3. Standard for Station, Shop and Yard Inspection and Maintenance

Approved June 25, 2002
APTA Rail Transit Standards Fixed Structures Inspection and Maintenance Committee

Approved September 2, 2002
APTA Rail Transit Standards Task Force

Authorized September 22, 2002
APTA Rail Transit Standards Policy Committee

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

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

(This introduction is not a part of APTA RT-FS-S-003-02, Standard for Station, Shop and Yard Inspection and Maintenance.)

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 this standard for:

- Individuals or organizations that inspect, maintain, and/or operate rail transit systems
- Individuals or organizations that contract with others for the inspection, maintenance, and/or operation of rail transit systems
- Individuals or organizations that influence how rail transit systems are inspected, maintained, and/or 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
- To 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.
Participants

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Standard for Station, Shop and Yard Inspection and Maintenance

1. Overview

This standard was prepared as part of a group of standards developed through the American Public Transportation Association (APTA) together with constituent member agencies.

This standard is prepared and approved solely for the purpose of satisfying the objectives described in Section 1.1 below. As such, it is not, nor does it purport, intend, mitigate, overcome, alter or diminish the force or mandate of any federal, state or local law or statute either currently or subsequently enacted.

1.1 Purpose

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:

a) Improve rail transit system (RTS) safety in general.

b) Create a forum in which rail transit systems share best practices.

c) Motivate the industry toward a proactive safety approach.

d) Enhance communication between rail transit systems and their suppliers.

e) Provide guidance for RTS new starts.

f) Pave the way for more uniform safety sensitive procurement specifications.

g) 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).

– Ensure that structural components and equipment are functioning as designed.
1.2 Scope

This standard applies to all rail transit systems including, but not limited to, light rail and heavy rail systems. For purposes of applicability, a station is defined as any stopping place for public transit conveyances, the spaces in which people begin or end their journeys.

The scope of this standard is limited to fixed equipment applicable to structures that directly affect the safety of people. Components included within the scope of this document are:

1.2.1 Stations

a) Elevated or aerial

b) Subway or below ground

c) At grade: low and high platform

1.2.2 Buildings

Including, but not limited to:

a) Maintenance facilities

b) Office and administrative structures

c) Substations

d) Operations and control facilities

1.2.3 Structural elements for buildings and stations

a) Foundations, including piles and cassetsions

b) Grade beams

c) Floor and roof slabs

d) Columns

e) Roof and canopy systems

f) Lateral support elements

g) Girders

h) Walls

i) Windows

j) Ceilings
k) Interior partitions
l) Doors
m) Electrical rooms
n) Pumping facilities
o) Mechanical equipment rooms
p) Hazardous material storage and containment areas

1.2.4 Electrical equipment
a) Transformers
b) Switch gear
c) Lighting system components
d) Electrical panels
e) Emergency generators
f) Transfer switches
g) Alarms

1.2.5 Heating, ventilation, and air conditioning equipment
a) Furnaces
b) Boilers
c) Unit heaters
d) Compressors
e) Chillers
f) Evaporators
g) Ventilation portals
h) Ventilation systems

1.2.6 Shop and yard equipment
a) Cranes
b) Hoists and related ropes

c) Wire rope fittings

d) Hooks and slings

e) Car or vehicle lifts

f) Jacks

g) Vehicle cleaning equipment

h) Paint stations

i) Wheel lathes, presses and boring equipment

j) Oil and water separators including part cleaning equipment

k) Welding and cutting equipment

l) Compressed air systems

m) Machine shop equipment; i.e. lathes, milling machines, large drill press

n) Test equipment; i.e. magnaflux, high voltage power supply, high current power supply, high pressure test rack

1.2.7 Plumbing

a) Ejectors

b) Hose bibs

c) Drains and sump pumps, roof drains

d) Ventilation drains

e) Track drains

f) Discharge lines

g) Fire sprinkler, standpipes and pumps

1.3 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. An
individual RTS may develop alternates to the 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:

a) Identify the specific APTA rail transit safety standard requirements that cannot be met

b) State why each of these requirements cannot be met

c) Describe the alternate methods used

d) 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).

2. Definitions

For the purposes of this standard, the following definitions and acronyms apply:

2.1 Definitions

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

2.2 Acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>ANSI</td>
<td>American National Standards Institute</td>
</tr>
<tr>
<td>APTA</td>
<td>American Public Transportation Association</td>
</tr>
<tr>
<td>AASHTO</td>
<td>American Association of State Highway Transportation Officials</td>
</tr>
<tr>
<td>AREMA</td>
<td>American Railway Engineering and Maintenance Association</td>
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<tr>
<td>ASCE</td>
<td>American Society of Civil Engineers</td>
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<tr>
<td>ASTM</td>
<td>American Society of Testing Equipment</td>
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<td>AWS</td>
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<td>Building Officials Codes of America</td>
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<td>CFR</td>
<td>Code of Federal Regulations</td>
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<td>FTA</td>
<td>Federal Transit Administration</td>
</tr>
<tr>
<td>NFPA</td>
<td>National Fire Protection Agency</td>
</tr>
<tr>
<td>RTS</td>
<td>rail transit system</td>
</tr>
</tbody>
</table>
3. Qualification of personnel

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

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

a) Licensed registered professional engineer, or

b) Qualified for registration as a professional engineer under the laws of the state, or

c) Have a minimum of ten years combined experience in inspection assignments in a responsible capacity, either as an hourly, supervisory or managerial employee.

