APTA STANDARDS PROGRAM

STANDARD

**APTA PR-CS-S-020-03, Rev. 2**

First Published: September 28, 2003

First Revision: March 2, 2004

Second Revision: February 10, 2025

**PRESS Construction and Structural Working Group**

# Passenger Rail Vehicle Structural Repair

**Abstract:** This standard provides the minimum requirements for structural repairs to passenger railroad equipment.

**Keywords:** passenger rail vehicles, structural repair, structural repair procedure, welding repair

**Summary:** This standard provides standard industry-accepted practices, procedures and quality assurance processes to be used for the evaluation and repair of structural damage to passenger railroad equipment.

## Foreword

The American Public Transportation Association is a standards development organization in North America. The process of developing standards is managed by the APTA Standards Program's Standards Development Oversight Council (SDOC). These activities are carried out through several standards policy and planning committees that have been established to address specific transportation modes, safety and security requirements, interoperability, and other topics.

APTA used a consensus-based process to develop this document and its continued maintenance, which is detailed in the manual for the APTA Standards Program. This document was drafted in accordance with the approval criteria and editorial policy as described. Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

This document was prepared by the Construction and Structural Working Group as directed by the Passenger Rail Equipment Safety Standards Policy Planning Committee.

This document represents a common viewpoint of those parties concerned with its provisions, namely transit operating/planning agencies, manufacturers, consultants, engineers and general interest groups. APTA standards are mandatory to the extent incorporated by an applicable statute or regulation. In some cases, federal and/or state regulations govern portions of a transit system's operations. In cases where there is a conflict or contradiction between an applicable law or regulation and this document, consult with a legal adviser to determine which document takes precedence.

This document supersedes APTA PR-CS-S-020-03, Rev. 1, which has been revised. Below is a summary of changes from the previous document version:

- Added clarity to abstract, summary, and scope and purpose.
- Section 1: Added examples for consideration when selecting a repair facility.
- Section 3: Removed repetitive verbiage on OEM documentation.
- Section 4: Clarified cribbing/cradling and repair supports. Removed generalized verbiage on how to remove damaged material.
- Section 5: Redefined the Repair Plan and made it optional when appropriate.
- Section 6: Added that weld joint configuration changes shall prompt calculations.
- Section 7: Added allowance for CWB to substitute AWS and allowance for EN codes if used by OEM. Added allowance for EN or other equivalent weld standards if approved by owner.
- Section 8: Broadened and detailed the purpose and scope of Repair Procedures and Quality Control Plan. Broadened which quality control documents shall be available on-site. Added requirement for plug welds to be approved by owner and clarified that ring welds do not require approval.
- Section 9: Reiterated that all material changes require owner approval and added references to assist equivalence evaluations. Clarified that only material changes require compliance to the applicable APTA material standard.
- References: Added C1.1 and D17.2 to list of AWS references for spot welds.
- Definitions: Added multiple new definitions.

# Table of Contents

## Participants

The American Public Transportation Association greatly appreciates the contributions the subworking group responsible for the drafting of this document. During the drafting of this document, the subworking group members included:

**Jason Hesse**, STV Inc, *Lead*

Javier Estrada Alvarez
Gabriel Amar, *Systra*
Fabrice Benizeau,
Paul Burys, *Raul V. Bravo + Associates*
Ignasi Casamayor
Sabrina Eisl, *SEPTA*
Michael Gill, *Atkins Global NA*
Manuel Gonzalez
Jiang Jin
Wayne Krahn, *SEPTA*
John Macewan, *SEPTA*
Robert MacNeill, *Simpson Gumpertz & Heger*
Michele Maggini
Eloy Martinez, *Hatch LTK*
Francis Mascarenhas, *Metra*
Francesco Maldari, *MTA Long Island Rail Road*
Skender Nezaj, *WSP*
Bogar-Mayel Pulido
Stephen Rogowski
Mehrdad Samani, *Hatch LTK*
Gerhard Schmidt, *Siemens Mobility*
Narayana Sundaram, *APTA*
Chris Testi
Stuart Trout, *MTA Metro-North Railroad*
Richard Williams
John Winter, *Delaware Car Company*
Jackson Xue, *WSP*
Martin Young, *Sound Transit*
Jean-Pierre Lapointe, *Alstom*

