Safety Management Systems Overview

APTA System Safety Seminar
June 18, 2016
FTA Safety and MAP-21

- FTA Legislation
  - State Safety Oversight Final Rule 49 CFR -674
  - National Public Transportation Safety Plan 49 USC 5329 (b)
  - Public Transportation Agency Safety Plan 49 CFR -673
  - Public Transportation Safety Certification Training Program 49 CFR- 672

- FTA Safety Authority
  - Issue directives
  - Conduct safety inspections, audits and investigations
  - Enforcement authority (grant funds spent to correct safety deficiencies)
  - Safety Management System (SMS) approach to safety
MAP-21 Safety Requirements for Public Transportation Agencies

- Public Transportation Agency Safety Plan (implement National Safety Plan Requirements)
  - Board of Directors approve Plan
  - Accountable Executive
  - SMS approach to safety
  - Performance targets
    - Safety performance criteria
    - State of good repair standards
  - Strategies for identifying risks and minimizing exposure to hazards
  - Adequately trained Safety Officer reports to General Manager or equivalent
- Safety Training Program
  - Operations personnel
  - Personnel responsible for safety
APTA Safety Management Program

• Builds a bridge between APTA System Safety Program Plan (SSPP) to APTA Safety Management System (SMS)

• Program development
  • Manual and Guidelines developed over a five year period and revisions reviewed by the APTA Rail Safety Committee
  • APTA Rail Safety Committee adopted both documents in June, 2015
  • APTA Mid Year Safety Committees voted for SMS Manual with Guidelines for each mode (rail transit, bus, commuter and intercity rail)
  • APTA SMS Manual was presented in a series of four APTA Webinars
What is SMS?

• APTA definition of SMS: organized set of programs, principles, processes and procedures for allocation of resources to achieve the condition where safety risks are managed to acceptable levels.

• FTA definition of SMS: formal, top-down, organization-wide, data-driven approach to managing safety risk and assuring the effectiveness of safety mitigations. It includes systematic policies, procedures, and practices for the management of safety risk.
SMS Answers These Questions

SMS provides processes to assist the transit agency in answering the following:

1. What is likely to be the cause of the transit agency’s next accident?
2. How does the transit agency know the likely cause of the next incident?
3. What is the transit agency doing to mitigate the risk?
4. Is the strategy or action working?
5. How do you know it is working?
Why SMS?

- Transit agency can examine how organizational factors contribute to incidents, accidents and near misses.
- Organizational factors show how the transit agency:
  - Allocates its resources
  - Defines and establishes operational procedures
  - Supervises front line personnel
  - Selects and trains staff
  - Monitors service delivery operations
  - Resolves human performance issues
4 Components (Pillars) of SMS

- **Safety Management Policy** – a written document that serves as the rules of the game

- **Safety Risk Management** - a process to identify the bad things that could happen and develop strategies to reduce the likelihood of the event occurring, or the severity of the outcome should it occur.

- **Safety Assurance** – activities to verify the effectiveness of safety risk mitigations, and the fashion in which safety functions or activities are being carried out.

- **Safety Promotion** - emphasizes communication and training to support the SMS
Safety Management Policy
Pillar 1 Components

- Safety management policy statement
- Safety accountabilities and responsibilities
- Integration with public safety and emergency management
- SMS documentation and records
Safety Management Policy Statement

- Signed by highest agency executive (Accountable Executive (CEO/GM or Board of Directors/oversight entity)
- Statement to provide resources for safety during service delivery
- Commits the agency to a safety reporting program to show that receiving safety information from employees is critical to success of the SMS
- Defines conditions under which exemptions from disciplinary actions would be applicable
- Defines unacceptable operational behaviors
- Is communicated with explicit support from executive management throughout the agency
Safety Accountabilities and Responsibilities

- Accountable Executive is identified
- Authorities defined for executive and senior managers
- SMS Manager: subject matter expert for implementation and day to day operation of the SMS
SMS Accountabilities and Responsibilities (cont’d)

