### 3.4.2 Goal Requirements
In specifying system safety goals, an Urban Rail Agency should be guided by the following:

- A goal should by nature be **long term**. Since the System Safety Program extends throughout the life of the Urban Rail system, the goal should have broad and continuing relevance.
- A goal should be **meaningful**. Goals are characterized by their broadness and continuing relevance. But they should not be so broad as to be meaningless. Specific, desired results should be identified and meaningful in terms of their impact on safety.
- A goal should be **achievable**. Any goal that meets the first two criteria but cannot be reached is meaningless.
- A goal in some real sense should be linked to or integrated with the safety commitment expressed in the corporate mission, vision and values of the organization.

### 3.5 Element 5: Identifiable and Attainable Objectives

Objectives are the working elements of the System Safety Program, the means by which the identified goals are achieved. Objectives should be “SMART” and meet five key conditions:

- Specific (S)
- Measurable (M)
- Attainable (A)
- Responsible (R)
- Timely (T).

#### 3.5.1 Quantifiable Objectives

Objectives should be easily quantifiable and use the proper measurement scale or value as a key performance indicator. However, they should still be meaningful in that they provide a framework for the day-to-day activities that enable safe Urban Rail Agency operations.

#### 3.5.2 Implementing Objectives

The methodology for implementing objectives is usually met through implementation of policy instructions (PIs) and/or standard operating procedures (SOPs), and work instructions (WIs). Hierarchical and overlapping procedural controls are central to the System Safety Program’s goal of establishing safe behaviors or safe operating ranges that can be used to detect
variations and any degradation toward unsafe outcomes. Good management practices for Urban Rail Agencies include the development of:

- Policies and procedures that set the framework for guiding the safety program, on a relatively long-term basis
- Policies and procedures accessible to those governed by them.

3.5.3 Accountability of Key Personnel

Identification of personnel accountable for attaining safety objectives is central to tracking and measuring progress toward desired results. Performance appraisal systems that evaluate safety performance as a key criterion are an effective means to satisfy this principle (see section 3.6.3).

3.6 Element 6: Strategic Planning, System Safety Program Plan Implementation, Control and Update

This section describes the strategic planning process and establishes the frequency for reviewing the System Safety Program Plan. It also describes the method by which updates, corrections, and modifications will be made to the Plan. The procedure should state whether the Plan should be updated on demand or at selected intervals. A description of the steps required for developing and issuing a change to the SSPP should be discussed. Top management approval of any Plan changes should be included as a step in the process.

3.6.1 Strategic Program Planning

Strategic planning is a management tool that is used to define the organizations’ vision, mission, core values, challenges and opportunities. The process is also used to establish short and long term goals, guide business practices and measure performance. The focus of the strategic planning process for safety should be development and continuous improvement of the System Safety Program, and demonstrating diligence toward industry safety standards so that the Urban Rail Agency can satisfy its safety mission within the community served. The Strategic Plan should identify the components of the safety program over a fixed time period, such as a three to five year period. Among the many benefits of the strategic planning process are creating a better alignment between the board, management and staff; aiding in decision making and establishing priorities; helping the agency become more customer oriented; creating more effective workflows; and restructuring services to gain more efficient use of limited resources.
According to the TCRP publication Strategic Planning and Management in Transit Agencies (Synthesis 59), “strategic planning must be linked to key organizational processes such as budgeting, capital programming and performance measurement. This is one of the important ways that ‘strategic planning’ becomes ‘strategic management’...Strategic management needs to be based on good data, and the plan needs to be updated on a regular basis”.

3.6.2 Update of the System Safety Program Plan

The System Safety Program Plan needs to be updated on an ongoing basis, at a minimum annually. The Urban Rail Agency, using the strategic planning process described in section 3.6.1, should determine the frequency of updates. New extensions or major modifications to the existing system will require an update to the Plan. Organizational changes, new or revised regulations or other factors can also trigger a Plan update. The safety unit within the organization normally manages the process for updating the Plan. The Urban Rail Agency should develop a procedure for updates to the Plan.

The Urban Rail Agency must coordinate with the State Safety Oversight agency for submission, revision and approval of the System Safety Program Plan.

3.6.3 Administrative Controls

To effectively execute the tasks needed to support the System Safety Program throughout the Urban Rail Agency, checks and balances need to be established in the administration of critical processes to ensure that the processes are correctly implemented. The Urban Rail Agency should incorporate safety into its performance appraisal process to reflect the goals and objectives of the System Safety Program Plan (see section 3.5.3).

3.6.4 Inter-departmental Coordination

A successful System Safety Program depends on coordination between the Urban Rail Agency’s different departments with respect to the goals and objectives of the System Safety Program Plan. Each Urban Rail Agency should form a central, inter-departmental, safety committee populated by personnel who possess the necessary knowledge and authority to resolve safety issues and implement the objectives of the SSPP. The Urban Rail Agency can use safety-related sub-committees, task forces, and employee/labor safety committees to assist the central safety committee. In all cases, the Urban Rail Agency should maintain formal agendas, meeting minutes, action items and tracking logs to document inter-departmental coordination and diligent implementation of the SSPP.
3.6.5 **Inter-Agency Coordination**

Many of the services used by Urban Rail Agencies to support safety efforts are within the jurisdictional control of other community organizations. The Urban Rail Agency should advise and assist emergency services and utilities in the safe performance of their work whenever they are within the vicinity of train operations. To satisfy these needs, inter-agency coordination should be effectively established and ongoing. Committees formed, such as the Fire Life Safety and Security Committee (FLSSC) should meet frequently to address mutual roles and responsibilities and to critique plans that support each other's needs, especially those that impact the safety of employees and passengers. Formalized structure is needed to track progress through the use and distribution of agendas and meeting minutes, to satisfy reporting relationships for each agency.
4.0 Safety Engineering Techniques and Analysis- Safety Risk Management

The practice of system safety integrates management systems with safety engineering practices to optimize safety performance at the highest level practicable within the constraints of time, cost and operational effectiveness. To achieve this performance, system risk should be identified, measured and controlled effectively using a variety of analytical methods and techniques. There are various types of risks including operational, project risk, regulatory, etc. This section of the SSPP establishes ways by which risks to the Urban Rail Agency can be determined, minimized, and controlled using evaluative tools to check the progress of implementing goals and objectives.

4.1 Element 7: Hazard Management Program

The Hazard Management Program is perhaps the heart of the System Safety Program. Key core elements of the Hazard Management Program are to:

- Identify and describe the most serious safety risks to the public, personnel and property
- Describe the desired safety outcomes or goals for each risk
- Develop and implement risk control strategies for prioritized safety risks.

While there has been much written about the level of formality needed for this section of the program, it remains an individual matter for each Urban Rail Agency to fit the proper process to its respective organization. The System Safety Program Plan should include the mechanism, accessible to all levels of the organization, by which hazards are identified, analyzed for potential impact to the operating system, and resolved in a manner acceptable to general management. The entire Hazard Management Process is a formalized procedure for risk acceptance by the Urban Rail Agency. The process requires the systematic identification of hazards and a coordinated hazard resolution methodology.

There are a number of Hazard Management models that may be used to guide the development of an Urban Rail Hazard Management Program. Guidance is contained in the FTA Hazard Analysis Guidelines for Transit Projects. A widely used model is Military Standard 882. Many of the common formal hazard analysis techniques in use today are based on the FTA guidelines and Military Standard 882.

4.1.1 Hazard Identification
Urban Rail hazards can come from many sources including results from formal safety analyses, results from internal safety and security reviews, results from performance testing and other rules compliance activities, infrastructure and vehicle maintenance inspections, reports from operators and supervisors (such as close-call reporting) and customer complaints.

Formal hazard analysis techniques that may be used by Urban Rail Agencies include Preliminary Hazard Analysis, System Hazard Analysis, Subsystem Hazard Analysis, Operations Hazard Analysis and Failure Modes and Effects Analysis. Additional specific hazard analyses may include collision hazard analysis and grade crossing hazard analysis.

The Urban Rail Agency should describe the methods used to ensure that as many hazards as possible are identified and entered into the Hazard Management Program before they cause problems. While it is virtually impossible to identify every hazard, there are various formal processes, as well as the time tested method of direct observation and input from field personnel on situations and designs which could cause accidents or incidents.