At the time this standard was completed, the PRESS Construction and Structural Working Group included the following members:

**Martin Young**, Sound Transit, *Chair*
**Mehrdad Samani**, Jacobs, *Vice Chair*
**Francis Mascarenhas**, Metra, *Secretary*

Hamed Abshari, *CDM Smith*
Gabriel Amar, *Systra*
Enrique Arroyo-Rico, *Alstom*
Juan Barahona, *Talgo*
Evelyne Berthomme, *Alstom*
Shafal Bhushan, *Baker Bellfield*
Martin Bigras, *Alstom*
Robert Bocchieri, *Applied Research Associates*
Paul Callaghan, *Transport Canada*
Luiz Cano Fernandez, *Alstom*
Bruce Cardon, *Metro Transit*
Michael Carolan, *Volpe Center*
Robert Cook, *SCRRA*
Joshua Coran, *Talgo*
Sean Cronin, *Metra*
Felipe Czank, *Alstom*
Marc DeLong, *VTA*
Harold Ellsworth, *Wabtec*
Shaun Eshraghi, *Volpe Center*
Steve Finegan, *Finegan Rail Consulting*
Christian Forstner, *Seisenbacher Rail Interiors*
Tom Freeman, *International Name Plate Supplies*
Andre Gagne, *Alstom*
Michael Gill, *AtkinsRéalis*
Robert Glen, *Jacobs*
Garrett Goll, *Voith US | VTI*
Travis Gorhum, *ENSCO Rail*
Glenn Gough, *Siemens Mobility*
Yosi Grunberg, *WSP*
Christian Gshnitzer-Baernthaler, *Alstom*
Dong Keun Ha, *SCRRA*
Nicholas Harris, *HNTB Corporation*
Jason Hesse, *STV Inc.*
Karina Jacobsen, *Volpe* Center

Paul Jamieson, *Retired*
Robert Jones, *Stadler*
Larry Kelterborn, *LDK Advisory*
Joseph Kenas, *Alstom*
Steven Kirkpatrick, *Applied Research Associates*
Rick Komm, *Keil*
Lukasz Kozdeba, *Canadian Railway Services*
Pierre Laberge, *Alstom*
Jean-Pierre Lapointe, *Alstom*
Peter Lapre, *Federal Railroad Administration*
Dominique Le Corre, *Alstom*
Ana Maria Leyton, *Transport Canada*
Patricia Llana, *Volpe* Center
William Luebke, *Kiel*
Robert MacNeill, *Simpson Gumpertz & Heger*
Francesco Maldari, *MTA Long Island Railroad*
John Manutes, *Federal Railroad Administration*
James Marks, *Canadian Railway Services*
Eloy Martinez, *HNTB Corporation*
Ronald Mayville, *Retired*
Patrick McCunney, *AtkinsRéalis*
James Michel, *AREMA*
Tomoyuki Minami, *JR Central*
Juergen Neudorfsky, *Seisenbacher Rail Interiors*
Steve Orzech, *Freedman Seating Company*
Chase Patterson, *Voith US | VTI*
Thomas Peacock, *AtkinsRéalis*
Benoit Poulin, *Alstom*
Anand Prabhakaran, *Sharma & Associates, Inc.*
Matthew Raun, *Stadler*
Joseph Reynolds, *MTA Long Island Rail Road*
Denis Robillard, *Baultar Concept*
Thomas Rutkowski, *Brightline Trains Florida*
Jean-Francios Savaria, *Alstom*
Bryan Sawyer, *UTA*
Gavin Schaefer, *Sound Transit*
Brian Schmidt, *San Joaquin Reg. Rail Commis.*
Gerhard Schmidt, *Siemens Mobility*
Martin Schroeder, *Jacobs*
David Seenath, *Metrolinx (GO Transit)*
Frederic Setan, *Alstom*
Kristine Severson, *Volpe* Center
Melissa Shurland, *Federal Railroad Administration*
Gunneet Singh, *Hatch*
Nick Sorensen, *Utah Transit Authority*
Benjamin Spears, *Hatch*
Rick Spencer, *Knorr Brake Corp.*
Jeremy Spilde, *Metro Transit*
Alois Starlinger, *Stadler*
Laura Sullivan, *Volpe Center*
Lukasz Szymsiak, *VIA Rail Canada*
Mehdi Taheri, *Raul V. Bravo + Associates*
Ryan Taylor, *Hatch*
Jason Thomas, *Metra*
Michael Trosino, *Amtrak*
Stuart Trout, *Retired*
Rudy Vazquez, *Amtrak*
Clifford Woodbury, *Hatch*
Jackson Xue, *WSP*
Tamar Yassa, *Transport Canada*
Theresa Zemelman, *Raul V. Bravo + Associates*
Steven Zuiderveen, *Federal Railroad Administration*