• Ensure accountability for SMS performance is at the highest level of the organization
• Implement SMS to meet agency safety performance objectives
• Establish committee structure necessary for size of agency to ensure safety information moves up, down and across the agency
• Communicate roles and responsibilities to all relevant individuals
Executive and Senior Managers

- Actively support and promote the SMS
- Ensure that they and their staff comply with SMS processes and procedures
- Assist in ensuring that resources are available to achieve SMS outcomes
- Continually monitor their area of SMS responsibility
SMS Manager

• Directs collection and analysis of safety information
• Manages hazard identification and safety risk activities
• Monitors safety risk mitigations
• Provides periodic reports on safety performance
• Maintains safety management documentation
• Plans and organizes safety training
Integration with Public Safety and Emergency Management

• Identify and describe coordination with external organizations and internal departments for dealing with emergencies and abnormal operations and return to normal operations

• Includes index of plans and procedures that support the agency safety and emergency management activities
SMS Documentation and Records

- Activities for documentation of SMS implementation
- Tools needed for day to day SMS operations
- Management of new or revised safety requirements (regulatory or otherwise)
- SMS documentation and records must be readily available to those with accountabilities for SMS performance or responsibilities for SMS implementation or operations
Safety Culture

• Components of safety culture
  • Safety recognized as highest organizational priority with management and employee commitment
  • Training provided so employees know how to do their job safely
  • Open, frequent and effective communication about safety
  • Adequate financial and human resources dedicated to employee safety and health
  • Management and employees will interrupt schedules and service for safety reasons
Safety Culture (cont’d)

- Competence in organization to draw appropriate conclusions from safety information
- Organization takes action visible to employees on all reported safety issues
- Organization collects and analyzes all relevant data and disseminates safety information
- Significant employee involvement in continuous improvement of safety policies and rules
- Safety culture ingrained in organization; no management or union leadership transition changes the commitment
- Accidents reviewed looking at future prevention rather than blame
Safety Culture (cont’d)

- High level of trust between management and frontline staff
- Employees encouraged to report near misses and other safety events without fear of blame or retribution
- The union is continually involved in the safety process as a full partner including joint safety data collection, analysis and problem solving
- If no union, shared ownership with and responsibility by employees for safety data collection, analysis and problem solving
- Employees are rewarded for reinforcing safety at work
Pillar 2- Safety Risk Management

• Transit agencies deal with many types of risks (operational, financial, legal, social, technical, cultural, political, safety). This presentation deals with safety risk
  • A process to identify the bad things that could happen and/or develop strategies to reduce the likelihood of the event occurring, or the severity of the outcome should it occur
  • A process to assess system design and verify that the system adequately controls risk
  • A formal risk management process that describes a system, assesses hazards, analyzes those hazards to evaluate the risk, and establishes controls to manage those risks
Safety Risk Management Components

- Hazard Identification and Analysis
- Safety Risk Evaluation
Hazard Identification and Analysis

- Employee safety reporting program
- Observations of operations
- Inspections
- Internal safety audits
- Internal safety investigations
- Accident reports
- Configuration management
- Compliance programs
- Committee reviews
- Industry data
- Governmental sources (FTA, NTSB, SSOA)
- Customer and public feedback or complaints
Hazard Identification Tools

• Formal and informal/quantitative and qualitative processes for identifying hazards all have value
• Accident/incident investigations
• Hazard/incident reporting systems to identify latent unsafe conditions
• Safety surveys to elicit feedback from front-line personnel about areas of concern and unsatisfactory conditions that may have accident potential
• Operational inspections or audits of all aspects of operations to identify vulnerable areas before accidents or incidents confirm that a problem exists
Hazard Identification- Risk Factors

- **Design Factors**: vehicles, tracks, equipment
- **Operating Procedures and Practices**: documentation, checklists
- **Communications**: medium, terminology and language
- **Personnel factors**: agency policies for recruitment, training and renumeration
- **Organizational Factors**: corporate safety culture, resource allocation, operating procedures
- **Physical Defenses**: adequate detection and warning systems, traffic control devices, signaling, barriers
- **Regulatory and Oversight Factors**: application and enforcement of regulations; certification of equipment, personnel and procedures; and adequacy of safety audits
Safety Risk Evaluation and Mitigation

