



Rail Transit Station, Shop and Yard Inspection and Maintenance

Abstract: This standard provides general requirements for periodic inspection of safety-critical components of rail transit stations, shops and yards.

Keywords: equipment inspections, maintenance, shops, stations, structures, yards

Summary: This standard covers what inspections and maintenance shall include, together with a general range of frequency for such inspections and maintenance and the qualifications of rail transit employees or contractors that perform these procedures. The standard provides both a rating system for safety-critical components and record-keeping requirements.

Scope and purpose: This standard was prepared and approved solely for the purpose of satisfying the objectives described below. As such, it does not mitigate, overcome, alter or diminish the force or mandate of any federal, state or local law or statute. The purpose of this standard is to establish requirements for inspection and maintenance procedures for safety-critical components in stations, shops and yards. The objectives of this standard are to improve RTS safety in general; to create a forum in which rail transit systems share best practices; to motivate the industry toward a proactive safety approach; to enhance communication between rail transit systems and their suppliers; to provide guidance for transit system new starts; to pave the way for more uniform safety-sensitive procurement specifications; and to assist federal, state and local authorities by suggesting harmony instead of variability in safety oversight programs. The inspection and maintenance procedures in this document, when properly performed, will achieve two fundamental outcomes: Reduce accidents and injuries to people (and over time eliminate these unnecessary occurrences) and ensure that structural components and equipment are functioning as designed. The scope of this standard is limited to fixed equipment applicable to structures that directly affect the safety of people.

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 Service 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 not part of APTA RT-FS-S-003-02, Rev. 1, “*Rail Transit Station, Shop and Yard Inspection and Maintenance.*”

This APTA standard has been established to provide general requirements for transit agencies for inspecting and maintaining various station, shop and yard infrastructure. This standard covers general inspection practices, inspection staff qualifications, inspection types and frequencies, and maintenance practices.

APTA rail transit safety standards represent an industry consensus on safety practices for rail transit systems to help achieve a high level of safety for passengers, employees, and the general public. This document was created by and for those parties concerned with its provisions; namely, rail transit systems (operating agencies), manufacturers, consultants, engineers, and general interest groups. This standard provides procedures for inspecting and maintaining rail transit structural systems.

APTA recommends the use of this document by:

- individuals or organizations that operate rail transit systems;
- individuals or organizations that contract with others for the operation of rail transit systems; and
- individuals or organizations that influence how rail transit systems are operated (including but not limited to consultants, designers and contractors).

This standard intends to meet the following objectives:

- to ensure special life/safety equipment is operational and reliable
- to help rail transit systems incorporate safety considerations during the inspection and maintenance process
- o identify inspection criteria and maintenance standards that provide a high level of passenger and personnel safety

The application of any standards, practices, or guidelines contained herein is voluntary. In some cases, federal and/or state regulations govern portions of how an RTS operates. In such cases, the government regulations override any conflicting practices this document requires or recommends.

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).

Rail Transit Station, Shop and Yard Inspection and Maintenance

1. Covered components

The scope of this document includes, but is not limited to, the following components (agencies are encouraged to augment the component list as necessary to complement their infrastructures):

- Stations:
 - elevated or aerial
 - subway or below ground
 - at grade: low and high platform
 - Operations Control Centers
 - communication rooms
- Buildings, including but not limited to:
 - maintenance facilities
 - office and administrative structures
 - substations
 - operations and control facilities
 - parking structures
- Structural elements for buildings, stations, etc.:
 - foundations, including piles and caissons
 - grade beams
 - floor and roof slabs
 - columns
 - roof and canopy systems
 - lateral support elements
 - girders
 - walls
 - windows
 - ceilings
 - interior partitions
 - doors
 - electrical rooms
 - pumping facilities
 - mechanical equipment rooms
 - hazardous material storage and containment areas
 - overhead catenary system (OCS) poles and anchor bolts (ultrasonic)
- Electrical equipment:
 - transformers
 - switch gear
 - lighting system components
 - electrical panels
 - emergency generators

- transfer switches
- alarms
- Heating, ventilation and air conditioning equipment:
 - furnaces
 - boilers
 - unit heaters
 - compressors
 - chillers
 - evaporators
 - ventilation portals
 - ventilation systems
- Shop and yard equipment:
 - cranes
 - hoists and related ropes
 - wire rope fittings
 - hooks and slings
 - car or vehicle lifts
 - jacks
 - vehicle cleaning equipment
 - paint stations
 - wheel lathes, presses and boring equipment
 - oil and water separators including part cleaning equipment
 - welding and cutting equipment
 - compressed air systems
 - machine shop equipment; i.e. lathes, milling machines, large drill press
 - test equipment; i.e. Magnaflux, high-voltage power supply, high-current power supply, high-pressure test rack
- Plumbing:
 - ejectors
 - hose bibs
 - drains and sump pumps
 - roof drains
 - ventilation drains
 - track drains
 - discharge lines
 - fire sprinkler, standpipes and pumps

