



APTA STANDARDS DEVELOPMENT PROGRAM

STANDARD

American Public Transportation Association
1300 I Street, NW, Suite 1200 East, Washington, DC 20006

APTA-RT-OP-S-005-03 Rev 3

First Revision: July 26, 2004

Second Revision: March 31, 2012

Third Revision: July 6, 2018

Operating Practices Working Group

Operations Control Centers

Abstract: This standard provides guidance for the development and operation of rail transit systems (RTSs) operations control centers (OCCs).

Keywords: central control, controller, dispatcher, operations control centers (OCC)

Summary: The OCC serves as a command and control facility usually associated with rail fixed guideway (RFG) systems. The OCC serves as the main location from which all aspects of the system are controlled and operational decisions are made regarding normal and non-normal operations. The facility also serves as the primary, but not necessarily exclusive, point of coordination for all operational decisions affecting rail service. This coordination usually includes both internal disciplines as well as external elements involving emergency response agencies.

Scope and purpose: This document addresses the operating standards and practice requirements in two general categories. Primary elements will involve the general design/function requirements of an OCC and establishing the overall level of authority that is essential in an OCC facility vis-à-vis the total system operation. This includes functional requirements of personnel within the facility and their applicable roles relating to field operations.

This document represents a common viewpoint of those parties concerned with its provisions, namely operating/planning agencies, manufacturers, consultants, engineers and general interest groups. The application of any standards, recommended practices or guidelines contained herein is voluntary. In some cases, federal and/or state regulations govern portions of a transit system's operations. In those cases, the government regulations take precedence over this standard. The North American Transit Services Association (NATSA) and its parent organization APTA recognize that for certain applications, the standards or practices, as implemented by individual agencies, may be either more or less restrictive than those given in this document.

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Introduction

This Introduction is no part of APTA RT-OP-S-005 Rev 3 “*Standard for Operations Control Centers.*”

This Standard for Operations Control Centers represents a common viewpoint of those parties concerned with its provisions, namely, transit operating/planning agencies, manufacturers, consultants, engineers and general interest groups. The application of any standards or recommended practices contained herein is voluntary. In some cases, Federal and/or State regulations govern portions of a Rail Transit System’s operations. In those cases, the government regulations take precedence over this standard. APTA recognizes that for certain applications, the standards or practices, as implemented by individual rail transit agencies, may be either more or less restrictive than those given in this document.

Note on alternate practices

Individual rail transit systems may modify the practices in this standard to accommodate their specific equipment and mode of operation. APTA recognizes that some rail transit systems may have unique operating environments that make strict compliance with every provision of this standard impossible. As a result, certain rail transit systems may need to implement the standards and practices herein in ways that are more or less restrictive than this document prescribes. A rail transit system may develop alternates to APTA standards so long as the alternates are based on a safe operating history and are described and documented in the system’s safety program plan (or another document that is referenced in the system safety program plan).

Documentation of alternate practices shall:

- identify the specific APTA rail transit safety standard requirements that cannot be met;
- state why each of these requirements cannot be met;
- describe the alternate methods used; and
- describe and substantiate how the alternate methods do not compromise safety and provide a level of safety equivalent to the practices in the APTA safety standard (operating histories or hazard analysis findings may be used to substantiate this claim).

Operations Control Centers

1. General requirements

The functional aspects of the operations control center (OCC) vary greatly among rail transit systems (RTS) due to mode difference (streetcar, light rail, or heavy rail rapid transit), system size, level of technology associated with the operation, and system specific functional requirements. In most modern light rail systems incorporating various levels of technology, OCC facilities adopt a minimalist approach in terms of staffing and technology applied, while larger, or more technologically advanced systems usually apply a greater degree of functionality (staffing and technology) within the OCC.

The RTS shall establish OCC hours of operation based on the RTS's operating and maintenance requirements. Most larger systems may require the OCC to be operational 24/7 even though their actual revenue service hours may be less. This would enable major maintenance activities to be performed during non-revenue hours and can best be controlled from the OCC. Some smaller RTSs may be able to operate their OCC on less than a 24/7 basis.