3.2 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.

4. Inspections

The RTS shall perform the inspections in this document routinely, intermediately, or comprehensively as prescribed by the individual RTS, to achieve the outcomes described in Section 1.1.

Annexes B-E provide examples of how to perform specific inspections in order to achieve the desired outcomes.

4.1 Routine inspections

4.1.1 Frequency

Routine inspections of components listed in Section 1.2 shall be performed at a frequency specified by the RTS.

4.1.2 Procedure

Routine inspections shall take note of defects that have a potential to cause injury or bodily harm to people.

4.1.3 Components of routine inspections

Routine inspections may cover, but are not limited to, the following:

a) Tripping hazards

b) Missing pieces of platform edges or tactile warning strips
c) Loose sections of overhead concrete

d) Broken handrails

e) Cracked stairway nosings

f) Peeling surface coatings

g) Defects noted during regular testing of shop equipment

h) Any other inspectional observation having the potential to cause injury or bodily harm to people

4.1.4 Ratings

Routine inspections will provide either a satisfactory or non-satisfactory finding.

4.1.5 Correction of deficiencies

Defects noted as non-satisfactory shall be corrected as soon as practical following notification to the responsible unit of the transit provider.

Maintenance to repair deficiencies shall be performed by personnel locally qualified to perform remedial work.

If immediate corrective action cannot be provided, the area(s) in question shall be either barricaded or cordoned off until remedial repairs are complete and the area is declared safe.

4.2 Intermediate inspections

4.2.1 Frequency

Intermediate inspections shall be performed annually, biannually, tri-annually or monthly as specified by the RTS. Individual rail transit systems shall have the latitude to determine which frequency to use in this category after considering both the age and condition of their equipment and structural components provided that, once a frequency has been elected, it shall remain consistent for purposes of reporting and fulfilling this requirement.

4.2.2 Procedure

Intermediate inspections shall be performed as specified by the individual RTS.

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

4.2.3 Components of intermediate inspections

Intermediate inspections and maintenance procedures shall be designated for structural
components and equipment and may cover, but are not limited to, the following:

a) Structural cracks or shifting
b) Severely corroded structural members
c) Structural deterioration of platform overhangs
d) Significant widening of expansion joints
e) Critical concrete slab protrusions
f) Falling sections of overhead concrete
g) Significant bulging of platform walls or partitions
h) Heavy water infiltration
i) Any other inspection observation having the potential to cause injury, bodily harm or to generate a costly investment by the transportation provider to effect remediation of the defect.

4.2.4 Ratings

Intermediate 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 utilize 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.

4.2.5 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(s) in question shall be removed from public use by a qualified person.

4.3 Comprehensive inspections

4.3.1 Frequencies

Comprehensive inspections are intended to be all-inclusive and shall be performed at least once every five year or as otherwise required by the RTS.

4.3.2 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 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.

4.3.3 Components of comprehensive inspections

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

a) Material deterioration or distress for section loss, cracking, misalignment, water penetration, settlement, corrosion, missing fasteners, buckled compression members, efflorescence, etc.

b) Concrete cores for compressive strength to reveal hidden deterioration in concrete or its reinforcement.

c) Surveys to determine corrosion activity in reinforcing or embedded steel, or potential corrosion activity of the reinforcing steel in concrete.

d) Chloride determination in order to record the level of corrosion, if any, related to unprotected steel.
e) Structural steel ultrasonic thickness to determine the amount of loss, if any, when compared to design thickness.

f) Steel coupons for tensile strength to determine if ruptured strength is consistent with original design intent.

g) Windsor probing to determine concrete strength.

h) Sampling to determine whether liquid infiltration is sewage, potable or ground water.

i) Video or boroscopic examination of supply and drain lines to expose and investigate enclosed spaces.

j) Strain gage analysis to measure the strain of materials under various loads.

k) Test pits to expose the surface of structural components in order to examine the conditions of material or framing members.

l) Structural alignment sweep and deflection surveys to determine potential displacement over time.

4.3.4 Ratings

Comprehensive inspections shall provide numerical ratings as described in Section 4.2.4 above for all structural components and/or equipment inspected.