**Project team**
Narayana Sundaram, *American Public Transportation Association*

## Introduction

*This introduction is not part of APTA PR-CS-S-020-03, "Passenger Rail Vehicle Structural Repair."*

This standard applies to the following:

1. Railroads that operate intercity or commuter passenger train service on the general railroad system of transportation.
2. Railroads that provide commuter or other short-haul rail passenger train service in a metropolitan or suburban area, including public authorities operating passenger train service.

This standard does not apply to the following:

1. Rapid transit operations in an urban area that are not connected to the general railroad system of transportation.
2. Tourist, scenic, historic or excursion operations, whether on or off the general railroad system of transportation.
3. Operation of private cars, including business/office cars and circus trains.
4. Railroads that operate only on track inside an installation that is not part of the general railroad system of transportation.

## Scope and purpose

This standard applies to passenger equipment and provides requirements to restore carbody damage to its originally intended structural performance. Guidance is given on best practices if the repair's corrective action requires 1) replacing components in kind, 2) requiring modification from the original design or 3) corrosion revitalization. This standard does not cover repairs to brakes, trucks, motors, engines, HVAC systems, doors, or wiring and piping, nor does it cover minor repairs, such as roof leaks or side sheet tears. Although the cosmetic appearance of repaired passenger equipment is important, it is not within the scope of this standard.

# Passenger Rail Vehicle Structural Repair

## 1. Repair facilities

All weld repairs shall be conducted by a repair shop/maintenance facility whose processes, quality standards, equipment and welders comply in all respects with requirements of the applicable AWS or CWB codes, OEM EN welding standards, or owner-approved equivalent welding standards for the materials used.

The following shall be considered when selecting the repair shop/maintenance facility and suppliers:

- previous experience and similar railcar repair
- personnel, management and engineering
- access to equipment, procedures and/or suppliers necessary to fabricate parts and complete repairs
- industry standard quality control practices

## 2. Inspection of repair area

Prior to beginning any work on damaged equipment, an assessment of the vehicle structure in the area where the repairs are to be made shall be performed to ensure that the car structure can be returned to the same level of structural integrity—as well as form, fit and function—as when first manufactured. Removal of some components or members may be necessary to complete this assessment.

An Assessment Report shall be made stating each item or member damaged, its location on the vehicle, and the type and extent of damage (e.g., “Draft sill buckled, web torn, weld at web/bottom plate joint failed”). The report shall indicate whether each part is to be repaired in place or replaced with a new one. Missing components shall also be noted in the report.

The Assessment Report should address possible hidden damage and unseen but anticipated damage. The Assessment Report shall be submitted to the owner for review and approval.

Depending on the extent of the damage, a second inspection should be performed after removal of all damaged parts, and any new information should be included in the inspection report.