Some RTSs have developed integrated OCCs where multiple modes of transportation are housed in a single location or a single room. The concept of the integrated OCC is to centralize decision-making for the different functions into a location for a more coordinated management of the transportation network.

2. Operational authority

The operational authority of the OCC shall be clearly defined in applicable RTS documents, these documents may include the rulebook, standard and emergency operating procedures, OCC manuals, or other documents as defined by the RTS. The RTS shall designate that control center personnel, usually controllers or dispatchers, are the responsible individual(s) having authority for mainline train movement. Decisions affecting such movements may be made in conjunction with designated field personnel. Additionally, control center staff may also exercise authority over any RTS remotely monitored and controlled support systems, such as ventilation systems, water pumps and valves, emergency telephone systems, etc.

This is effective for overall system safety, as it establishes the primary focus to control system operations in a manner that allows this functional authority to be rigidly controlled and not allow field intervention in the decision-making process, which might compromise safety.

3. Selection and training of personnel

Selection and training of personnel assigned to the OCC varies greatly and depends largely upon the functional responsibility the individual is assigned to and their level of authority over field operational elements. Since the authority and responsibility of the positions varies greatly, from having full authority for field operations and personnel to minimal responsibility (e.g., clerical or passenger information interface), so does the level of effort applied to selection and training within specific categories of employment or assignment. Guidelines for selection of personnel are provided in the annex to this document.

3.1 Training of personnel

The core elements of any training program shall require full exposure to applicable rules, regulations, procedures, and applicable line-specific physical characteristics. This is best achieved through both classroom

orientations/lectures, field experience and simulated scenarios complemented by on-the-job training (OJT). As the trainee begins to become more familiar with the duties and responsibilities of the position, he or she can be provided with increasingly more freedom to perform required functions under the direction of the trainer or designated employee. The RTS shall require the trainee to satisfactorily demonstrate each critical task to the trainer or designated employee.

The RTS shall formally document all training program requirements and materials. Each trainee shall be provided a complete copy of the training materials in either hard copy or an electronic version for reference. The RTS shall maintain formal records of testing and student progression. All training material and records shall be available for review by both internal and external oversight agencies. The training program shall, at a minimum, include the following elements:

- A course syllabus outlining the total requirements of the training program, inclusive of facility and physical characteristics familiarization, classroom training, testing requirements and on-the-job training.
- Introduction to the philosophy, goals and objectives of the OCC facility.
- Field training or review to ensure working knowledge of the functional elements of the RTS, such as train operations, station operations, yard/tower operations, line supervision, police/security requirements, wayside facilities, etc., including, but not limited to the following:
 - a) workstation operations
 - b) standard operating procedures (SOPs) and administrative orders
 - c) control and support facilities, such as power distribution, train control, communication, supervisory control and data acquisition (SCADA) systems, etc.
 - d) safety-related practices and functions, inclusive of the agency emergency plan.
 - e) operating strategies
 - f) radio protocol and phraseology
 - g) incident management
 - h) headway adherence
 - i) restoration of service techniques
 - j) standardized on-the-job training plan for each critical function, with associated evaluations and documentation, within the control center facility
 - k) roadway worker protection and track access

Upon satisfactory completion of all required training, the employee will receive formal certification or qualification in the appropriate category. Certification may include an oral examination with senior staff and shall include a written comprehension exam and practical examination.

3.2 Recertification/requalification of personnel

Given the dynamic nature of operating rail transit systems, where methods and procedures change frequently, personnel assigned to the control center environment must receive retraining or recertification. The RTS shall determine and document the required frequency of recertification/requalification of safety-sensitive personnel, not to exceed a two-year minimum. The RTS shall determine the methods and approach of its evaluation activities. The purpose and intent of recertification/ requalification is to ensure that OCC personnel are current with regard to newly developed standards, procedures and rules as they apply to the operating system. Further, as requirements and standards are implemented or modified for the OCC, it is essential to determine the extent to which assigned personnel are conversant with such changes. The recertification/requalification shall include, but not be limited to, presentation material and comprehension exams. When recertification/ requalification is achieved, the RTS shall include appropriate documentation in the employee's personnel record or training file.