For new start Urban Rail Agencies, formal hazard analyses, such as a Preliminary Hazard Analysis, are useful to analyze, as completely as possible, all aspects of rail system design. Rail projects with FTA funding are required to perform a Preliminary Hazard Analysis. As there is no “history” to provide other means of analyzing the operation, a new Urban Rail Agency should have the necessary hazard analyses built into design, construction and procurement contracts.

Conversely, systems in operation, especially those that have been operating for a long time, may not need to get involved with such formal levels of hazard analysis on a regular basis. Usually, the input of operating and maintenance personnel can provide the type of data that can be used for a sufficient hazard analysis process. The key factor is that whatever process is used, it should be formal enough to have been documented in a procedure, available to all units of the organization, reviewed and administered on a routine basis (usually by system safety staff), and have a high level of visibility and participation. Any hazard process should have appropriate sign-offs and checks and balances built in. If an Urban Rail Agency uses the committee approach to safety coordination, hazard identification and resolution should be a regular part of the committee activities.

Hazard identification is an ongoing process, visible throughout the rail system life cycle. Accordingly, it needs to be coordinated with other activities like accident/incident investigation so that accidents and incidents resulting from
previously unidentified hazards are subsequently entered into the hazard resolution stage of the process, with all essential documentation of such situations maintained.

4.1.2 Hazard Evaluation and Categorization

Hazards can be categorized (or evaluated) in many different ways. Once common way to categorize hazards is in terms of severity and probability of occurrence (as done in Military Standard 882). The key factor is to have a formal framework in place to assess hazards in terms of severity and probability and to provide a method for reducing risks. It is also extremely important to design, in advance, a process for handling exceptions to the established procedure, as it is virtually impossible to anticipate every situation.

Hazard severity is defined as a subjective measure of the worst credible mishap, resulting from personnel error, environmental conditions, design inadequacies, and/or procedural inefficiencies for system, sub-system, or component failure or malfunction. For example, a hazard with a severity Category I occurs when the hazard can result in death, system loss or severe environmental damage.

Hazard probability is defined as the probability that a specific hazard will occur during the planned life expectancy of the system element, sub-system, or component. It can be described in potential occurrences per unit of time, events, population, items, or activity. For example, a hazard with a probability of “frequent” is likely to occur frequently or to be continuously experienced.

Once a hazard is identified, an analysis as to its potential severity and probability of occurrence is performed. The process for this analysis should be standardized by the Urban Rail Agency and documented by an approved procedure. This procedure should be followed as prescribed. While it is possible to develop a qualitative methodology for this type of analysis, the most practical method for Urban Rail application is simple, deductive reasoning applied on a collective or organizational basis. The composite management staff (all key line and staff departments) can effectively determine the severity of all but the most difficult or unusual hazards.

It is important, however, to determine in advance the exact mechanism for implementation of this process, as well as some type of administrative appeal process should consensus on categorizing a specific hazard prove too difficult to achieve.
Hazards identified on an ongoing basis should be entered into the formal Hazard Management Program, the same as those identified by formal analysis techniques associated with new procurement and new system construction. All employees involved in the hazard identification process should know and understand their respective roles.

4.1.3 Hazard Tracking and Resolution

Hazard resolution is defined as the analysis and subsequent actions taken to reduce, to the lowest level practical, the risk associated with an identified hazard. Hazard resolution is not synonymous with hazard elimination. In an Urban Rail environment, there are some hazards that are impossible to eliminate and others that are highly impractical to eliminate. For example, Urban Rail systems with grade crossings can never eliminate the hazard of a motor vehicle-train or pedestrian-train collision. Reduction of risk to the lowest practical level can be accomplished in a variety of ways, from protective and warning devices to special procedures and education. However, there are some hazards that present a risk that cannot be accepted, because of severity and high probability, which should be eliminated.

Part of the hazard resolution procedure should be a predetermined matrix prescribing which hazard types (identified by their severity and probability indices) are acceptable, acceptable with mitigation, and unacceptable. Once this matrix is defined by the Urban Rail Agency, deviation from the prescribed resolution process should occur only through approved, predetermined channels.

In addition to the hazard resolution matrix, a companion procedure should accompany it describing exactly how hazards defined as “unacceptable” and “undesirable” will be reduced to an acceptable level. This procedure is usually called “Order of Precedence”: design changes, installation of controls and warning devices and the implementation of special procedures. The Order of Precedence for resolving hazards is as follows:

- **Design to Minimize Risk.** Design to eliminate hazards through design selection
- **Safety Devices.** Hazards that cannot be eliminated or controlled through design selection should be controlled to an acceptable level through the use of fixed, automatic or other protective safety design features or devices. Provisions should be made for periodic functional checks of safety devices
- **Warning Devices.** When design or safety devices cannot effectively eliminate or control an identified hazard, devices should be used to detect the condition and to generate an adequate warning signal to
correct the hazard or provide for personnel evacuation. Warning signals and their application shall be designed to minimize the probability of incorrect personnel reaction to the signals and should be standardized within like types of systems. Warning devices should be designed to operate above excessive ambient conditions, such as high noise or intense illumination.

- **Procedures and Instruction.** Where it is impossible to eliminate or adequately control a hazard through design selection or the use of safety and warning devices, procedures and/or training should be used to mitigate the hazard. Precautionary notations should be standardized as specified by top management. Safety critical tasks and activities may require certification of personnel efficiency.

The hazard resolution procedure should also include a hazard tracking process. Normally safety committees, such as the Safety and Security Review Committee (SSRC), track hazards to resolution. Any prescribed review by management staff should be predefined to ensure the process cannot be bypassed, although provision can be made for allowing exceptions to the process in an approved manner. Management policies are used to set these risk tolerance levels.

The entire Hazard Management Program is a formalized, predetermined procedure for risk acceptance by the Urban Rail management staff. It allows for a systematic hazard identification process and a coordinated hazard effects minimization process. Management of the Hazard Management Program (which includes responsibility for all supporting documentation and coordination) should be the responsibility of line management. The safety unit should develop and update the Hazard Management Program, and should provide advice to staff and oversight of the process. The coordination process can take on many different forms, such as safety committees and internal communication mechanisms. It is important that hazard tracking logs be maintained to ensure that hazards are tracked to resolution. The key to success still remains in the predetermined, administered process for hazard management.

### 4.1.4 Hazard Reporting to the State Safety Oversight Agency

The FTA State Safety Oversight Rule 49 CFR Part 659 talks about the Urban Rail Agency’s hazard management process (in Section 659.31). The Urban Rail Agency must specify the conditions under which the oversight agency must be notified regarding identified hazards, describe the notification process and follow-up information taken to resolve the hazard, and describe how the Urban Rail Agency will provide on-going reporting to the oversight agency.
regarding hazard resolution activities. This process must be described in the System Safety Program Plan.

4.2 Element 8: Accident/Incident Reporting and Investigation

Conducting investigations of accidents and incidents is related to the Hazard Management Program in that feedback and follow-up from these investigations should be automatically evaluated for hazard resolution. Once an incident occurs, it is incumbent upon the Urban Rail Agency to identify potential actions to prevent a recurrence of the respective problem. The basic elements necessary for a properly executed investigation of accidents, incidents, and close-calls are listed below.

4.2.1 Criteria and Procedures

A formal policy should exist and be fully understood by all organizational groups as to exactly which accidents/incidents will be investigated. This policy should include a pre-determination on such things as thresholds for automatic activation of an investigation, guidelines on whether incidents should be investigated immediately or after the fact, and who is in charge of each specific level of investigation.

Preparation of appropriate procedures, formats, and approaches for performing investigations should be documented and properly implemented. Verification of full understanding and compliance with such procedures by all organizational elements is also required.

4.2.2 Internal and External Notification

Pre-determination of the appropriate notification of accidents and participation in accident investigations should be understood and available to all involved Urban Rail Agency personnel. The Urban Rail Agency should define exact criteria for establishing notification thresholds both internally and externally to the organization. These criteria are usually expressed in terms of fatalities, number of injuries requiring medical attention away from the scene, property damage, collisions at grade crossings, derailments, etc.

The FTA’s 49 CFR Part 659 (659.33) requires that the Urban Rail Agency notify the oversight agency within two hours for certain types of rail transit incidents. The SSPP should contain the requirements for reporting the accident to internal and external organizations. The Urban Rail Agency must coordinate with the State Safety Oversight Agency to satisfy their requirements for reporting of accidents within required timeframe. In addition, Urban Rail Agencies that share track with the general railroad system
are subject to FRA notification requirements. The NTSB must also be notified for certain types of rail transit incidents.