- Safety risk is expressed and measured by predicted probability and severity of a hazard’s potential consequences
- Safety risk evaluation considers existing mitigations to determine whether further measures are needed to mitigate the potential consequences of the hazards
- Safety risk mitigation
  - Actions taken to reduce the likelihood and/or severity of the potential hazard
  - Enables a transit agency to actively manage safety risk aligned with safety performance targets
  - Consists of initial, ongoing and revised mitigations
- Risk register
  - Records identified risks
  - Records severity
  - Actions to be taken to mitigate the risk
Safety Risk Assessment

- Likelihood of the hazard precipitating an unsafe event
- Severity of the consequences of an unsafe event if the hazard is allowed to remain
- Exposure to the hazard (number of passenger-miles per day; number of pedestrians using a grade crossing during the peak-hour; number of vehicles per hour; characteristics of transit users). Probability of adverse consequence is greater with increased exposure to unsafe conditions
Trade-Offs of Hazard Management

- Probability of occurrence
- Severity
- Measures
  - Design to eliminate the hazard
  - Add safety/security devices
  - Add warning devices
  - Institute special procedures

Cost Considerations
<table>
<thead>
<tr>
<th>MIL-STD-882E</th>
<th>Safety Risk Assessment Matrix</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Severity</strong></td>
<td><strong>Catastrophic</strong></td>
</tr>
<tr>
<td><strong>Probability</strong></td>
<td>1</td>
</tr>
<tr>
<td>A - Frequent</td>
<td>1A</td>
</tr>
<tr>
<td>B - Probable</td>
<td>1B</td>
</tr>
<tr>
<td>C - Occasional</td>
<td>1C</td>
</tr>
<tr>
<td>D - Remote</td>
<td>1D</td>
</tr>
<tr>
<td>E - Improbable</td>
<td>1E</td>
</tr>
<tr>
<td>F - Eliminated</td>
<td></td>
</tr>
</tbody>
</table>

1A, 1B, 1C, 2A, 2B | High | Unacceptable
1D, 2C, 3A, 3B | Serious | Undesirable with management decision required
1E, 2D, 2E, 3C, 3D, 3E, 4A, 4B | Medium | Acceptable with review by management
4C, 4D, 4E | Low | Acceptable without review
## Hazard Frequency Categories

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Level</th>
<th>Qualitative Definition</th>
<th>Quantitative Definition</th>
<th>Probability of Occurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequent</td>
<td>A</td>
<td>Likely to occur frequently in an individual item or the system; may be continuously experienced in fleet</td>
<td>MTTHE &lt; 2 mos</td>
<td>P &gt; 10-1</td>
</tr>
<tr>
<td>Probably</td>
<td>B</td>
<td>Likely to occur several times in the life of an individual item or the system; will occur frequently in fleet</td>
<td>2 mos &lt; MTTHE &lt; 1 yr</td>
<td>10-1 &gt; p &gt; 10-2</td>
</tr>
<tr>
<td>Occasional</td>
<td>C</td>
<td>Likely to occur sometime in the life of an individual item or the system; will occur several times in fleet</td>
<td>1 yr &lt; MTTHE &lt; 10 yrs</td>
<td>10-2 &gt; p &gt; 10-3</td>
</tr>
<tr>
<td>Remote</td>
<td>D</td>
<td>Unlikely but possible to occur in the life of an individual item or the system; unlikely but can be expected to occur in fleet</td>
<td>10 yrs &lt; MTTHE &lt; 100 yrs</td>
<td>10-3 &gt; p &gt; 10-6</td>
</tr>
<tr>
<td>Highly Unlikely</td>
<td>E</td>
<td>So unlikely that it can be assumed occurrence may not be experienced in the life of an individual item or the system;</td>
<td>MTTHE &gt; 100 yrs</td>
<td>10-6 &gt; p</td>
</tr>
</tbody>
</table>
Hazard Identification and Risk Management Checklist