3.3 Specialized/familiarization training

The RTS shall define and incorporate appropriate specialized/familiarization training into its OCC training curriculum. This category of training is usually provided to expose control center personnel to essential elements that enhance their job-related skills. Such training may be provided off-site or in a classroom seminar environment. Training may be associated with rail operations, management principles, physical characteristics, and/or new system technology, such as computer hardware or software. The intent is to provide the employee with a selected training module in an atmosphere that allows concentration and focus without normal control center distractions.

3.4 Scenario-specific training

The RTS shall develop training that incorporates the use of scenarios that replicate real-world situations. If the RTS has an OCC simulator, the RTS shall incorporate use of the simulator into the scenario based training. The RTS shall establish protocols for how scenario-based training is administered and evaluated. The RTS shall determine the types of scenarios used based on the operating conditions and environment of its own system.

4. Fitness for duty

The RTS shall establish requirements specifying the RTS's definition and requirements of OCC personnel fitness for duty.

APTA provides guidance for fitness for duty and fatigue management of rail transit personnel in the following standards:

- **APTA RT-OP-S-018-11** "*Fitness for Duty Program Requirements*"
- **APTA RT-OP-S-023-17** "*Fatigue Management Program Requirements*"

4.1 FTA drug and alcohol testing requirements

Personnel designated as "safety sensitive" shall comply with all required alcohol and drug-testing requirements as mandated by the Federal Transit Administration (FTA) and other regulatory authorities. This includes pre-employment, recertification, special circumstances, post-accident and random testing. State or local authorities may mandate additional testing requirements. Reference 49 CFR Parts 655 and 40 for all testing procedures and requirements.

5. Electronic device distraction policy

APTA provides guidance for personal electronic device distraction policies in APTA RT-OP-S-017-11

6. Hours of service of OCC personnel

All safety-sensitive OCC positions may be subject to FTA, Federal Railroad Administration (FRA) or state and other regulatory oversight standards. Therefore, it is essential that all applicable standards related to hours of service be reviewed, and if none found, the RTS shall develop and adopt relevant standards that determine minimum time between work shifts and maximum on-duty assignment time.

Consideration should be given to extraordinary conditions that may require the extension of work assignments beyond normally established limits. The OCC manager or designee shall, based on adverse operating,

emergency conditions or situations beyond the control of the RTS, be empowered to declare an emergency, suspending any or all the hours of service standards. This action shall be clearly communicated to all affected parties describing the reasons for the declaration, job classes affected, and the expected duration of the order. The RTS shall establish a protocol for recording and retaining information related to any decisions to assign work that exceeds the hours of service limitations established by the RTS. Return to normal operation shall occur as quickly as the situation allows.

7. OCC procedures

The RTS shall develop procedures to address normal, special and emergency operations, which may include, but not be limited to, the situations listed in Section A.8 of the annex. See also Section A. 8.1, 8.2 and 8.3 for additional information on procedures.

The RTS shall periodically review and update, as appropriate, the OCC procedures per a timeline established by the RTS.

The RTS shall evaluate the changes required for procedures when upgrading OCC technologies and/or equipment.

8. OCC access and monitoring

For the purposes of safety and security, the RTS shall develop a process for controlling and monitoring authorized access to the OCC.

The RTS shall consider incorporating the use of audio or video recording devices within the OCC to provide recorded information on work practices not captured on recorded radio or phone lines.