External notification requirements and the preparation of necessary reports to all regulatory agencies and governing boards should be identified and personnel assigned to carry out these requirements.

4.2.3 **Cause Analysis**

While actual procedures for accident/incident investigation may vary greatly from one Urban Rail Agency to another, especially in such areas as the department in charge and responsible for corrective actions, the ultimate goal remains the same: elimination of accidents. This will not occur unless a thorough incident investigation has developed all of the facts in evidence and a cause analysis is performed in accordance with the Hazard Management Program. Findings, conclusions, and recommendations resulting from investigations should be specified as to type, format, distribution, and retention.

4.2.4 **Reporting and Follow-up Documentation**

All necessary information pertaining to a specific occurrence should be in a standard format and stored in a specified location. Applications for use of incident documentation include ongoing training, especially where human error and procedural error are involved; litigation, where documentation of efforts to prevent such incidents can be extremely valuable especially to establish that Urban Rail management is reasonable and prudent; and budget development, where certain re-designs and equipment purchases can be easily justified. Assurance should be provided that all recommendations and identified needs for corrective actions are assigned, tracked, reported, and verified. This is an extremely important step to providing a key element in recurrence prevention.
5.0 Safety Change Management and System Verification - Safety Assurance

The System Safety Program should be able to ensure that the margin of safety designed and built into the Urban Rail system is maintained consistently over time and is not diminished by necessary changes that are inevitable in a transportation system. To provide this level of safety assurance, a method for managing change should be adopted and a system to verify the effectiveness of program implementation should be incorporated. Because changes to the transportation system are constant and come from all aspects of Urban Rail operations, different techniques for identifying and managing change in the organization should be adopted to ensure that the integrity of safety procedures, equipment, and personnel are not compromised. Changes found to be beneficial to one part of the organization may create the opportunity for a catastrophic incident in another part of the organization, if there is no effective means of identifying, analyzing, and controlling changes that occur across the system. At a minimum, administrative controls should be in place to monitor the condition of configuration control procedures. Checks should be made on the review and update of procedures to ascertain they are being accomplished in a timely fashion and are consistent with supporting the strategic planning process.

The Urban Rail Agency’s performance measurement system should include safety data acquisition and analysis to measure and verify safety within the Agency. The Urban Rail Agency must develop a defined list of safety performance indicators for each safety priority risk and associated targets that the Urban Rail Agency will use to determine if it is achieving the specified safety goals that it has established for itself within the Public Transportation Agency Safety Plan.

5.1 Element 9: Safety Data Acquisition and Analysis

One of the most important services the safety unit provides for the Urban Rail Agency is the collection, maintenance and distribution of safety data relative to system operation. In some agencies, this data may be collected by other parts of the organization, such as risk management. Many Urban Rail Agencies use computerized data base management systems to manage all of the agency’s safety data. It is important to use a reliable data management system that enables users to extract various kinds of reports and do trend analysis.

5.1.1 Safety Performance Measures

As recommended in the Transit Rail Advisory Committee for Safety publication Implementing Principles in Rail Transit Agencies, “defined performance measures
serve as leading indicators of safety performance and risk and are used to identify, analyze, diagnose, and assess risk and to direct and incentivize employee performance. Performance measures and findings from independent assessments, close call reporting and behavior-based safety approaches are used to improve the responsiveness of the organization to safety risks by adjusting processes, policies, strategies and investments. By allowing managers to predict and proactively address potential safety issues, undesired events are prevented before they impact operational safety.”

Effective practices defined in the TRACS document include the following:

- “Leading indicators of safety performance, safety culture, and accident precursors are defined, measured and monitored
- All employees understand the value of collecting and reporting data to support risk analysis, address unsafe conditions, and prevent accidents
- Reliable data is collected on operational performance, safety, maintenance, close calls and training. Systems are in place to analyze trends, track and report data, and guide decisions. Variations from expected outcomes are reviewed to understand where the organization is failing and what corrective action is necessary to restore performance
- Performance measures based on industry standards are cascaded through the organization so everyone is clear about fulfilling strategic safety goals. The performance measures are used to continually encourage all levels of the organization to reduce the risk to the agency
- The organization uses performance measures to evaluate the effects of new programs and processes on safety.”

Leading indicators are input based measures that have an indirect relationship to an end product or goal and can influence lagging indicators. Leading indicators measure and track performance before a problem arises. Examples of leading safety performance indicators include running red signals, no stop at broken gates, doors open on the wrong side, improper berthing door, railway worker protection violation, use of cell phones while operating vehicles or machinery and complaints per 100,000 passengers.

Lagging indicators are also an effective way to measure performance of the organization. Lagging indicators are outcome-based measures that are directly related to an end product or goal. Lagging indicators measure performance against prior goals. An example of a lagging safety performance indicator is the number of preventable accidents per 100,000 miles.

5.1.2 Safety Data Analysis
Safety data includes information gathered from within the Urban Rail Agency on various operating events relative to safety. Analysis of this system specific data can be used to determine trends and patterns in system operation. Included as part of the Hazard Management Program, data collection and analysis can be used to identify hazards before they cause accidents by such techniques as trend analysis. Data acquisition and analysis thus becomes a vital component for efforts to improve system performance, not only with respect to safety, but also in the overall delivery of service to the riding public. The responsibilities for providing, receiving, processing and analyzing data should be listed here and can be general or specific, based on the needs of the Urban Rail Agency.

Exactly what types of analysis techniques are used as part of the data analysis process should be determined by the individual needs of each Urban Rail Agency. This decision is based on variable aspects of the Urban Rail environment such as whether any major system changes or procurements are underway. Frequently, ongoing procurement contracts require a certain amount of safety data and analysis to be provided by suppliers. It should be determined in advance how this data will be used and who will be responsible for its evaluation.

Communication with other Urban Rail Agencies is also a productive source of input into both the data acquisition and hazard management processes. This type of coordination can be used to discover potential problems before they occur at a given Urban Rail Agency by monitoring events at other Urban Rail Agencies, especially those with similar components. Development of “lessons learned” from historical data is a key component of the Safety Data Acquisition and Analysis element. Participation in industry committees, workshops and conferences, and other efforts in this regard further enhance the value of data acquisition/analysis.

Another form of safety data analysis is benchmarking. A benchmark is a standard or point of reference used in measuring or judging quality or value. The process of benchmarking can be defined as a structured approach to identify actions that lead to superior performance. Benchmarking is not merely a comparison of performance data or a creation of tables. Performance measurements, for example, deliver little benefit on their own, but they stimulate productive questions and lines of inquiry for more in-depth analysis and research. Benchmarking can be applied internally within the Urban Rail Agency or externally by comparison to other similar types of rail agencies.

5.2 Element 10: Configuration Management
Configuration Management is the top-level methodology for assessing the impact of change to safety critical areas of operations. Configuration management is a process that ensures, as much as possible, that all property, equipment, system design elements, etc. are documented as to configuration, both accurately and completely. Any changes to an individual sub-system or fleet/inventory wide change should be recorded on as-built drawings and addressed in training courses, maintenance manuals, and procedures in a timely and effective manner. The Configuration Management Process should include, at a minimum, procedures for the Urban Rail Agency to make configuration changes that have the potential to affect safety critical elements, the process for incorporating these changes into all appropriate documentation, and the process for ensuring that all necessary units, including the safety unit, are formally made aware of such changes. Configuration management works in conjunction with Safety and Security Certification and other stand-alone programs to ensure the highest level of safety practicable is maintained throughout the Urban Rail system’s life cycle.

5.2.1 Standards/Design Control

The Urban Rail Agency should develop a Safety and Security Design Criteria Manual. The Safety and Security Design Criteria Manual should make reference to applicable standards where they exist and govern the operation of safety critical functions of the Urban Rail Agency. The areas where deviations or waivers to regulatory requirements were adopted also need to be identified and documented. In areas where no standards exist for safety critical processes or equipment, design criteria and controls used should be referenced and originals retained in accordance with Urban Rail Agency policy or regulatory requirements.

5.2.2 System Modification- New Processes/Equipment

Urban Rail Agencies are in a perpetual state of acquisition, as new equipment, system expansions and modifications, and system rehabilitations require constant design and procurement efforts. Ongoing acquisitions and procurement in fact can be more critical than initial design for many reasons. Coordination and compatibility with the existing system, construction efforts under operating conditions, and testing and break-in phases should all be managed as part of the ongoing system safety effort.