• Formal mechanisms for systematic identification of hazards (such as safety assessments and safety audits) are in place
• An occurrence reporting system is in effect
• Management has provided adequate resources to support hazard identification programs including staff training
• Competent personnel administer the hazard identification program
• Management fosters a non-punitive and just environment—employees involved in reported incidents are aware that they will not be penalized for normal errors
Hazard Identification and Risk Management Checklist

- Hazard identification data are systematically analyzed and saved
- Criteria are established for assessing identified safety risks
- Risks are analyzed and ranked by competent personnel
- Viable risk control measures are evaluated
- Management takes action to mitigate the risks
- Actions taken to eliminate or mitigate identified hazards are communicated to staff
- Employees are trained on safety risk techniques
- Systems are in place to report near misses/close calls, anomalies and weak signals
- Procedures are in place to confirm that the actions taken are working as intended
- Significant safety concerns potentially affecting other transit agencies are shared across the industry
Pillar 3- Safety Assurance

• Processes used to ensure safety risk controls developed under the safety risk management process achieve their intended objectives throughout the life cycle of a system. These processes may reveal hazards not previously identified and identify or assess the need for new risk controls, as well as the need to eliminate or modify existing controls

• Evaluates whether the transit agency implements appropriate and effective mitigations

• Continuous process that monitors the safety performance of the agency
Safety Assurance Components

- Safety Performance Monitoring and Measurement
- Management of Change
- Continuous Improvement
Subcomponent - Safety Performance Monitoring and Measurement

• Focuses on monitoring the safety performance of the transit agency through routine monitoring of operations and maintenance activities

• Senior management needs this data to evaluate whether:
  • Implemented safety risk mitigations are appropriate and effective
  • How well the agency’s safety performance matches established safety objectives and safety performance targets
Monitoring Performance and Evaluating Results

- Agree on outcomes and activities to monitor
- Select key metrics
- Identify data needs
- Pilot test and collect baseline data
- Set targets
- Monitor performance and evaluate results
- Report findings
- Integrate findings into agency decision making
Performance Targets

• Acceptable/desired level of a metric to be accomplished by a future date or over a period of elapsed time
  • Reduce the rate of fatalities to 0.25 per 100 million passenger-miles by 2017
• Measurable, acceptable to stakeholders, consistent with targets set by state and federal organizations
Effective Safety Performance Monitoring System

- Stakeholder involvement and acceptance
- Focus on agency goals and activities
- Clarity and precision
- Credibility and robustness
- Variety of measures
- Number of measures
- Hierarchy of measures
- Forward looking measures
- Integration into decision-making
- Timely reporting
- In context
- Realism of goals and targets
Safety Performance Monitoring Activities

• Monitor employee safety reporting program
• Monitor service delivery activities (including field observations)
  • Safety data acquisition and analysis
  • Accident/incident reporting and investigation
  • Infrastructure maintenance and inspection
  • Vehicle maintenance, inspection and repair
  • Passenger operational environment
Safety Performance Monitoring Activities

- Monitor operational and maintenance data
- Conduct safety surveys
- Conduct safety audits, studies, reviews and inspections
- Conduct safety investigations
- Evaluate data and information from external agencies or peers
Leading Indicators

- Input based measures that have an indirect relationship to an end product or goal and can influence lagging indicators. Measure and track performance before an incident happens
  - Running red signals
  - Improper berthing door
  - Railway worker protection violation
  - Use of cell phones while operating vehicles or machinery
  - Complaints per 100,000 passengers
  - Workplace inspections
  - Audits
  - Safety training
  - Near misses
Lagging Indicators

• Outcome-based measures that are directly related to an end product or goal
• Measure performance against prior goals
• Examples
  • Fatal accidents per specified time period
  • Number of preventable accidents per specified time period
  • Employee work days lost to injuries per specified time period
  • Workers compensation payments per specified time period
Safety Performance Measures – Passenger Safety