2. Qualification of personnel

2.1 Individual in charge of inspections, maintenance, reporting defects and inventory

Each organization or agency shall designate an individual to be in charge of inspections, maintenance, reporting defects and inventory. Such individual shall possess the following minimum qualifications:

- licensed as a registered professional engineer; or
- qualified for registration as a professional engineer under the laws of the state; or
- a minimum of 10 years' combined experience in inspection assignments in a responsible capacity, either as an hourly, supervisory or managerial employee.

2.2 Inspector

Consistent with individual need, each RTS shall develop and maintain properly trained employees or contractors in order to satisfy the purpose and scope of this standard. Inspectors shall be knowledgeable and trained to perform safe inspections of the components they are inspecting.

3. Inspections

The RTS shall perform the inspections in this document as routine, special or comprehensive as prescribed by the individual transit system, to achieve the outcomes described in “Scope and purpose.”

Appendix B provides example inspection reports of how to perform specific inspections in order to achieve the desired outcomes.

3.1 Routine inspections

3.1.1 Frequency

Routine inspections of components listed in Section 1 shall be performed at a frequency (annually, biannually, tri-annually or monthly) as specified by the rail transit system. Individual rail transit systems shall have the latitude to determine which frequency to use in this category after considering age and condition of its equipment and structural components, provided that, once a frequency has been established, it shall remain consistent unless a subsequent evaluation of age and conditions dictate otherwise.

3.1.2 Procedure

Routine inspections shall be performed as specified by the rail transit system. The RTS can elect to have inspections performed by internal or external parties. Routine inspections shall take note of defects that have a potential to cause injury or bodily harm and any other deficiency observed during the course of the inspection.

3.1.3 Components of routine inspections

Routine inspections and maintenance procedures shall be designated for all structural components and equipment, including but not limited to the following:

- tripping hazards
- missing pieces of platform edges or tactile warning strips
- loose sections of overhead concrete
- broken handrails
- cracked stairway nosings
- peeling surface coatings
- defects noted during regular testing of shop equipment
- any other inspectional observation having the potential to cause injury or bodily harm to people
- structural cracks or shifting
- severely corroded structural members
- structural deterioration of platform overhangs
- significant widening of expansion joints
- critical concrete slab protrusions
- falling section of overhead concrete
- significant bulging of platform walls or partitions
- heavy water infiltration
- any other inspection observation having the potential to cause injury or bodily harm, or to generate a costly investment by the transportation provider to remediate the defect

3.1.4 Ratings

Routine inspections shall provide a numerical rating for all components and/or equipment that documents that the said component or equipment is functioning as designed. Routine inspections shall use the following ratings:

- **Good:** Functioning as designed. No deficiencies found. No repair required. Follow normal maintenance cycle.
- **Fair:** Functioning as designed. Minor deficiencies found. Potential exists for minor maintenance repair.
- **Marginal:** Functioning as designed. Moderate deficiencies found. Potential exists for rehabilitation. Lower-priority repairs.
- **Poor:** Partially does not function as designed. Numerous deficiencies found. High-priority repairs required.
- **Very poor:** Does not function as designed. Severe deficiencies found. Highest-priority repairs required.

Structural components or equipment graded either poor or very poor shall include a plan of corrective action with a timetable for rehabilitating the defect.

3.1.5 Correction of deficiencies

The RTS shall immediately remove defective equipment discovered during inspections that cause unsafe conditions from service until fully repaired.

Likewise, in areas where inspections indicate that structural components are in need of repair and cause unsafe conditions, corrective rehabilitation shall be performed immediately by either internal or external forces.

Where immediate corrective action cannot be achieved, the area in question shall be removed from public use by a qualified person, or question shall be either barricaded or cordoned off until remedial repairs are complete and the area is declared safe.

3.2 Special inspections

3.2.1 Frequency

Special inspections occur infrequently, but are needed in the event of damage to a structure or equipment including, but not limited to, collision, fire, flood or landslide, or as follow-up to previous inspection findings where more detailed examination may be required. Special inspections can range from a short duration of a single element or component of equipment to a much broader inspection of several elements or pieces of equipment.