## 3. Design information

If available, vehicle owners shall make the OEM drawings and/or specifications available to the contractors for review. If not, inspection and analysis of the as-built structure and materials can suffice with the approval of the owner.

## 4. Preparation

Prior to beginning any repair, the vehicle shall undergo a thorough inspection to determine the best method of supporting the structure during the repair procedure. Where necessary, supports shall be located in a manner to minimize any sagging or distortion to any part of the undamaged vehicle when damaged areas are cut away. The repair area shall be supported at positions on the car with sufficient strength to carry the loads and

 

to account for load redistribution that might occur by cutting away materials during the repair. The supports shall prevent sagging or other deformations during the repair. Cribbing using timbers or other means shall be used to distribute the load when necessary.

## 5. Repair Plan

The purpose of a Repair Plan is to communicate to the equipment owner the repair contractor's standard approach for the repairs in question. The Repair Plan is highly recommended for all extensive repairs and should also be considered for less extensive repairs. Repairs that entail a simple or routine scope can be defined within the project's Repair Procedures per Section 8.1, allowing the Repair Plan to be omitted.

The Repair Plan should be prepared based on the assessment described in Section 2, outlining the overall scope of the repairs, a generalized repair approach, quality control methods and the expected final condition of the repaired area. Each damaged item or member shall be listed in the Repair Plan with indication of whether the approach will be to repair or replace them. Preexisting practices and techniques that are expected to be used in developing the Repair Procedures of Section 8.1 should be included.

The Repair Plan must be submitted to the owner for review and approval as early in the project as feasible but before Calculations Report or Repair Procedures submittals. Project activities can proceed concurrently during the plan review, if agreed upon with the owner.

## 6. Repair strength

The goal of structural repairs shall be to restore the damaged area to its original configuration, strength level and crashworthiness, unless the equipment owner intends to modify the vehicle.

If applicable, the equipment owner and repair contractor shall agree on an allowance threshold for corrosion.

If the Repair Plan calls for replacing members in kind—i.e., with pieces of the same material (alloy, thickness, temper and finish), size, shape, and connection details—then no calculations shall be required. However, if any members are to be spliced, made of different material, welded with a different joint configuration or assembled from components different from the original, then calculations shall be required to show that the original strength levels will be achieved.

Calculations shall take into account the following: yield and ultimate strengths of the repair materials compared with the original materials; shape factors; buckling strength; strength and stiffness of splices and connections; collision loading; crashworthiness; and the effect of welding on strength, residual stresses and the service performance. The original vehicle design calculations may be used where appropriate.

A Calculations Report shall be submitted for review in a format acceptable to the equipment owner.

## 7. Workmanship and qualifications

All repairs shall be done in accordance with the Repair Procedures described in Section 8.1 and in accordance with the workmanship requirements of the applicable AWS code: C1.1, D1.1, D1.2, D1.3, D1.6, D15.1 and D17.2.

Equivalent CWB codes may be used in place of the AWS requirements in this standard. EN welding codes may be used in place of AWS requirements in this standard if the vehicle was designed and/or manufactured per the same EN welding and inspection codes. With owner approval, EN or other alternative equivalent welding codes may be used, even if not designed and/or manufactured per the same welding and inspection codes.

 

Welding procedures shall be either prequalified or test qualified in accordance with the requirements of the applicable AWS standards: D1.1, D1.2, D1.3, D1.6 and D15.1. Personnel performing any welding shall have valid AWS qualifications specific to the application, in accordance with the AWS: C1.1, D1.1, D1.2, D1.3, D1.6, D15.1 and D17.2.

Personnel inspecting welds shall be qualified in accordance with AWS Certified Welding Inspector program requirements. Personnel performing nondestructive testing of welds shall be qualified to ASTM International and/or American Society for Nondestructive Testing (ASNT) standards for the nondestructive testing (NDT) method applied.