- Fatalities per time period
- Injuries per time period
- Fatal accidents per time period
- Injury accidents per time period
- Property damage accidents per time period
Safety Performance Measures – Workplace Safety

- Work day lost to injuries by type
- Work related fatalities
- Workers compensation payments
Safety Performance Measures – Accident Potential

• Percent positive drug/alcohol tests
• Number rail station overruns
• Number of red signal violations
• Number of traffic tickets issued to bus operators
Safety Performance Measures – Safety Culture

- Number of safety improvement ideas submitted by employees per quarter
- Number of employees attending weekly safety meetings
- Number of close calls reported per month
Safety Performance Measures – Other

- Number vehicle defects reported by operators
- Number of infrastructure defects reported by operators
- Number of fires by location
- Customer satisfaction surveys
- Percent preventive maintenance inspections competed within 10% of scheduled mileage
- Percent employees scoring greater than 85% on proficiency tests
Subcomponent Management of Change

- Configuration Management - process that ensures that all property, equipment, system design elements are documented as to configuration, both accurately and completely. Any changes to individual subsystems or fleet/inventory wide changes should be recorded on as-built drawings, addressed in training courses, maintenance guides and procedures
  - Standards/Design Control
  - System Modification - New Processes/Equipment
  - Document Control
Safety and Security Certification

• Series of processes that collectively verify the safety and readiness of a project for public use
  • Identification and assessment of hazards/vulnerabilities along with resolutions
  • Codes, guidelines and standards related to safety and security are included in design criteria
  • Drawings and specifications are in conformance with design criteria
  • Facilities, systems, equipment are designed, constructed, built, inspected and tested in accordance with specifications, codes, standards and criteria
  • Tests, plan and rulebooks are developed for operations
  • Personnel are trained to handle normal and emergency situations
  • Emergency response personnel are familiar with the transit system and emergency procedures
Subcomponent
Continuous Improvement

- Agree on outcomes critical to safety performance
- Select metrics for monitoring outcomes
- Gather baseline data on current conditions
- Set specific targets and dates for reaching these targets
- Collect data on regular basis to assess whether the targets are being met
- Analyze performance data and report results
- Integrate performance results in decision-making
Continuous Improvement - Safety Assessment

• Internal Safety Management Reviews
  • Follow formal written process
  • Determine compliance with safety policies, rules, regulations, codes, procedures, assigned safety activities and requirements

• External Safety Management Reviews
  • Compliance to policies, plans, procedures, milestones or other requirements
  • Performance reviews focus on the product, process and system to determine how well they meet the customer’s needs and identify areas for improvement
  • Peer Reviews to assess all aspects of transit operations and functions
Safety Culture Assessment

- Employee surveys
- Written questionnaires
- Face to face interviews
- Focus group interviews
- Ability of agency to focus on long term performance
- How the agency handles conflicts
- How the agency views errors and mistakes
- How the organization focuses on improving safety defenses instead of assigning blame
- Agency’s proactive stance toward safety
Safety Promotion

• Provides visibility of executive management commitment to safety
• Fosters continuous improvement and reliability of safety performance by increasing safety awareness through safety communication and training
  • Ensures employees at all levels perform their duties safely and consistent with corporate goals, division/department policies, procedures, rules and regulations
  • Communicates lessons learned and key safety information
  • Makes employees aware of safety priorities and safety concerns at agency levels and how they relate to their own duties and responsibilities
Safety Promotion Components

- Robust Lines of Effective Safety Communication
- Competencies and Training
Component
Safety Communication

• Two way feedback loop between frontline employees and management about safety information
• Safety-related information must be actively and routinely communicated; should focus on raising awareness of hazards and risk reduction
• Regular open discussion of safety concerns encourages employees to report concerns; demonstrates management commitment to both the employees and the agency’s safety performance objectives
Workplace Safety Program

- Industrial/Occupational Safety Program
- Fitness for Duty Program
  - Drug and Alcohol Program
  - Fatigue Management Program
  - Human Factors
    - Cognitive Distraction
    - Attentional Error
  - Medical Monitoring
  - Critical Incident Debriefing-Post Traumatic Stress
- Track Access and Roadway Worker Protection
Contractor Safety Requirements