5.2.3 Document Control

Methods for identification and maintenance of control documents should include a provision for handling those documents deemed to be safety critical. Many methods and systems of document control exist and it is at the discretion
of the Urban Rail Agency to adopt one that fits their organizational needs. The document management system can use a hierarchical method to manage documents, such as a document tree. Many such systems are automated and are used to track and store electronic documents and/or images of paper documents. To maintain effective document control within the organization, the Urban Rail Agency should establish a procedure for reviewing and approving documents prior to release; ongoing review and approvals; identification of changes and revisions; identifying and controlling external documents like customer supplied documents or supplier manuals; and preventing unintended use of obsolete documents.

5.3 **Element 11: Safety and Security Certification**

Urban Rail Agencies are required to develop and implement a formal Safety and Security Certification process for major projects including new rail systems or extensions, the acquisition and integration of new vehicles and safety critical technologies into existing service or major rehabilitation projects.

Safety and Security Certification is a series of processes that collectively verify the safety and security readiness of a project for public use. Certification addresses conditions that could result in harm: safety (unintentional) and security (intentional). Projects can be completely new start rail systems or modifications to the existing system. Guidelines for how to implement a Safety and Security Certification Program can be found in the FTA/APTA *Handbook for Transit Safety and Security Certification*. The Urban Rail Agency must develop a Safety and Security Certification Plan (SSCP) that describes how the agency plans to implement the Certification Program.

Safety and Security Certification offers benefits to the Urban Rail Agency including:

- Identification and assessment of hazards and vulnerabilities, along with documented action taken to resolve critical and catastrophic events
- Codes, guidelines and standards related to safety and security are included 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 codes, standards, criteria and specifications.
Verification tests, plans (safety, security, operating, maintenance) and rulebooks are developed for operations.

Personnel are trained to handle normal and emergency situations and emergency response personnel are familiar with the Urban Rail Agency and its emergency procedures.

Safety committees that are convened during the Safety and Security Certification process often include the Fire Life Safety and Security Committee and the Safety and Security Review Committee.

The final step in the Safety and Security Certification process is the Safety and Security Certification Verification Report (SSCVR). This report documents the completion of safety and security activities contained in the Urban Rail Agency's Safety and Security Certification Plan with noted open items and workarounds.

5.4 Element 12: Safety Assessment

An important component of the System Safety Program is assessment of how well the System Safety Program is performing. Safety assessments consist of internal and external safety management reviews.

5.4.1 Internal Safety Management Reviews

System safety is the formal process of managing a system to ensure that all identified safety elements in a given environment are in place and are performing as designed. In the Urban Rail environment, it is difficult to identify any elements which are not safety related, even if only indirectly. The Internal Safety Management Review process thus becomes extremely important in determining if all organizational elements, equipment, procedures and functions are performing as intended, from a system safety perspective. It requires constant attention and activity.

The Internal Safety Management Review determines compliance with the Urban Rail Agency’s safety policies, rules, regulations, guidelines, codes, procedures, assigned system safety activities, and requirements as prescribed within the System Safety Program Plan. Items found not in conformance are reported and Corrective Action Plans filed to improve the deficiencies.

The Urban Rail Agency should develop a procedure for conducting Internal Safety Management Reviews. This procedure should include the following items:
Identification of departments and functions subject to safety management review
Responsibility for scheduling safety management reviews and identification of persons to conduct the safety management reviews
Process for conducting safety management reviews including development of checklists, procedures and issuing of findings
Review of reporting requirements
Tracking the status of implemented recommendations
Coordination with the State Safety Oversight Agency.

5.4.2 External Safety Management Reviews

External safety management reviews consist of three types of safety management reviews: compliance, performance and peer. Each type of safety management review has value and should be performed to assess the state of safety within the Urban Rail system.

5.4.2.1 Compliance

Compliance safety management review focuses on verification of compliance to policies, plans, procedures, milestones, or other predetermined requirements. These compliance safety management reviews indicate whether requirements are met (yes or no) or partial compliance. This type of safety management review is reactive, identifying problems after they occur with the hope of preventing future occurrences. Typically, Urban Rail Agency compliance safety management reviews compare the organization’s performance against its System Safety Program Plan. The compliance safety management review team can consist primarily of safety personnel who verify evidence of compliance.

5.4.2.2 Performance

Performance safety management reviews focus on the product, process and system to determine how well they meet the customer’s needs (specified or unspecified) as well as to identify opportunities for improvement. This type of safety management review emphasizes improvement, while focusing on specified and unspecified customer needs. It is more proactive with the goal of identifying programs before they occur. Performance safety management reviews identify potential problem sources and opportunities that may not be directly related to problems, such as reduction in materials or cycle time.

The performance safety management review team usually consists of cross-functional teams with subject matter experts. Their focus is on clarifying performance objectives and criteria and they review actual performance as
part of the review. Examples are observing work in progress including night shifts; performing drills or simulated activities when the actual work cannot be observed in normal mode; interviewing the individuals who actually perform the work; performing surveys or conducting focus groups of customers or employees; and, in addition to problem identification, try to find out why the problem occurred, the cause of the problem and what could be done to prevent the problem. The Urban Rail Agency can measure its performance against stated goals, objectives and key performance indicators.

5.4.2.3 Peer Reviews

Peer reviews are a valuable resource to Urban Rail Agencies for assessing all aspects of transit operations and functions. Highly experienced urban rail personnel who are selected on the basis of their subject matter expertise conduct the peer reviews on-site. Through the benefits of on-site interviews of Urban Rail Agency staff and review of relevant documents, the peer review panel concludes its review with a summary of observations and recommendations.

6.0 Safety Program Implementation - Safety Promotion

This section of the Plan identifies Elements 13-21, which define specific program areas where good management practices are applied to support the attainment of organizational safety goals. Many of these program implementation elements are associated with APTA standards and FTA regulations and effective industry practices, which provide detailed guidance in carrying out these functions.

Good management practice is to task departments that have safety critical responsibilities with the development of a Department/Division Safety Action Plan that contains detailed information on how department/division safety goals and objectives will be achieved.

Maintenance inspections should also be closely coordinated with the Hazard Management Program, as personnel responsible for maintenance inspections will frequently be in a position to observe and report on hazardous conditions.

6.1 Element 13: Infrastructure Maintenance and Inspection
Maintenance of identified safety critical items such as track, signals, traction power, train control systems, communications, facilities and structures is critical to the safe operation of an Urban Rail system. If these assets are not maintained properly and to exacting standards, the rail system will suffer collisions, derailments and long-term interruptions in service. Therefore the Urban Rail Agency should develop an Asset Management System and a Safety Maintenance System Plan, which includes a program to regularly verify that the Urban Rail Agency is maintaining all of its safety and service critical systems to the standards established by the Urban Rail Agency and the industry in general.

As required by MAP-21 the Asset Management System should include capital asset inventories and condition assessments, decision support tools and investment prioritization. Capital assets include equipment, rolling stock, infrastructure and facilities for use in public transportation owned or leased by the Urban Rail Agency.

The first step in establishing such a program is to identify which assets and systems need regular maintenance and to which standards. Typically these assets and systems include track, traction power, signals, train control, communications, grade crossings, emergency ventilation and fire protection. A customized list for each Urban Rail Agency needs to be established. Once the Urban Rail Agency has identified the major systems, the next step is to identify subsystems that need maintenance and regular inspection. For example, for track the subsystems include tangent track, special trackwork (turn outs, switches, frogs, switch machines), and curves and spirals. Then, for each of the subsystems, identify specific equipment needing regular maintenance and inspection by name and location.

A regular cycle of inspections needs to be developed and documented, along with the list of exactly which items are to be inspected. Appropriate maintenance documentation methods and the use of proper tools and test equipment are other issues to be addressed. Written observations of defective or missing equipment should be reported whenever observed. Maintenance inspections should also be closely coordinated with the Hazard Management Program, as personnel responsible for maintenance inspections will frequently be in a position to observe and report on hazardous conditions.