3.2.2 Procedure

Special inspections shall be performed as specified or required by the individual rail transit system.

Internal or external parties may conduct special inspections provided that such intermediate inspections generate documentation that structural components and equipment are functioning as designed.

3.2.3 Components of special inspections

Special inspections and maintenance procedures shall be specified as required or as needed by the individual rail transit system.

3.2.4 Ratings

Special inspections shall provide a numerical rating for all components and/or equipment that documents that the said component or equipment is functioning as designed. Intermediate inspections shall use the following ratings:

- **Good:** Functioning as designed. No deficiencies found. No repair required. Follow normal maintenance cycle.
- **Fair:** Functioning as designed. Minor deficiencies found. Potential exists for minor maintenance repair.
- **Marginal:** Functioning as designed. Moderate deficiencies found. Potential exists for rehabilitation. Lower-priority repairs.
- **Poor:** Partially does not function as designed. Numerous deficiencies found. High-priority repairs required.
- **Very poor:** Does not function as designed. Severe deficiencies found. Highest-priority repairs required.

Structural components or equipment graded either poor or very poor shall include a plan of corrective action with a timetable for rehabilitating the defect.

3.2.5 Correction of deficiencies

The RTS shall immediately remove defective equipment discovered during inspections that cause unsafe conditions from service until fully repaired.

Likewise, in areas where inspections indicate that structural components are in need of repair and cause unsafe conditions, corrective rehabilitation shall be performed immediately by either internal or external forces.

Where immediate corrective action cannot be achieved, the area in question shall be removed from public use by a qualified person or shall be either barricaded or cordoned off until remedial repairs are complete and the area is declared safe.

3.3 Comprehensive inspections

3.3.1 Frequencies

Comprehensive inspections are intended to be all inclusive and shall be performed at least once every five years or as otherwise required by the rail transit system.

3.3.2 Procedure

At a minimum, comprehensive inspections shall include the following:

- an external assessment that details findings, conclusions and a plan with corrective details and specifications for items not functioning as designed
- a management assessment tool that details inventory and prioritizes corrective actions for rehabilitations that may be large in scale and require a capital investment to complete satisfactorily
- an engineering assessment with graphic exhibitions

These inspections may be conducted by consulting organizations independently and apart from the transportation properties soliciting these impartial evaluations.

3.3.3 Components of comprehensive inspections

Comprehensive inspections and subsequent remedial recommendations shall cover, but are not limited to, the following:

- material deterioration or distress for section loss, cracking, misalignment, water penetration, settlement, corrosion, missing fasteners, buckled compression members, efflorescence, etc.
- concrete cores for compressive strength to reveal hidden deterioration in concrete or its reinforcement
- surveys to determine corrosion activity in reinforcing or embedded steel, or potential corrosion activity of the reinforcing steel in concrete
- chloride determination in order to record the level of corrosion, if any, related to unprotected steel
- structural steel ultrasonic thickness to determine the amount of loss, if any, when compared with design thickness
- steel coupons for tensile strength to determine if ruptured strength is consistent with original design intent
- Windsor probing to determine concrete strength
- sampling to determine whether liquid infiltration is sewage, potable or ground water
- video or borescopic examination of supply and drain lines to expose and investigate enclosed spaces
- strain gage analysis to measure the strain of materials under various loads
- test pits to expose the surface of structural components in order to examine the conditions of material or framing members
- structural alignment sweep and deflection surveys to determine potential displacement over time

3.3.4 Ratings

Comprehensive inspections shall provide numerical ratings as described in Section 3.2.4 for all structural components and/or equipment inspected.

4. Documentation and record maintenance

Each RTS shall develop and maintain, in accordance with its chosen inspection frequencies, an inventory or database with dynamic flexibility to maintain the following records:

- category of structural component or equipment
- name, location and age of the structural component or equipment
- date of most recent routine, intermediate or comprehensive inspections
- most recent rating for the structural component or equipment
- subsequent maintenance provided as a direct result of said inspection
- independent engineering assessment, if applicable
- graphic exhibition, if applicable
- date of next scheduled inspection, which shall conform to the frequency of the inspection cycle adopted

Appendix B provides examples of inspection documentation.

Definitions

rail transit system (RTS): The organization or portion of an organization that operates rail transit service and related activities. Also called operating system, operating authority, transit system, transit authority or rail system.