9. OCC design considerations

In the development, design and location of an OCC, the RTS shall consider the following:

- Public relations/social media desk
- Maintenance functions desk (e.g. track/guideway; communications; power; vehicles; etc.)
- Ergonomic considerations in functional design / human systems interface
- Backup OCC
- Emergency procedures and continuity of operations (primary and backup facilities) for OCC
- Dedicated and secure space for local and regional emergency responders
- Use/integration of legacy and new equipment
- Technical support personnel
- Configuration and sustainability management (e.g. wires, workstations, software)

When considering these criteria, the RTS shall involve the inputs of rail operations personnel and subject matter experts (SMEs).

10. Determination of adequate OCC staffing levels

The RTS shall evaluate all factors that affect the adequate level of staffing in the OCC to ensure safe, efficient, and sustainable staffing levels that allows safe management of the system. At a minimum, factors to consider shall include:

- Hours of service
- Fitness for duty
- Attrition
- Minimum staffing requirements
- Training and qualification periods
- System modifications / expansions
- Procedural changes
- Retraining and requalification periods
- Sick, personal, and vacation time
- Special events
- Continuity of operations
- Contractual obligations

11. Backup OCC

The RTS shall consider establishing an independent backup OCC as a part of its Continuity of Operations Plan. The RTS shall develop a threat and vulnerability assessment (TVA) that identifies backup OCCs.

References

American Public Transportation Association, “Moving People Safely,” Third Edition, 1977.

Code of Federal Regulations:

49 CFR Part 40, Procedures for Transportation Workplace Drug and Alcohol Testing Program, October 2001. http://www.dot.gov/ost/dapc/NEW_DOCS/PART40.pdf

49 CFR Part 653, Prevention of Prohibited Drug Use in Transit Operations, October 2000. http://www.access.gpo.gov/nara/cfr/waisidx_98/49cfr653_98.html

49 CFR Part 654, Prevention of Alcohol Misuse in Transit Operations, October, 2000. http://www.access.gpo.gov/nara/cfr/waisidx_00/49cfr654_00.html

49 CFR Part 655, Prevention of Alcohol Misuse and Prohibited Drug Use in Transit Operations, October, 2001. http://www.access.gpo.gov/nara/cfr/waisidx_03/49cfr655_03.html

U.S. Department of Transportation “Partnering for Safety: Managing Fatigue,” March 1999.

Abbreviations and acronyms

ADA	Americans with Disabilities Act
APM	automated people mover
ATO	automatic train operation
ATP	automatic train protection
CCTV	closed-circuit television
CFR	Code of Federal Regulations
CRT	cathode ray tube
FAA	Federal Aviation Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
NATSA	North American Transit Services Association
OCC	operations control center
OJT	on-the-job training
RFG	rail fixed guideway
RTS	rail transit system
ROW	right-of-way
SCADA	supervisory control and data acquisition
SME	subject matter expert
SOP	standard operating procedure
TVA	threat and vulnerability assessment

Summary of document changes

- Committee membership updated.
- New section added at the end ‘Summary of changes’.
- Some global changes to sections headings and numbering resulted when sections dealing with references and acronyms were moved to the end of the document.
- Old section 5 (new section 2) title changed from “Operations Control Center” to “Operational Authority:”
- Old section 7.1 titled “Medical-physical/psychological” discussed the requirement for control center staff to meet all standard agency requirements for physical fitness. This section was deleted and a new

statement added to say that the RTS shall determine requirements for fitness for duty for OCC personnel.

- Added a new section 7 ‘OCC Access’.
- Old sections 9.1, 9.2 and 9.3 with reference to “Normal Operations”, “Non-Normal Operations”, and “Emergency Operations” moved to the Annex of the document under new sections A.8.1, A.8.2, and A.8.3 respectively.
- Old section A.3 “Operations Control Center – Functional Elements” has been modified and is shown in the Annex under new A.4 “Staffing”. It shows typical position categories with a brief description of the job function.