It is imperative that the proper corrective actions be prescribed, implemented, and tracked as part of a verification process. Such inspection records become extremely valuable tools in establishing that the management organization is reasonable and prudent in discharging its professional safety responsibilities.
6.2 **Element 14: Vehicle Maintenance, Inspection and Repair**

Vehicle maintenance is critical to the safe operation of an Urban Rail system. If vehicles are not maintained properly and to exacting standards, the rail system will suffer collisions, derailments and long-term interruptions in service. Therefore the Urban Rail Agency should develop a Vehicle Maintenance System Plan that identifies safety critical items and a program to regularly verify on that the Urban Rail Agency is maintaining its vehicles to the standards established by the Urban Rail Agency and the industry in general. The Urban Rail Agency should also establish an Asset Management Plan for vehicles (see section 4.1).

The first step in establishing such a program is to identify which vehicle assets and systems need regular maintenance and to which standards. A customized list for each Urban Rail Agency needs to be established. Once the Urban Rail Agency has identified the major vehicle systems, the next step is to identify subsystems that need maintenance and regular inspection.

This section should address the responsibilities and requirements of all groups performing maintenance related to rail vehicles. Issues such as preventive maintenance, scheduled inspections, and failure maintenance should be addressed here, either specifically or generally, by referencing documents such as maintenance plans and directives with safety critical systems, components and processes identified. Procedures for performing maintenance, inspection and repair of safety critical systems and components should be well written, with appropriate training provided and a system for verification of proper work practices employed. Deferred maintenance practices should address the interaction with safety related vehicle systems and components, and a “go/no go” criteria should be established. Appropriate maintenance documentation methods and the use of proper tools and test equipment are other issues to be addressed.

6.3 **Element 15: Rules and Procedures Review**

One of the most important functions of the Urban Rail Agency is to ensure that rules and procedures are carefully developed, maintained and followed throughout all administrative, operational and maintenance departments. The SSPP should include the process for development of rules and procedures, whether by individual departments, a rules and procedures committee, a central safety committee, etc.

The internal verification process should contain a methodology to ensure uniform, coordinated development and implementation of rules and
procedures; and should include techniques used to assess the implementation of operating and maintenance rules and procedures by employees, and techniques to assess the effectiveness of supervision relating to the implementation of operating and maintenance rules. The process should also include how results are incorporated into the Hazard Management Program.

Operational rule books and safety critical procedures should be controlled documents that are issued under prescribed authority, reviewed by and distributed to all those who have responsibility for duties affected by the rules or procedures, and have a method of ensuring that rules are understood and acknowledged by all employees. Employees have the right and responsibility to challenge the safety or work processes or rules and have the option of elevating their issues beyond their immediate first line of supervision.

Rules and procedures must be protected from unauthorized changes and modifications, and should be subject to periodic review and formalized update procedures. Likewise, administrative and maintenance departments should do the same for rules and procedures affecting classification of the employees and contractors who work under their authority. In the maintenance department areas, this process not only applies to safety rules but also to procedures for conducting inspections and making repairs to equipment. Improper maintenance procedures have been the dominant cause of numerous accidents in the transportation industry.

6.4 Element 16: Training and Certification

Training, certification and recertification (on a prescribed schedule) applies to Urban Rail Agency personnel and to agency contractors. New training and certification programs, or changes to existing programs, must be subject to safety reviews. Organized labor should be included in the development and implementation of Urban Rail Agency training and certification programs. In some instances, there may be specialized organized labor agreements for specific projects undertaken by the Urban Rail Agency. These agreements must also be factored into the development and implementation of training programs. Competency in required rules and procedures is achieved through training and confirmed through proficiency testing.

6.4.1 Urban Rail Agency Personnel

Proper qualification of operating and maintenance personnel is a vital part of a safe Urban Rail environment. The agency’s System Safety Program must require that all necessary training is conducted and documented. The first step in the training process is to identify categories of safety-related work requiring training. The next step is to develop comprehensive training,
certification and recertification programs for personnel within these job categories. Continuing safety education and training is important to reduce the Urban Rail Agency risk.

The maintenance of complete and accurate certification records of operating and maintenance personnel is required, as well as the content, presentation materials and testing results, including the grading process used. This is necessary to establish the requirements that ensure completeness and validity of course content and testing and that these activities result in employee competency to carry out their duties safely and effectively. While the level of detail presented in the System Safety Program for training and certification requirements is at the discretion of the Urban Rail Agency, a training, certification and recertification program should be in place and referenced in this section.

The agency should also implement a policy for field personnel ride alongs and efficiency testing to evaluate operational personnel compliance with safety policies and procedures.

Training programs should be provided to emergency response personnel (see section 4.5.2). This training should be documented in a similar manner to operations and maintenance training.

6.4.2 Contractor Personnel

When contractors work on urban rail property, especially under operating conditions, certain requirements should be applied to all members of the contractor work force (see section 4.6.4 and 4.7). This is essential for the safety of passengers, Urban Rail Agency employees, contractor employees, and the protection of Urban Rail Agency property. The contractor and all contractor employees should be clear from the outset that the Urban Rail Agency is primary and that all necessary rules and procedures will be followed without exception. This places a significant responsibility on the Urban Rail Agency and responsible units for ensuring that all contractor personnel (1) are instructed on the procedures, (2) know the procedures, and (3) follow the procedures. Contractor training records need to be maintained along with the content or presentation materials and testing results.

6.5 Element 17: Emergency Planning and Response

Emergency response is a primary component of any Urban Rail Agency’s System Safety Program. The Urban Rail Agency’s Fire Life Safety and Security Committee is the forum where rail personnel and emergency response
personnel (fire, police, emergency medical services, etc.) discuss issues, coordinate activities and plan for response to emergencies.

6.5.1 Emergency Preparedness Plan

Emergency preparedness must be formalized into a strategic plan and afforded constant attention through regular updates. Descriptions of relationships with external emergency response agencies, along with detailed responsibilities, should be included as part of the Emergency Preparedness Plan, including references to other master and support documents and procedures supporting emergency plans and response protocols. External response agencies include local agencies (fire, police, EMS, etc.) and regional agencies (State Office of Emergency Preparedness, State Fire, etc.). The Urban Rail Agency should develop an Emergency Preparedness Plan, such as that described in the FTA's Recommended Emergency Preparedness Guidelines for Rail Transit Systems. The process for updating this plan should be provided to all employees, contractors and emergency response personnel.

The Emergency Preparedness Plan should include a discussion of emergency drills. Emergency drills are conducted on an ongoing basis for an operating Urban Rail Agency and during the commissioning process for extensions to rail lines. Emergency drills for extensions and new lines are part of the agency’s Safety and Security Certification program.

Typical drills include:

- Train on fire in a station
- Train on fire between stations
- Natural disasters (earthquake, tornado, floods, wildfire, etc.)
- Hostage situation aboard train
- Fire on the track
- Derailment between stations
- Collision between two rail vehicles
- Grade crossing collisions – vehicle and pedestrian
- Collision with person on track
- Special events (sports, concerts, arts, etc.)
- Terrorist attack.

The emergency planning and response procedures should be revised with knowledge or lessons learned acquired through emergency drills and actual events. Periodically scheduled meetings with outside agencies, emergency drills, and the revision and distribution of emergency response procedures are required, with necessary approvals and checks for completion provided in the System Safety Program Plan.
6.5.2 Training

Training is an integral part of the Urban Rail Agency’s emergency response program. Training courses need to be developed for employees, contractors and emergency response personnel. This training should include practical exercises in performing responses to abnormal conditions, including evacuations of personnel (including those with disabilities) and ways to coordinate with emergency responders. The training should use a Pass Fail Criteria.

Public safety organizations (fire, police, emergency medical services, etc.) need to learn how to function on Urban Rail property including access and egress to vehicles, traction power, guideway access, etc. Employees and contractors need to learn how to use the Incident Command System in an emergency. Training programs should be conducted on an ongoing basis for an operational system and should be consistent with operating risks identified by the Urban Rail Agency, Transportation Safety Institute (TSI), Federal Emergency Management Agency (FEMA), National Transit Institute (NTI) and other organizations. Prior to beginning revenue service on an extension or a new line, emergency response personnel, employees and contractors must be trained in emergency response for the extension or new line. This training is part of the Urban Rail Agency’s Safety and Security Certification Program.

6.6 Element 18: Workplace Safety Program

The most valuable resource any Urban Rail Agency has is its employee work force. Time and money are constantly being invested to bring the individual members of the work force to a condition of maximum and effective productivity. It is essential from an employee perspective and also from a good management perspective to ensure, to the highest degree practicable, the safety of employees and contractors.