- Contracting for Services
  - Contractor Safety Plan
- Contracting for Facilities, Equipment and Materials
  - Contractor Safety Plan
  - Maintenance programs consistent with manufacturer requirements and/or organizational industry standards
- Construction Management
  - Contractor Safety Plan
  - Safety and security certification
Materials Management

- Procurement of materials and services and receipt, control and distribution of materials – executed in accordance with laws and regulations, quality standards
  - Materials meet specifications and are properly labeled and packaged
- Procured items evaluated for health, safety and environmental compliance with regulatory requirements and industry standards
- Perform formal quality assurance on safety critical items
Public Safety Programs

• Passenger and public safety outreach
• Short term programs targeted to specific issues, locations or communities
• Long-term, ongoing programs to heighten awareness of safety issues
  • Platform gap
  • Escalator safety
  • Trespass
  • Door closing
  • Grade crossing safety
Component Competencies and Training

- Training is needed for all employees with respect to their role and responsibilities as they relate to agency safety performance.
- Frontline employee safety management training should provide for the development of safety reporting competencies (formal training on what to report and what not to report) and procedures established for reporting.
- Passenger behaviors at platforms and onboard.
- At safety management level, formal training should develop safety management competencies for supervision:
  - How to analyze safety data.
  - How to extract information from safety data.
  - How to turn safety information into safety intelligence for management decision making and resource allocation.
Rules and Procedures Review

- Process for development of rules and procedures
  - Uniform, coordinated development and implementation
  - Techniques to assess the implementation of operating rules and procedures by employees
  - Techniques to assess the effectiveness of supervision relating to the implementation of operating and maintenance rules
  - How results are incorporated into the Safety Risk Management Program
- Rules and procedures are controlled documents
Training and Certification Program

• For employees and contractors
  • Categories of safety critical safety-related work requiring training and certification
  • Identifies training that is subject to regular safety related inspection and testing
  • A description of the training and certification program for employees and contractors in safety related positions
  • Process used to maintain and access employee and contractor training records
  • Process used to assess compliance with training and certification requirements
• For emergency services personnel
SMS Implementation Timeline

- Phase 1 – (1 year)
  - Identify accountable executive
  - Establish SMS implementation team
  - Define scope of SMS
  - Analyze agency’s existing safety processes and compare to SMS requirements
  - Develop an SMS Implementation Plan
  - Establish key office/person responsible for SMS administration and maintenance
  - Establish SMS training program
  - Initiate SMS communication channels
SMS Implementation Timeline (cont’d)

• Phase 2 (1 year)
  • Establish safety policy and objectives
  • Define safety management responsibilities and accountabilities
  • Establish SMS coordination committee
  • Establish Emergency Response Plan
  • Initiate development of SMS documentation
SMS Implementation Timeline (cont’d)

• Phase 3 (1 year)
  • Establish voluntary hazards reporting procedure
  • Establish safety risk management procedure
  • Establish occurrence reporting and investigation
  • Establish safety data collection and processing system
  • Develop high consequence safety performance indicators, identify accident precursors, targets and alert settings
  • Establish change management procedure that includes safety risk assessment
  • Establish internal review program
  • Establish external review program
SMS Implementation Timeline
(cont’d)

• Phase 4 (1 year)
  • Enhance existing disciplinary procedure with consideration of unintentional errors/mistakes from deliberate/gross violations
  • Integrate hazards identification from occurrence investigation reports with the voluntary hazard reporting procedure
  • Integrate hazard identification and safety risk management procedures with contractors or customers where applicable
  • Develop lower consequence safety performance indicators and associated targets and alert settings
SMS Implementation Timeline (cont’d)

- Phase 4 (1 year)
  - Establish or integrate SMS information into existing internal and external review programs
  - Establish operational and safety culture review/survey programs where appropriate
  - Ensure SMS training program for all relevant personnel is ongoing and relevant
  - Promote safety information sharing and exchange internally and externally