Document history

Document Version	Working Group Vote	Public Comment/ Technical Oversight	Rail CEO Committee Approval	Rail Standards Policy & Planning Committee Approval	Publish Date
First published	—	—	—	—	June 8, 2003
First revision	—	—	—	—	July 26, 2004
Second revision	—	—	—	—	March 31, 2012
Third Revision	October 12, 2017	January 31, 2018	February 13, 2018	April 13, 2018	July 6, 2018

Appendix A (informative): Additional information on OCCs

A.1 Overview

This informative annex provides additional information that should be considered by the RTS in utilizing this standard for developing operating rules pertaining operations control centers. The scope and purpose of this standard are provided on the cover page.

A.2 General design/functional requirements

Some smaller RTSs apply a minimal level of functionality and application of technology. This minimal functionality takes the form of assigned OCC personnel (train controllers) who maintain radio communication with field services (trains and other personnel). This application may or may not provide remote monitoring of train location status or control of field equipment, including signal indications and track switches.

Larger RTSs usually provide the capability of monitoring the location of all trains on the system on a dynamic status basis. This status information may also include schedule adherence, all track switches, wayside signals, interlockings, intermediate track circuits, and traction power distribution. Additional non-train operation elements may also be monitored and/or controlled. These elements usually include the following, but are not limited to:

- Tunnel fan ventilation status.
- Fire control elements.
- Station facilities, including escalators, elevators and ancillary room intrusion alarms.
- Closed-circuit television (CCTV) monitoring and other security.
- Passenger information coordination, including but not limited to public address announcements, station electronic messaging and schedule information.
- Automatic fare collection status information.
- Bus dispatching/other modes. While not a universally accepted practice, certain multi-modal agencies incorporate bus dispatching/monitoring in an expanded control center environment to include other modes, including bus operations, paratransit services, APMs, etc.
- Operations support functions, i.e., car equipment, wayside equipment, technical support, crew dispatching, etc.

Depending upon the application, the OCC may contain track and information display panels or CRT desktop display elements. These elements are usually in conjunction with monitoring/operating control consoles/workstations where personnel can effect control, command or communication actions.

Because there is significant interface with computers and communication, the main OCC room may be augmented with an adjacent communications equipment room or other ancillary facilities. The associated room provides proximity for support elements that apply to the OCC facility. The main OCC room usually is a low-light, accessible and ergonomically designed facility with sound absorption material in order to maintain the minimum noise levels. OCC facilities may also contain adjacent personnel quarters, e.g., conference/training/briefing room(s), lunch/break room, locker rooms, restroom facilities, etc. Further, the location of OCC facilities will also vary, but in most cases, it is a secure facility with controlled access, integrated into one of the agency's existing facilities (yard facility structures or main administrative office building) and in close proximity to the operating system.

A.3 Functional elements

The functional elements within the OCC depend on the size of the RFG system, the level of technology applied and the transit modes monitored within the facility. The functions and workstations may include the following:

- Central control shift supervisor/manager
- Train operation/monitoring/display panels
- Traction power distribution and monitoring
- Passenger/customer services/communications
- Communication systems
- Police services/security
- CCTV
- Wayside/facilities maintenance
- Rail vehicle maintenance
- Clerical support
- Bus operations (if collocated)

A.4 Staffing

The actual number of personnel assigned to the OCC is largely a function of the size of the RFG system and the functional elements mentioned above.

The number of personnel in each category, functions they perform, or whether the position exists at all is system specific and is also determined by system size, technology and other priorities.

Depending on the level of technology applied and functional authority that rests within the OCC, the variety of position categories include, but is not limited to the following:

- **OCC manager:** Sometimes called control center supervisor or chief officer, the position and function that assumes management responsibility for the efficiency and effectiveness of all personnel on the shift.
- **Train controllers or dispatchers:** Also known as system supervisors, the function that directs and coordinates the movement of trains as called for in the daily service schedule and implements delay mitigation and emergency strategies. Decisions affecting such movements may be made in conjunction with designated field personnel. Train controllers' tasks may include responsibility for bad order train management, processing of routes at switch networks, activation of emergency procedures, oversight of maintenance activities on the ROW, etc.
- **Traction power supervisor/power distribution director:** Function that operates controls and coordinates activities related to traction power and auxiliary power distribution systems.
- **Passenger/customer services representative/supervisor:** Function responsible for transmitting pertinent service related information, including ADA elements, by telephone, radio and public address system and other mediums to the riding public and news service organizations.
- **Communication console operator:** Function responsible for coordinating all communication elements at a particular console or workstation. As the "voice" on the radio, this position usually works in coordination with the train controller.
- **Security/police services dispatcher:** Function responsible for handling 911 calls, dispatching police officers or security personnel as appropriate, providing telephone assistance and monitoring CCTV and other electronic alarm systems.
- **CCTV observer:** Function responsible for monitoring CCTV and providing related passenger assistance.

- **Facilities supervisor/station manager:** Function responsible for managing the daily activities that occur at passenger stations or termini, such as providing customer service, ensuring equipment (fare collection, elevators, escalators, video displays, etc.) is in proper working order, assisting with managing emergencies, etc.
- **Wayside/equipment maintenance supervisor:** Function that dispatches, manages and coordinates activities conducted by the maintenance department, within the right-of-way envelope, in support of routine maintenance or emergency maintenance response.
- **Rail vehicle maintenance supervisor:** Function responsible for directing field technical support personnel in troubleshooting and recovering of train equipment failures.
- **Clerical support:** Function that provides all OCC administrative support functions, such as computer data entry, typing, filing, etc.
- **Bus dispatcher or other intermodal coordinator:** Function responsible for managing the daily distribution of buses or other modes of transportation per the published timetable. This position is also responsible for delay emergency response and alternate rail service management.

A.5 Selection of personnel

Selection of personnel varies widely based on position within the OCC and level of responsibility. Lower-level assignments (i.e., communication or public information personnel) require less stringent scrutiny and can be processed in conjunction with the agency's standard internal human resource policies related to the specific position. However, the greater the level of responsibility (train controllers/dispatchers, traction power console operators, etc.), the greater the degree of evaluation required.

The essential requirements for selection of personnel include the establishment of a policy related to internal hiring of experienced agency personnel or external hiring of individuals with a non-transit background. The preference is to hire internally based on an employee's substantial knowledge of system operational elements and standards and practices. However, some agencies have opted for external hiring and providing a more substantial level of training spread out over a greater length of time. The latter usually requires a thorough and extended familiarization and orientation training experience for the new hire to have an understanding of the unique interdisciplinary elements associated with the transit operating environment. Once this is achieved, then training can more appropriately focus on control center operations and associated requirements.

These requirements should include an individual's ability to function in a confined environment, frequently with little or no external access or stimulation. Other characteristics include low light environment and extended periods being in a seated position at a workstation or console. Other elements include specialized skills, including multitasking and abstract reasoning. Because of the specific nature of the OCC environment and its uniqueness, many agencies have adopted psychological testing to determine whether a potential candidate possesses any personal psychological characteristic that would manifest itself in such a way as to create adversity or conflict.

Selection of personnel varies depending on current human resource/hiring policy. The process may also include a battery of tests that assess an individual's general intelligence, computer skills, management or supervisory knowledge, and even more substantive tests that include personality profiles and abstract reasoning. The latter tests are administered to determine an individual's ability to function in a control center environment and the extent to which he or she is intellectually capable of multitasking. Some agencies have patterned their selection of OCC personnel to that of the Federal Aviation Administration (FAA) in the selection of air-traffic controllers.

A.6 Safety-sensitive category for designated personnel

The FTA has established a series of guidelines that identify the elements that classify individuals as safety sensitive. These include personnel who are directly or indirectly involved in a decision-making role relative to

the dispatch or movement of revenue service vehicles, who provide security and carry a firearm, or who are in a position of controlling field equipment and operations. Reference 49 CFR Parts 653, 654, 655 and 40.