The effects of safety incidents extend beyond the immediate and dramatic consequences of the worst accidents. Economic effects of incidents can include costly repairs, lost workdays, and higher insurance premiums for the Urban Rail Agency, as well as loss of mobility and congestion that can affect the entire regional economy. Psychological effects can include posttraumatic stress reactions. Major accidents are not just the result of one individual’s behavior or actions. Major accidents typically have organizational antecedents with multiple causes involving people operating across many levels or functions within an organization. Therefore, predicting and preventing major accidents requires addressing the root causes based in organizational practices, management systems and culture.
6.6.1 Industrial/Occupational Safety Program

The Urban Rail Agency should ensure that its Industrial/Occupational Safety Program conforms to all legal and regulatory requirements. These include requirements for hazardous materials safety and applicable occupational safety and health requirements. See Appendix E for a description of environmental management programs which includes hazardous materials safety. However, it should be emphasized that these regulatory requirements are only minimum requirements and by themselves are insufficient to meet the employee safety needs in an Urban Rail Agency environment. Efforts should be made to maintain a comprehensive Industrial/Occupational Safety Program above and beyond these minimums to account for special conditions prevalent in rail maintenance facilities and rail operations. An Industrial/Occupational Safety Program should be designed to have the best possible input from all necessary units, including contributions from the employees themselves. These programs should be coordinated with labor unions and their local representatives. Contractors should also conform to industrial and occupational safety program requirements (see section 4.7).

6.6.2 Fitness for Duty Program

Safe operations within the Urban Rail Agency require that employees and contractor personnel are fit for duty. Many factors can affect their overall fitness including drugs and alcohol, fatigue, prescription drugs, and cognitive distractions.

6.6.2.1 Drug and Alcohol Program

Since virtually all U.S. Urban Rail Agencies require federal funds for continued growth and operation, the drug testing requirements of the FTA form the basis for the drug and alcohol programs at most Urban Rail Agencies. Above and beyond these programs, it is incumbent on the Urban Rail Agency to provide a mechanism for ensuring that the same oversight is provided for any type of substance that can alter the mental and physical conditions of the employee, such as over-the-counter medications. The bottom line is protecting the riding public and Urban Rail Agency employees and contractors. All efforts should be outlined in the SSPP and/or reference made to the appropriate master document containing that information.

6.6.2.2 Fatigue Program

Fatigue conditions cannot be overlooked as a potential for creating hazardous operating conditions, as history has shown that fatigue can become the primary cause or a contributing factor in Urban Rail accidents. The SSPP
should provide reference to fatigue countermeasures to manage this risk potential. Effective measures include establishing a second job policy, medical evaluations for sleeping disorders and awareness training programs for employees and contractors.

6.6.2.3 Medical Monitoring Program

Developing and applying appropriate medical standards for safety sensitive positions should extend beyond the pre-employment examination and take into account the aging process on sensory degradation and its effect upon safety within the Urban Rail environment. Medical monitoring programs should be appropriate to the classification of the employee and frequent enough to identify physical or mental deterioration of employees below the thresholds established for safe performance of their duties.

6.6.2.4 Critical Incident Debriefing- Post Traumatic Stress

A Critical Incident Debriefing (involving Urban Rail Agency employees and representation from the labor unions) should occur for significant incidents, such as major accidents or service disruptions. The Urban Rail Agency should prepare an After Action Report that includes the following items:

- Review interagency relationships to minimize interagency misunderstandings
- Review decision making processes
- Ensure that a formal review of problems encountered is performed
- Learn from innovations developed during incidents
- Aid personnel in coping with the stresses of complex, traumatic events.

Transit personnel and emergency responders often face emotional damage from serious incidents. This trauma is known as posttraumatic stress disorder (PTSD). The Urban Rail Agency should provide access to mental health professionals and/or peer counseling sessions for employees and responders who witness severe injuries or fatalities.

6.6.3 Cognitive Distraction and Attentional Error

Cognitive distraction refers to an employee taking his or her mind from his or her job. This can be a voluntary or involuntary diversion of attention from the primary task of operating a vehicle or other equipment. One major cause of cognitive distraction is the increased use of personal electronic devices, such as cell phones, while operating a vehicle or other equipment. In December 2011 the National Transportation Safety Board released a safety resolution calling for 50 states and the District of Columbia to ban the non-emergency use
of personal electronic devices (other than those designed to support the driving task) for all drivers. The Urban Rail system should develop a procedure regarding the use of Portable Electronic Devices

6.6.4 Track Access and Roadway Worker Protection

Track access procedures are essential to providing a safe environment for personnel working on or around the track. All Urban Rail employees, contractors, and other outside personnel must follow track allocation procedures that are in place at the urban rail agency. These procedures should be referenced in the SSPP.

As defined in the *APTA Standard for Roadway Worker Protection Program Requirements*, the objective of a Roadway Worker Protection Program is to create conditions in which workers may perform duties on or near the right of way with consistent and strong programs in place to assure worker safety. In 2012, the Transit Cooperative Research Program (TCRP) published a document titled *Practices for Wayside Rail Transit Worker Protection (TCRP 95)*. The Urban Rail Agency should have in place a program that includes rules and procedures for employee actions, formalized supervision and control actions, administration of training programs, and effective use of technology.

6.7 Element 19: Contractor Requirements for Safety

The Urban Rail Agency should codify provisions for safety-related policies, procedures or other documentation regarding contracted services, regardless of the type of operation. If the agency contracts out for services, it should define the safety related requirements and deliverables within the scope of the contract documents. The Urban Rail Agency’s System Safety Program Plan can be used as a guideline for the contractor to develop a project specific contractor Safety Plan that will address all safety elements, including Occupational Safety and Health Administration (OSHA) and Environmental Protection Agency (EPA) regulations. Establishing safety requirements within the contract also supports consistent application of the required safety elements in the event of contractor turnover.

The Urban Rail Agency's SSPP should also delineate how the agency will manage contractor safety. The specific ways that the Urban Rail Agency will monitor the application of the approved contractor Safety Plan should also be included within the contract documents. This ensures that reporting and performance objectives are clearly understood by all contractors and subcontractors responsible for performing safety critical services.

6.7.1 Contracting for Services
Agencies that use contractors to perform safety-related functions need to ensure that those services are being performed in accordance with recommended safety criteria. Contract provisions should require contractors providing these safety-related services to incorporate and document the proposed application of recommended safety elements within the scope of its contract submittals. At a minimum, a contractor Safety Plan should be required as a contract deliverable for review and approval by the Urban Rail Agency for contractors who are performing safety related services. The contractor’s Safety Plan should be designed to meet the Urban Rail Agency program requirements, as outlined within the agency SSPP, and should describe the means and methods for attainment of safety program goals and objectives, along with all applicable local, state and federal regulations. The contractor Safety Plan should be customized to address the safety requirements as applied to the scope of the contract, and related safety provisions as defined within the Urban Rail Agency’s SSPP. Other contractor documentation requirements applicable to the safety elements outlined in this Manual should also be specified as deliverables within the scope of contract documents including, but not limited to, Operating and Safety Rules and Procedures, Drug and Alcohol Program, Training Plan, Safety and Security Certification Plan and Quality Assurance Manual.

The contractor Safety Plan needs to be defined and submitted by the contractor to the Urban Rail Agency for review and approval. This submittal should include safety personnel resources designated to administer the program requirements and their respective qualifications to perform these responsibilities. Finally, the Urban Rail Agency should require the contractor to submit regular key performance indicator reports and analysis designed to assess the level of effectiveness by which the program elements have been implemented.

6.7.2 Contracting for Facilities, Equipment and Materials

Urban Rail Agencies may also decide to contract maintenance and repair services to address infrastructure needs including facilities, equipment and materials. Contingent on the scope of these contract services, many provisions described in the previous section (4.7.1) may apply, including the submittal of a contractor Safety Plan. At a minimum, the agency should ensure the proposed facilities, equipment and materials operating and safety management programs are documented by the contractor and reviewed and approved by the Urban Rail Agency to ensure they meet all applicable local, state and federal regulatory requirements. Maintenance programs should also be consistent with applicable manufacturer recommended requirements and/or relevant organizational maintenance standards. As described above,
relevant maintenance and safety procedures and training, drug and alcohol, and quality assurance programs, if applicable, should also be submitted to the agency for review and/or approval.