# 8. Repair process

## 8.1 Repair Procedures

Before any material is added or reinstalled, Repair Procedures or process sheets shall be prepared for each repair based on the Repair Plan described in Section 5 and shall be submitted to the owner for review and approval. The Repair Procedures shall sequence the removal and installation of material by detailing, at a minimum, whether the replacement is partial or entire, locations and techniques of cutting and splicing, material information, bracing and layout procedures, inspection points, and welding information including heat treatment information.

Any changes to or deviations from the Repair Procedures shall be fully documented and shall require approval by the owner. If drawings and/or sketches are required as part of the Repair Procedures, see Section 8.3.

## 8.2 Quality Control Plan

Prior to beginning any repair, a Quality Control Plan shall be prepared for the overall project and be specific to the tasks to be accomplished. At a minimum, the Quality Control Plan shall provide general details to applicable documentation control, material control, critical inspections, hold points, testing, equipment calibration and personnel qualification records. The Quality Control Plan shall be included in the Repair Plan for review and approval.

The repair operations shall be available for inspection by the equipment owner at all times. Detailed quality control documents, process sheets, drawings, weld procedures and personnel qualification records for all work in progress shall be available at the work site. Welder qualification records shall be maintained at the work site or as agreed to by the owner. Material certifications shall be submitted to the owner prior to any fabrication.

> **NOTE:** Limits on cosmetic items such as flatness, indentations, surface preparation prior to painting, etc. should, if necessary, be established by mutual agreement between the contractor and the equipment owner.

## 8.3 Fabrication

Drawings and/or sketches shall be prepared for all parts to be fabricated, showing material, temper, thickness, bend radii, grain orientation (if necessary), tolerances, size and shape.

Stainless steel shall be processed only with machines reserved for stainless steel or that have been completely cleaned of any carbon steel residue.

Aluminum alloys shall not be cut by thermal means, and stainless steel and aluminum alloys shall not be heated for fabrication, unless the specific process has been reviewed with and agreed to by the owner.

 

Welds shall be made only where and as shown on drawings, weld procedures and process sheets.

Aluminum components shall not be heated for straightening, fit correction or any other purpose. Carbon steel and stainless steel components shall be heated only when the proposed heating process and temperature limits are specifically approved by the owner.

Before welding is started, all parts to be joined shall be properly cleaned of coatings and films such as paint, zinc, rust, oxides, mill scale, oil, grease and other foreign materials. Cleaning materials and processes shall be approved by the equipment owner.

## 8.4 Welding procedure

All welding processes and procedures shall comply with applicable AWS codes specified in the References section of this document. As required by the owner, a detailed Welding Procedure Specification Form (Data Sheet) specific to the application shall be completed prior to performing each weld repair.

The owner shall have the right to require the making of test welds to settle any question that may arise as to the suitability of any welding method or procedure used during production. AWS codes shall be followed in the making of tests and the settlement of other questions that may arise regarding welding practice.

All welding consumables shall be purchased to conform to applicable AWS specifications; provided in packages of convenient size; and marked with the manufacturer's name and the specification, classification, diameter, net weight and other characteristics of the material. The consumables shall be stored conforming to the applicable AWS codes so as to protect them from damage, and so they can be easily identified. Material shall be issued and handled in such a way as to prevent it from being mixed with that of another specification.

Joint welding procedures that are to be employed shall be qualified by conforming to the AWS standards listed in the References section of this document. When the procedure is required to be qualified by test, a written procedure qualification record shall be prepared in accordance with the applicable AWS codes. When the appropriate AWS standard listed in the References section allows the use of prequalified joints, these joints shall conform in all respects to the provisions of the applicable AWS codes in order to be exempt from testing.

All parts to be joined by welding shall be adequately supported or held in their proper position by appropriate tables, jigs and/or fixtures. The method of depositing weld metal shall be chosen to minimize warpage. All complete penetration welds made from one side without backing or back gouging shall be qualified by test using production welding techniques and welders. Where partial penetration welds are proposed, the contractor shall provide design calculations supporting the weld size desired and conduct tests to prove that production welding shall achieve the required penetration with an acceptable margin of safety.