A.8 OCC standard operating procedures

In order for the OCC to exercise appropriate command and control over field operations, it is essential to incorporate a series of SOPs. These SOPs are used in conjunction with other applicable rules and regulations and provide OCC personnel with an RTS-approved method of maintaining service levels and handling field occurrences (emergency and otherwise). These SOPs encompass a wide range of categories and generally provide a prescribed method of effectively and safely dealing with any occurrence on the system. The SOPs take into consideration passenger and employee safety, safeguards for RTS facilities, and generally accepted “best practices” for dealing with occurrences involving operations, safety/security, incidents involving natural disasters and accidents or other major incidents. The development of such SOPs usually involves personnel from appropriate disciplines within the system, as well as outside emergency or governmental agencies having jurisdiction or responsibility for response.

The RTS shall establish procedures for distribution of the SOPs. These procedures should include the requirement that recipients sign for all SOPs.

Examples of possible SOPs to consider are shown below but are not meant to be an exhaustive list.

A.8.1 Normal operations

1. Terminal station interlocking operation
2. Making station stops
3. Mixed/street traffic operations
4. Wheelchair boarding requirements/placement/securement
5. Bicycles onboard trains
6. Automatic train operation (ATO)
7. Ground inspection of in-service trains
8. Characteristics of automatic train protection (ATP)
9. Station operations (fare gates, restrooms, agent booths, etc.)
10. Express train operations

A.8.2 Special operations

1. Track out of service
2. System failure/service recovery techniques
3. Special events service, including charter train operation
4. Medical occurrences
 - Onboard trains/in stations
 - Sick or injured passengers or employees
 - Death or injury on the right-of-way
5. Establishing slow/work zones (protection of workers/contractors)
6. Reverse traffic operation
7. Manual block operation
8. Failure of train doors
9. Movement of a disabled train
10. Cutting out train brakes and/or propulsion
11. Civil unrest/protest demonstrations, onboard trains and in stations or other facilities
12. Establishing “bus bridge” and other supplemental service
13. Protection of on-track maintenance equipment, shunting and non-shunting

14. Broken crossing gates, operational requirements/restrictions
15. Loss of signal control, cab or wayside
16. Rotating power outages
17. Removal and restoration of traction power (non-emergency)
18. Intrusion into the right-of-way (vehicle, trespasser, other)
19. Preparation and use of a rescue train
20. Crowd control
21. Unruly passenger(s)

A.8.3 Emergency operations

1. Earthquakes and/or volcanic eruption
2. Flood in trackway/subway stations/tunnels
3. Fires
 - Wayside fires
 - Fire on a train
 - Fire on the right-of-way
 - Fire on an elevated structure
 - Fire in a tunnel
 - Fire in a station
4. Extreme weather
 - Hurricanes
 - Tornadoes/high winds
 - Heat or cold
 - Ice or snow
5. Bomb threats
6. Bomb detonations
7. Total system shutdown and restoration
8. Partial system shutdown and restoration
9. Civil unrest
10. Terrorist acts:
 - Use of intelligence
 - Hijacked equipment
 - Hostages/barricaded subject
 - Bio-chemical hazards (on trains/in stations)
 - Unauthorized person in control of train
 - Cyber-criminal/terrorist computer system attacks
11. Hazardous materials spill (non-terrorist act)
12. Derailments
13. Passenger evacuations, trains:
 - From tunnels
 - From elevated structures
 - From open right-of-way
14. Passenger evacuations, stations
15. Overhead wire down
16. Removal and restoration of traction power (emergency)
17. Emergency reporting/notification list (agency/local/state/federal)
18. Train/pedestrian/trespasser/employee accidents
19. Contacting outside emergency response agencies (police, fire, paramedic, hazardous material, bomb squad, etc.)
20. Collisions, train to train and other

21. Broken rail
22. Track irregularities (rail kinks, misaligned track, etc.)
23. Activation/control of tunnel ventilation systems
24. Loss of station power
25. Continuity of operations
26. Loss of signals, switches and power