6.7.3 Construction Management

Construction contractors working on or near the Urban Rail Agency’s property have the potential to create safety hazards that should be mitigated through the development of structured programs that provide a clear understanding of relevant safety procedures and work site requirements. All construction contractors should comply with relevant local, state and federal regulations. In addition, these contractors should also comply with relevant Urban Rail Agency safety procedures including track access and right of way safety procedures. Contract provisions should mandate compliance to these requirements and require the necessary training and qualifications of personnel to ensure these standards are understood and effectively implemented. Safety and Security Certification requirements should be specified within the contract documents as applicable.

In most cases, construction management contractors should be required to submit, for review and approval by the Urban Rail Agency, a contractor Safety Plan that documents the scope of the contractor’s safety program and the means by which all safety requirements will be achieved. In some larger urban rail properties, the Urban Rail Agency may have its own Construction Safety Manual. In that case, the construction management contractor will typically submit Job Hazard Analyses (JHA) and an Injury and Illness Prevention Program in accordance with the requirements of the Urban Rail Agency’s Construction Safety Manual.

Construction management on-site safety professional qualifications should also be submitted for review and approval by the Urban Rail Agency. All construction subcontractors should be required to adhere to the provisions contained within the prime contractor’s Safety Plan. The Urban Rail Agency needs to describe within the scope of its SSPP the means by which construction contractor safety performance will be evaluated and assessed in accordance with the construction management contractor’s approved program plan submittals.

6.8 Element 20: Procurement and Stores

Procurement of materials and services, and the receipt, control and distribution of materials should be executed in accordance with quality standards, established user department needs and governing laws and regulations. The procurement department within the Urban Rail Agency must
ensure that materials purchased by the organization for use by its employees or on its property meet specifications and are properly labeled and packaged. All items procured should be evaluated for health, safety and environmental compliance with current applicable regulatory specifications and industry standards.

When materials are procured, it is important to identify safety critical items, and to do quality assurance on these items. Also, materials have to be properly stored and shelf life considered. Hazardous materials must also be carefully evaluated and stored. Obsolescence planning should be performed to remove equipment that no longer has functional value; to relocate equipment from areas where it no longer has functional value to where it is best suited; and to acquire new technology as needed.

### 6.9 Element 21: Passenger and Public Safety Programs

Urban Rail Agencies should include provisions for passengers and the general public to be on or pass through a railroad environment that is both safe and secure. This includes use of provided parking lots, street and sidewalk access to facilities, properly designed and maintained passenger stations and boarding areas, rolling stock safety features, and adequate emergency egress plans and response capabilities.

#### 6.9.1 Passenger Operational Environment Programs

Managing the safety aspects of the passenger operational environment is differentiated from the static fixed facility issues identified in Element 7 (section 4.1) such as presence of fire protection equipment, alarms and cameras. The Passenger Operational Environment is the way in which the facilities provided are used by the patrons. This includes safe walking paths through parking lots to separate pedestrian and vehicle conflicts, minimization of slip and fall potential, adequate lighting, being able to communicate with patrons, methods to minimize platform crowding, platform gap warnings or physical barriers, train door control procedures, proper escalator or elevator use, and pedestrian grade crossing safety, among others.

#### 6.9.2 Public Safety Programs

A formalized passenger and public safety outreach program to provide essential safety information to Urban Rail patrons and the general public is an important part of the safety effort. The outreach program requires planning, leadership, organization and documentation to be effective. Some of these programs are short term efforts targeted to specific communities while others are well established long-term efforts with general applicability.
to continuously heighten awareness to common problems such as door closing, platform gap, escalator safety and trespass. The presence of highway-rail grade crossings necessitates the establishment of a grade crossing management effort. To truly mitigate the hazards identified at highway-rail grade crossings, all parties involved with the crossings should participate in hazard analyses to identify and mitigate the hazards.

6.10 Element 22: Rail Corridor Operational Safety

The safety of the operating rail corridor is perhaps the largest challenge to management of risk for an Urban Rail Agency. Employee and contractor safety within the operating envelope presents a continuous challenge to the safety of operations. Other serious operating hazards such as highway-rail grade crossings, unauthorized intrusion or trespass, traffic signal coordination with rail operations, joint freight operations, and evacuation from elevated or underground structures should be managed at a safety critical level using the Hazard Management Program to develop and implement plans, procedures and practices to mitigate the hazards. For these reasons, Urban Rail Agencies are encouraged to implement a Corridor Safety Action Plan that identifies the rail corridor and provides specific management focus to programs that will eliminate or mitigate safety risks along the corridor.

Examples of hazards within the rail corridor and mitigation strategies are discussed below.

Highway-Rail Grade Crossings

A multiple disciplinary approach to grade crossing safety is essential for proper design, installation, maintenance and operations to occur. Grade crossing safety management should be continuously reviewed and the Hazard Management Program applied to ensure that the highest level of safety is achieved on all routes, under all service conditions.

To assist in hazard elimination/mitigation, the U.S. Department of Transportation has developed a Highway/Rail Grade Crossing Action Plan. The Transit Cooperative Research Program (TCRP) has also published many documents that relate to highway-rail grade crossings including Integration of Light Rail Into City Streets (Report 17), Light Rail Service: Pedestrian and Vehicular Safety (Report 69) and Improving Pedestrian Safety and Motorist Safety Along Light Rail Alignments (Report 137). These publications provide valuable information to assist the Urban Rail Agency to work with others in proactive ways to determine highway-rail crossing hazards and ways to eliminate or mitigate such hazards. Identification extends to determining whether the crossing could be separated or eliminated, what signal protection
may be appropriate, whether traffic patterns should be changed to eliminate the potential for accidents, etc.

The Urban Rail Agency should use, when appropriate, enforcement strategies and outreach programs such as Operation Lifesaver and “4-E” type programs (Elimination, Engineering, Education and Enforcement) as part of their System Safety Program. Specific attention should be given to pedestrian activity at grade crossings, near or at stations, and the conditions created by multiple train operations in a corridor often referred to as the “second train” approach.

Trespassing and Intrusion

Trespassers are a major concern for all Urban rail Agencies. They comprise a high potential for accidents in terms of deaths and/or injuries to themselves and endanger passengers on trains during emergency braking to avoid them. Trespassers may be children playing in the wrong place, a person who may attempt suicide, hikers on a short cut, etc. The System Safety Program Plan should include identification and/or evaluation of the risk to the operation and/or passengers created by trespassers, as well as the risk of injury and death to trespassers. The Urban Rail Agency should have measures in their design criteria and plans and procedures in place to mitigate trespass incidents. Some effective measures include a review of real estate holdings to determine how best to keep non-authorized personnel out, fencing and other barriers, deployment of intrusion detection equipment and alarms, and providing public education that includes elements similar to the “4-E” Program.

Suicide Prevention

Most Urban Rail Agencies periodically experience passengers who attempt suicide by train. The most common behavior is jumping into the path of a train entering a station. Engineering the platform/train interface is a critical element to suicide prevention. Platform edge doors physically separate passengers from moving trains and prevent access to track level by unauthorized personnel. For systems without platform edge doors, other engineering solutions such as refuge areas beneath platforms, intrusion detection and surveillance systems can be considered.

The System Safety Program should include provisions for train operators to detect and report warning signs for passengers considering self-harm. The operations control center should develop procedures to slow trains entering stations following such a report and to dispatch supervisors and law enforcement. Consideration can be given to enhanced signage to dial free telephone calls to a local suicide hot line. In addition, the System Safety
Program should include an employee and family assistance program and a peer support group or similar counseling service for all employees affected by a suicide incident including train operators, emergency response personnel, maintenance of way staff involved in cleaning the scene and train maintenance personnel charged with cleaning the train.

*Joint Freight Operations*

Some Urban Rail Agencies operate over lines where side-by-side passenger and freight operations exist or where passenger and freight operations cross each other. Each of these arrangements, including pertinent policies, procedures, and relevant issues should be addressed or clearly referenced in the SSPP.