Finished welds shall present a clean appearance and quality consistent with the AWS standards referenced in the References section of this document. Grinding of welds and surface restorations such as paint, buffing of stainless steel, etc. shall be consistent with the owner's specifications and directives.

Heat treatment or stress relief, if required, shall be performed in accordance with the applicable AWS codes and ASTM specification for the material involved, or the recommendations of the material manufacturer.

Plug welds shall be approved by the owner and be permitted only with extra-low-carbon stainless steel and shall not be used in aluminum alloys. However, ring welds shall not require explicit approval.

If spot welds are used, they shall be in accordance with AWS C1.1, AWS D17.2 and MIL-W-5868.

 

The extent to which these referenced publications are applied shall be in accordance with the original fabrication configuration or as agreed upon between repair contractor and owner.

# 9. Materials

## 9.1 General

If OEM material specifications are not available, then a metallurgical analysis shall be made of a material sample taken from the damaged part or from structure adjacent to the area to be repaired. Care shall be taken to ensure that excessive heat or corrosion has not compromised the sample characteristics.

Materials selected for repair shall equal or exceed the characteristics determined by analysis regarding their yield and ultimate strength, ductility, corrosion resistance, and chemistry. Vehicle owners shall approve all material changes. Material changes can be assessed for equivalence using the following references:

- ASTM DS67D-EB, Handbook of Comparative World Steel Standards, 5th Edition, 2016
- ASM International, Worldwide Guide to Equivalent Irons and Steels, 5th Edition, 2006
- ASM International, Worldwide Guide to Equivalent Nonferrous Metals & Alloys, 4th Edition, 2001
- ASM International Handbook:
    - Volume 1: Properties and Selection of Irons, Steels and High Performance Alloys, 1990
    - Volume 2: Properties and Selection: Nonferrous Alloys and Special-Purpose Materials, 1990
    - Volume 2A: Aluminum Science and Technology, 2019
    - Volume 2B: Properties and Selection of Aluminum Alloys, 2019

## 9.2 HSLA and low-carbon steel

HSLA and low-carbon steel material changes shall be per APTA PR-CS-S-034-99, “Design and Construction of Passenger Railroad Rolling Stock,” or an equivalent approved by the owner.

## 9.3 Stainless steel

Stainless steel material changes shall be per APTA PR-CS-S-004-98, “Austenitic Stainless Steel for Railroad Passenger Equipment,” or an equivalent approved by the owner.

## 9.4 Aluminum

Aluminum material changes shall be per APTA PR-CS-S-015-99, “Aluminum and Aluminum Alloys for Passenger Car Body Construction,” or an equivalent approved by the owner.

# 10. Inspection

After completing the repair, a thorough inspection of welds shall be performed by authorized personnel in accordance with the requirements of the AWS or other applicable standard and under the supervision of a certified welding inspector. All welds shall be visually inspected. In addition, welds in critical (highly stressed) areas shall be inspected using appropriate NDT methods. The Repair Procedures or Repair Plan shall specify critical areas and NDT methods for specific welds. Welds not meeting the inspection acceptance criteria specified in the referenced applicable welding standard documents shall be repaired and reinspected.

Inspection records shall be maintained at the work site or as agreed to by the owner.

 

The following industrial standards and specifications are recommended for inspection of welds:

**Visual examination**
AWS D1.1, Part C (use criteria for cyclically loaded structures)

**Dye penetrant examination**
ASTM E165, E1417

**Magnetic particle examination**
ASTM E709, E1444

**Radiographic examination**
ASTM E94, E390, E1032, E1742
AWS D1.1-2002, Part E

**Ultrasonic examination**
ASTM E114, E164, E1901
AWS D1.1-2002, Part F or Annex K

**Qualification of NDT personnel**
ASTM C1490

 

## Related APTA standards

**APTA PR-CS-S-004-98,** "Structural Stainless Steels for Railroad Passenger Equipment"
**APTA PR-CS-S-015-99,** "Aluminum and Aluminum Alloys for Passenger Car Body Construction"
**APTA PR-CS-S-034-99,** "Design and Construction of Passenger Railroad Rolling Stock"

## References

This standard shall be used in conjunction with the latest revision of the following publications.