Abbreviations and acronyms

ANSI	American National Standards Institute
AASHTO	American Association of State Highway Transportation Officials
AREMA	American Railway Engineering and Maintenance Association
ASCE	American Society of Civil Engineers
ASTM	American Society of Testing Equipment
AWS	American Welding Society
FTA	Federal Transit Administration
NATSA	North American Transit Services Association
NFPA	National Fire Protection Agency
OCS	overhead catenary system
RTS	rail transit system

Summary of document changes

- Document formatted to the new APTA standard format.
- Sections have been moved and renumbered.
- Definitions, abbreviations and acronyms have been moved to the back of the document.
- Two new sections added: “Summary of document changes” and “Document history.”
- Some global changes to section headings and numberings resulted when sections dealing with references and acronyms were moved to the end of the document, as well as other cosmetic changes, such as capitalization, punctuation, spelling, grammar and general flow of text.
- Added descriptive paragraph to the Introduction outlining the standard contents.
- Added language to Section 1, “Covered components,” in order to broaden the listed covered components and to encourage agencies to augment the provided list as needed.
- Added overhead catenary system (OCS) poles and anchor bolts to the list of items for inspection and maintenance in Section 1.
- Added inspector qualification language to Section 2.2 requiring inspectors to be knowledgeable and trained to inspect the components that are being inspected.
- Removed requirement for separate intermediate inspections and included the criteria as part of routine inspection criteria in subsection 3.1.
- Added language in Section 3.1.1 regarding routine inspection frequency to clarify requirements of the rail transit system.
- Added language in Section 3.1.2 regarding routine inspection procedures to formally allow the RTS to have the option to use internal or external resources and note all observed deficiencies.
- Added language in Section 3.1.3, “Components,” of routine inspections to clarify inspection and maintenance for all structural components and equipment.
- Added language and a rating scale in Section 3.1.4 for clear, concise comprehension of inspection and reporting.
- Modified Section 3.1.5 to incorporate requirement for removal of equipment from service that can cause an unsafe condition.
- Added special inspection in subsection 3.2 to allow for inspections that occur infrequently in the event of damage, etc.

- Modified sample inspection report rating scale in Appendix B and Appendix C to match the scale shown in the standard. Modified the numerical portion of the scale to mimic structure inspection standards depicting a lower rating number coinciding with a lower condition rating.

Document history

Document Version	Working Group Vote	Public Comment/ Technical Oversight	Rail CEO Approval	Rail Standards Policy & Planning Approval	Publish Date
First published	June 25, 2002	—	—	Sept. 22, 2002	September 2002
First revision	Feb 11, 2016	January 31, 2017	February 22, 2017	March 15, 2017	April 7, 2017

Appendix A (informative): Bibliography

- [B1] AASHTO Manual for Maintenance Inspection of Bridges, prepared by the Highway Subcommittee on Bridges and Structures for the American Association of State Highway and Transportation Officials.
- [B2] AREMA Manual of Railway Engineering.
- [B3] ASCE Rehabilitation of Public Transit Facilities.
- [B4] FTA Study of Subway Station Design and Construction.
- [B5] NFPA 130 Standards for Fixed Guideway Rail Systems.

Annex B (informative): Sample inspection reports

FIGURE 1
 Sample Station Inspection Report

5: Good 4: Fair 3: Marginal 2: Poor 1: Very Poor		Outside areas, stairways, railings	Mezzanine, platforms	Booths, turnstiles, exit gates	Toilets, rooms, offices	Signs, windows, tile, walls	Refuse areas, solar cans, canisters	Lights, concessionaires	Elevators and escalators
		1	2	3	4	5	6	7	8
Station		1	2	3	4	5	6	7	8
A Independence Pl.	8:00 a.m.	3	4	3	3	3	3	3	4
	9:00 a.m.								
B Freedom St.	9:15 a.m.	4	3	3	3	3	3	3	3
	10:55 a.m.								
C Court House Rd.	11:15 a.m.	3	3	3	3	4	3	4	3
	12:00 p.m.								
D									
E									
F									
G									
H									
I									
Date:		Signature:						Pass No.:	
Time on:		Checked by:							
Time off:									
A2	Platform edge strip loose at marker 150+00 northbound								
B1	Loose railing at marker 350+00 northbound								
B4	Lock not functioning female restroom								
C5	Signage vandalized above stairway P6								
C7	Lights out in cleaners room north mezzanine								