5. Documentation and record maintenance

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

a) Category of structural component or equipment.

b) Name, location, and age of the structural component or equipment.

c) Date of most recent routine, intermediate, or comprehensive inspections.

d) Most recent rating for the structural component or equipment.

e) Subsequent maintenance provided as a direct result of said inspection.

f) Independent engineering assessment, if applicable.

g) Graphic exhibition, if applicable.

h) Date of next scheduled inspection which shall conform to the frequency of the inspection cycle adopted.

Annexes B-E provide examples of inspection documentation.
Annex A

(Informative)

Bibliography


Annex B

(Informative)

Station inspection report

<table>
<thead>
<tr>
<th>Station</th>
<th>1</th>
<th>2</th>
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<th>4</th>
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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 rest room
C5 Signage vandalized above stairway P6
C7 Lights out in cleaners room north mezzanine
Annex C

(Informative)

**Lighting inspection report**

Date (MM/DD/YY): ___________  Station Name: _________________  Line: _______________

Inspection (Y/N): ___________

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

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Mezzanine

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<th>And</th>
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Toilets

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**Electrical Distribution Room Inspection**

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<th>N=No</th>
<th>Normal</th>
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<th>N=No</th>
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<td>LADDER AVAILABLE</td>
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<td>STAIRBOX AVAILABLE</td>
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<td>FIRE EXITING OK</td>
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<td>RUBBER MATS OK</td>
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<td>ROOM LIGHTING OK</td>
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**FUSES**

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<th>CIRCUIT NO</th>
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LIGHT MAINTAINER SIGNATURE ___________________________  SUPERVISOR’S INITIAL _________

LIGHT MAINTAINER SIGNATURE ___________________________  USE BACK FOR REMARKS
Annex D

(Informative)

Concrete and structural steel inspection

Rating criteria

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

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. Petrographic 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 walkthrough/visual inspection
13. Strain gage analysis
14. Test pits/probe/concrete removal
15. Structural steel alignment sweep and deflection survey
Annex E

(Informative)

Concrete and structural steel inspection

<table>
<thead>
<tr>
<th>Date of Inspection:</th>
<th>5/26/02</th>
<th>Inspected By:</th>
<th>DA, JP</th>
<th>Station Data:</th>
<th>Mezzanine:</th>
<th>Elevated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Station Number:</td>
<td>25</td>
<td>Weather:</td>
<td>50 F, Sunny</td>
<td>Platform:</td>
<td>2</td>
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<tr>
<td>Station Name:</td>
<td>Independence Avenue</td>
<td>Tracks:</td>
<td>3</td>
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<tr>
<td>Line:</td>
<td>Green</td>
<td>Overall Condition:</td>
<td>5</td>
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<table>
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<tr>
<th>Level/Component</th>
<th>Rating</th>
<th>Condition</th>
<th>Qty.</th>
<th>Photo</th>
<th>Location</th>
<th>Test</th>
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<tbody>
<tr>
<td>Street</td>
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<td></td>
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</tr>
<tr>
<td>Beam Connection</td>
<td>5</td>
<td>Missing bolts and brackets</td>
<td>2.00 EA.</td>
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<tr>
<td>Bracing</td>
<td>3</td>
<td>Moderate corrosion</td>
<td>180.00 LF</td>
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<td>Column</td>
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<td>Severe section loss and bent @ web &amp; flange</td>
<td>1.00 EA.</td>
<td></td>
<td>6</td>
<td>07-1</td>
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<tr>
<td></td>
<td>5</td>
<td>Severe section loss @ base</td>
<td>5.00 EA.</td>
<td>25-01</td>
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<tr>
<td>Column Drain</td>
<td>3</td>
<td>Bent</td>
<td>1.00 EA.</td>
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<tr>
<td>Column Encasement</td>
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<td>Severe spall &amp; severe section loss</td>
<td>15.00 SF</td>
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<td>7</td>
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<tr>
<td>Drain</td>
<td>4</td>
<td>Missing</td>
<td>10.00 EA.</td>
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<td>Mezzanine</td>
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<tr>
<td>Ceiling Slab</td>
<td>4</td>
<td>Heavy deterioration of wood planks</td>
<td>400.00 SF</td>
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<td>9</td>
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<tr>
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<td>3</td>
<td>Moderate scaling</td>
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<td></td>
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<td>Heavy spall with exposed rebar</td>
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<td>Severe deterioration of wearing surface and ½” deep spalls</td>
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<td>Under Deck Beam</td>
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<td>Heavy section loss</td>
<td>100.00 LF</td>
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<td>07-2</td>
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<td>5</td>
<td>Severe section loss at connection</td>
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<td>Underdeck Walls</td>
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<td>Canopy</td>
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<td>Heavy deterioration and rotting</td>
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<td>Heavy deterioration and rotting along perimeter</td>
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<td>Heavy delamination @ top flange &amp; connection</td>
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<td>Moderate section loss</td>
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