*Guideway Evacuation*

All Urban Rail Agencies should have plans, policies and procedures for emergency evacuation from trains and from the rail guideway. The Urban Rail Agency's Standard Operating Procedures should address means of evacuation for each type of guideway including elevated, underground, at grade in an exclusive alignment, and at grade in city streets. Access points for emergency responders, in some cases dedicated access, should be identified.
APPENDIX A - COMPARISON OF MANUAL FOR THE DEVELOPMENT OF URBAN RAIL SYSTEM SAFETY PROGRAM PLANS TO JUNE 2001 APTA MANUAL FOR THE DEVELOPMENT OF SYSTEM SAFETY PROGRAM PLANS

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<td>Identification of lines of authority used to manage safety issues</td>
<td>3.1.2, 3.2.2, 3.5.3</td>
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<td>Coordination with the oversight agency including timeframes for submission, revision and approval</td>
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<td>659.19(e)-1</td>
<td>Description of specific activities needed to implement system safety program including tasks performed by rail safety function, by position and management accountability, specified in matrices and/or narrative</td>
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<td>Safety related tasks performed by other rail transit departments by position and management accountability, specified in matrices and/or narrative</td>
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<td>Process used to implement hazard management program – hazard identification</td>
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<td>Hazard control and elimination</td>
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<td>Hazard tracking</td>
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<td>659.19(f)-5</td>
<td>Requirements for on-going reporting to the oversight agency relating to hazard management activities and status</td>
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<td>Process used to ensure that safety concerns are addressed in modifications to existing systems, vehicles and equipment which do not require formal safety certification but may have safety impacts</td>
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<td>Safety certification process for New Starts and subsequent major projects to extend, rehabilitate or modify an existing system, or to replace vehicles and equipment</td>
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<td>Process used to develop, implement and track corrective actions that address</td>
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<td>Process to evaluate emergency preparedness such as annual emergency field exercises</td>
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<td>After action reports and implementation of findings</td>
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<td>Revision and distribution of emergency response procedures</td>
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<td>Techniques to assess the implementation of operating and maintenance rules and procedures by employees, such as performance testing</td>
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<td>Techniques to assess the effectiveness of supervision relating to the implementation of operating and maintenance rules</td>
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<td>Inspection schedules and procedures</td>
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<td>How results are entered into the hazard management program</td>
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<td>659.19(o)</td>
<td>Description of maintenance audits and inspections including identification of affected facilities and equipment, maintenance cycles, documentation required and the process for integrating identified problems into the hazard management process</td>
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<td>Description of training and certification program for employees and contractors – categories of safety-related work requiring training and certification</td>
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<td>659.19(p)-2</td>
<td>Description of training and certification program for employees and contractors in safety-related positions</td>
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<td>659.19(p)-3</td>
<td>Process used to maintain and access employee and contractor training records</td>
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<td>659.19(p)-4</td>
<td>Process used to assess compliance with training and certification requirements</td>
<td>4.4.1, 4.4.2</td>
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<td>659.19(q)-1</td>
<td>Description of configuration management control process- authority to make configuration changes</td>
<td>6.1</td>
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<td>659.19(q)-2</td>
<td>Process for making changes</td>
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<tr>
<td>659.19(q)-3</td>
<td>Assurances necessary for formally notifying all involved departments</td>
<td>6.1</td>
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<tr>
<td>49 CFR 659 Section</td>
<td>Requirement</td>
<td>APTA Urban Rail Manual</td>
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<tr>
<td>659.19(r)-1</td>
<td>Description of safety program for employees and contractors that incorporates local, state and federal requirements – safety requirements that employees and contractors must follow when working on, or in close proximity to, rail agency property</td>
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<td>659.19(r)-2</td>
<td>Processes for ensuring the employees and contractors know and follow the requirements</td>
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<td>659.19(s)</td>
<td>Description of hazardous materials program including the process used to ensure knowledge of and compliance with program requirements</td>
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<td>659.19(t)</td>
<td>Description of the drug and alcohol program and the process used to ensure knowledge of and compliance with program requirements</td>
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<td>659.19(u)</td>
<td>Description of the measures, controls and assurances in place to ensure that safety principles, requirements and representatives are included in the procurement process</td>
<td>4.8</td>
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APPENDIX C - COMPARISON OF MAP-21 SAFETY REQUIREMENTS TO THE APTA URBAN RAIL SAFETY MANUAL

Table 3
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<thead>
<tr>
<th>MAP-21 Section</th>
<th>Requirement</th>
<th>Urban Rail Manual Section</th>
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<tr>
<td>5326 (b)</td>
<td>Transit Asset Management System (State of Good Repair)</td>
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<td>5326 (c)</td>
<td>Performance Measures and Targets</td>
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<td>5329 (c)</td>
<td>Public Transportation Safety Certification Training Program</td>
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<tr>
<td>5329 (d)</td>
<td>Public Transportation Agency Safety Plan</td>
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<tr>
<td>5329 (d) (1)(A)</td>
<td>Board of directors (or equivalent entity) approve the agency safety plan and any updates to the safety plan</td>
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<tr>
<td>5329 (d) (1)(B)</td>
<td>Methods for identifying and evaluating safety risks throughout all elements of the public transportation system of the recipient</td>
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<tr>
<td>5329 (d) (1)(C)</td>
<td>Strategies to minimize the exposure of the public, personnel and property to hazards and unsafe conditions</td>
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<td>5329 (d) (1)(D)</td>
<td>Process and timeline for conducting an annual review and update of the safety plan</td>
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<tr>
<td>5329 (d) (1)(F)</td>
<td>Assignment of an adequately trained safety officer who reports directly to the general manager, resident, or equivalent officer</td>
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<td>5329 (d) (1)(G)</td>
<td>Comprehensive staff training program for the operations personnel and personnel directly responsible for safety including completion of a safety training program and continuing safety education and training</td>
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<td>5329 (d) (2)</td>
<td>Interim Agency Safety Plan</td>
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<td>5329 (d) (3)</td>
<td>Public Transportation Agency Safety Plan Drafting and Certification</td>
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<td>State Safety Oversight Program</td>
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<td>5330</td>
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<td>5331</td>
<td>Alcohol and Controlled Substances Testing</td>
<td>4.6.2.1</td>
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APPENDIX D - SAMPLE MATRIX OF SAFETY RESPONSIBILITIES

Table 1
A safety task responsibility matrix showing interfaces among the system safety unit and other ST units for identified safety responsibilities and the key reports or actions required, is provided below. This matrix depicts the roles and responsibilities of both ST safety function and the other ST departments.

<table>
<thead>
<tr>
<th>TASK/ACTIVITY</th>
<th>State Safety Oversight</th>
<th>Contractors</th>
<th>Executive/Safety Management</th>
<th>Finance/Risk Management</th>
<th>QA/QC</th>
<th>Legal/ESD</th>
<th>Human Resources</th>
<th>Facilities</th>
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### TASK/ACTIVITY

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**Legend used above:**

- **P** Primary Task Responsibility. The identified participant(s) is (are) responsible for the preparation of the specified documentation.
- **S** Secondary or Support Responsibility. The identified participant(s) is (are) to provide the necessary support to accomplish and document the task.
- **R** Review/Comment Responsibility. The identified participant(s) may review and provide comment on the task or requirement.
- **A** Approval Responsibility. The identified participant is to review, comment and subsequently approve the task or requirement.
APPENDIX E - ENVIRONMENTAL MANAGEMENT PROGRAMS
Urban Rail Agencies are required to have a program in place for the safe use, transport, storage and disposal of chemicals and substances. The Urban Rail Agency’s SSPP should address a program to manage hazardous materials.

Most Urban Rail Agencies come under the jurisdiction of either state or federal Environmental Protection agencies. It is incumbent on each Urban Rail Agency to determine which regulations it should follow and then ensure that all organizational elements are aware of these requirements and how they should be followed. Emphasis is placed on the issues of handling and storage of potentially hazardous materials safely, with the end result of protecting people and the work environment. Examples of areas to be addressed include storage vessel construction, alarms and signage, emergency response (i.e. emergency medical response, preparedness drills), personal protective equipment and installations (i.e. respirators, gloves, shower/eyewash stations, etc.), inventory and compatibility issues, waste collection and handling, and established work practices on site, and managing community relations off-site.

The proper handling of hazardous waste, including use of proper containers, marking, labeling, storage spill containment and response, transportation for disposal, and accurate recordkeeping is all highly regulated by federal, state and local laws. The SSPP should establish authority and responsibility for meeting these requirements and provide proactive program guidance in managing and controlling the attendant hazards.

When control procedures and equipment fail and hazardous substances are released, a completely different response is required. Emergency response should be planned for all contingencies with all participants’ roles and responsibilities outlined. The details of the emergency response should be contained in the Urban Rail Agency’s Emergency Preparedness Plan (see section 4.5).