FIGURE 2
 Sample Lighting Inspection Report

Date (MM/DD/YY): _____ Station Name: _____ Line: _____

Inspection (Y/N): _____

Call #: _____ Time Repaired: _____ Time Arrived: _____ Time Departed: _____

Platform					Location			Circuit		No. of Lamps				Lamp
NB	SB	MID	LOC	EXP	NE	SE	CE	SER	MUL	BO	LO	ST	BK	Type
Mezzanine														

Stairways and Post Globes	#													
	#													
	#													
	#													
	#													
	#													
Token Booths	#													
	#													
	#													
	#													
Toilets														

Quarters														
(Specify)														

FIGURE 2
 Sample Lighting Inspection Report

Electrical Distribution Room Inspection											
Y=Yes N=No	Normal		Reserve		Y=Yes N=No	Normal		Reserve			
CLEAN, NO DEBRIS					SERVICE OK						
DOORS LOCKED					ATS OK						
LADDER AVAILABLE					TRANSFORMERS OK						
STAIRBOX AVAILABLE					DC FEED OK						
FIRE EXITING OK					EQUIP. GRDING OK						
RUBBER MATS OK					HEATER OK						
ROOM LIGHTING OK					EXHAUST FAN OK						
FUSES											
CIRCUIT NO											
QUANTITY											
VOLTS											
AMPS											

LIGHT MAINTAINER SIGNATURE _____ SUPERVISOR'S INITIAL _____

LIGHT MAINTAINER SIGNATURE _____ USE BACK FOR REMARKS

FIGURE 3

Sample Concrete and Structural Steel Inspection Report

Date of Inspection:	Inspected by:	Station Data:
Station Number:	Weather:	Platform:
Station Name:	Tracks:	
Line:	Overall Condition:	Elevated

Level/ Component	Rating	Condition	Qty.	Photo	Location	Test
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Street

Beam Connection	5	Missing bolts and brackets	2.00 EA.		2	
Bracing	3	Moderate corrosion	180.00 LF		3	
Column	5	Severe section loss and bent @ web & flange	1.00 EA.		6	1-Jul
	5	Severe section loss @ base	5.00 EA.	25-01	1	
Column Drain	3	Bent	1.00 EA.		4	
Column Encasement	5	Severe spall & severe section loss	15.00 SF		7	
Drain	4	Missing	10.00 EA.		5	

Mezzanine

Ceiling Slab	4	Heavy deterioration of wood planks	400.00 SF		9	
	3	Moderate scaling	800.00 SF		81	
	4	Heavy spall with exposed rebars	20.00 SF	25-2	10	
Floor Slab	5	Severe deterioration of wearing surface and ½ in. deep spalls	800.00 SF		8	
Under Deck Beam	4	Heavy section loss	100.00 LF	25-3	82	2-Jul
	5	Severe section loss at connection	15.00 LF		80	
Underdeck Walls	5	Severe deterioration	7.00 SF		12	
	4	Heavy deterioration	20.00 SF	25-3	11	

Platform

Canopy	4	Heavy deterioration and rotting	600.00 LF		16	
	4	Heavy deterioration and rotting along perimeter	600.00 LF		27	
Column	5	Severe section loss @ bottom of section	1.00 EA.		17	
	5	Severe section loss @ bottom	12.00 EA.		26	

Stair

Beam	4	Heavy delamination @ top flange & connection	10.00 LF		21	
	3	Moderate section loss	80.00 LF		30	

Annex C (informative): Concrete and structural steel inspection

TABLE 1
 Rating Criteria

Rating	Condition	Description
5	Good	Functioning as designed. No deficiencies found. No repair required. Follow normal maintenance cycle.
4	Fair	Functioning as designed. Minor deficiencies found. Potential exists for minor maintenance repair.
3	Marginal	Functioning as designed. Moderate deficiencies found. Potential exists for rehabilitation. Lower-priority repairs.
2	Poor	Partially does not function as designed. Numerous deficiencies found. High-priority repairs required.
1	Very poor	Does not function as designed. Severe deficiencies found. Highest-priority repairs required.

TABLE 2
 Tests

1	Concrete cores for compressive strength
2	Windsor probe concrete strength
3	Half-cell reinforcement corrosion survey
4	Concrete slab chloride determination
5	Pachometer survey
6	Petro graphic survey
7	Structural steel ultrasonic thickness survey
8	Steel coupons for tensile strength
9	Water sampling
10	Video exam of supply and drain lines
11	Video and borescopic probes
12	Initial walk down/visual inspection
13	Strain gage analysis
14	Test pits/probe/concrete removal
15	Structural steel alignment sweep and deflection survey