American Welding Society standards:

- AWS C1.1, Recommended Practices for Resistance Welding
- AWS D1.1, Structural Welding Code – Steel
- AWS D1.2, Structural Welding Code – Aluminum
- AWS D1.3, Structural Welding Code – Sheet Steel
- AWS D1.6, Structural Welding Code – Stainless Steel
- AWS D15.1, Railroad Welding Specification – Cars and Locomotives
- AWS D17.2, Specification for Fusion Welding of Aerospace Applications

ASTM International standards:

- ASTM C1490, Standard Guide for the Selection, Training and Qualification of Nondestructive Assay (NDA) Personnel
- ASTM DS67D-EB, Handbook of Comparative World Steel Standards
- ASTM E94, Method for Controlling Quality of Radiographic Testing
- ASTM E114-95 (2001), Standard Practice for Ultrasonic Pulse-Echo Straight-Beam Examination by the Contact Method
- ASTM E164, Standard Practice for Ultrasonic Contact Examination of Weldments
- ASTM E165, Standard Test Method for Liquid Penetrant Examination
- ASTM E390, Standard Reference Radiographs for Steel Fusion Welds
- ASTM E709, Standard Guide for Magnetic Particle Examination
- ASTM E1032, Standard Test Method for Radiographic Examination of Weldments
- ASTM E1417, Standard Practice for Liquid Penetrant Examination
- ASTM E1444, Standard Practice for Magnetic Particle Examination
- ASTM E1742, Standard Practice for Radiographic Examination
- ASTM E1901, Standard Guide for Detection and Evaluation of Discontinuities by Contact Pulse-Echo Straight-Beam Ultrasonic Methods

MIL-W-5868, "Weld Resistance Spot and Seam"

## Definitions

**hidden damage:** Damage found after the repair work has started.

**modification:** A change to the structure changing the original equipment manufacturer's configuration. Changes can include but are not limited to a component being spliced or changes to its material type, thickness, size, shape or weld configuration.

**original strength level:** The strength of a specific area of structure from the original equipment manufacturer's configuration. This includes the intended design strength and its actual margin of safety.

**passenger equipment:** Refer to definition provided in 49 CFR §238.5.

 

**Repair Plan:** A set of guidelines on how to select and repair different types of damage found in a vehicle's structure. Details are kept broad to allow application to multiple areas of damage. A Repair Plan may reference Repair Procedures for specific types of damage.

**Repair Procedures:** A set of specific process sheets, manufacturing instructions or facility procedures detailing sequential steps to repair a specific damaged area found in a vehicle's structure.

**unseen but anticipated damage:** Hidden damage that is expected based upon the assessment inspection of the damaged vehicle.

## Abbreviations and acronyms

**ASM** ASM International (formerly the American Society for Metals)
**ASNT** American Society for Nondestructive Testing
**ASTM** ASTM International (formerly the American Society for Testing and Materials)
**AWS** American Welding Society
**CWB** Canadian Welding Bureau
**EN** Euronorm
**LAHT** low-alloy, high-tensile
**HSLA** high-strength, low-alloy
**NDT** nondestructive test
**OEM** original equipment manufacturer

## Document history

| Document Version | Working Group Vote | Public Comment/ Technical Oversight | Rail CEO Approval | Policy & Planning Approval | Publish Date |
|---|---|---|---|---|---|
| First published | — | — | — | May 23, 2003 | Sept. 28, 2003 |
| First revision | — | — | — | — | March 22, 2004 |
| Second revision | August 30, 2024 | November 1, 2024 | Nov. 23, 2024 | Feb. 9, 2025 | Feb. 10, 2025 |

 