

# **SIMON**

**U.S. Department of Transportation  
Federal Railroad Administration - Office of Safety**

## **Code of Federal Regulations**

**Title 49**



### **Track Safety Standards Part 213**

### **Subpart A to F Class of Track 1-5 Includes Defect Codes**

*Includes all revisions through  
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*Distributed By:*

***The Railway Educational Bureau***



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Authority: 49 U.S.C. 20102-20114 and 20142; 28 U.S.C. 2461; note; and 49 CFR 1.49(m).

Executive Order 12812

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## Part 213 – Track Safety Standards

### Subpart A — General

#### § 213.1 Scope of part.

- (a) This part prescribes minimum safety requirements for railroad track that is part of the general railroad system of transportation. The requirements prescribed in this part apply to specific track conditions existing in isolation. Therefore, a combination of track conditions, none of which individually amounts to a deviation from the requirements in this part, may require remedial action to provide for safe operations over that track. This part does not restrict a railroad from adopting and enforcing additional or more stringent requirements not inconsistent with this part.
- (b) Subparts A through F apply to track Classes 1 through 5. Subpart G and 213.2, 213.3, and 213.15 apply to track over which trains are operated at speeds in excess of those permitted over Class 5 track.

#### § 213.2 Preemptive effect.

Under 49 U.S.C. 20106, issuance of these regulations preempts any State law, regulation, or order covering the same subject matter, except an additional or more stringent law, regulation, or order that is necessary to eliminate or reduce an essentially local safety hazard; is not incompatible with a law, regulation, or order of the United States Government; and that does

not impose an unreasonable burden on interstate commerce.

### § 213.3 Application.

- (a) Except as provided in paragraph (b) of this section, this part applies to all standard gage track in the general railroad system of transportation.
- (b) This part does not apply to track—
  - (1) Located inside an installation which is not part of the general railroad system of transportation; or
  - (2) Used exclusively for rapid transit operations in an urban area that are not connected with the general railroad system of transportation.

### § 213.4 Excepted track.

A track owner may designate a segment of track as excepted track provided that—

- (a) The segment is identified in the timetable, special instructions, general order, or other appropriate records which are available for inspection during regular business hours;
- (b) The identified segment is not located within 30 feet of an adjacent track which can be subjected to simultaneous use at speeds in excess of 10 miles per hour;
- (c) The identified segment is inspected in accordance with 213.233(c) and 213.235 at the frequency specified for Class 1 track;

- (d) The identified segment of track is not located on a bridge including the track approaching the bridge for 100 feet on either side, or located on a public street or highway, if railroad cars containing commodities required to be placarded by the Hazardous Materials Regulations (49 CFR part 172), are moved over the track; and
- (e) The railroad conducts operations on the identified segment under the following conditions:
- (1) No train shall be operated at speeds in excess of 10 miles per hour;
  - (2) No occupied passenger train shall be operated;
  - (3) No freight train shall be operated that contains more than five cars required to be placarded by the Hazardous Materials Regulations (49 CFR part 172); and
  - (4) The gage on excepted track shall not be more than 4 feet 10 $\frac{1}{4}$  inches. (This paragraph (e)(4) is applicable September 21, 1999.)
- (f) A track owner shall advise the appropriate FRA Regional Office at least 10 days prior to removal of a segment of track from excepted status.

### **§ 213.5 Responsibility for compliance.**

- (a) Except as provided in paragraph (b) of this section, any owner of track to which this part applies who knows or has notice that the track does not comply with the requirements of this part, shall—

## Subpart A

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- (1) Bring the track into compliance;
  - (2) Halt operations over that track; or
  - (3) Operate under authority of a person designated under § 213.7(a), who has at least one year of supervisory experience in railroad track maintenance, subject to conditions set forth in this part.
- (b) If an owner of track to which this part applies designates a segment of track as "excepted track" under the provisions of §213.4, operations may continue over that track without complying with the provisions of subparts B, C, D, and E of this part, unless otherwise expressly stated.
- (c) If an owner of track to which this part applies assigns responsibility for the track to another person (by lease or otherwise), written notification of the assignment shall be provided to the appropriate FRA Regional Office at least 30 days in advance of the assignment. The notification may be made by any party to that assignment, but shall be in writing and include the following-
- (1) The name and address of the track owner;
  - (2) The name and address of the person to whom responsibility is assigned (assignee);
  - (3) A statement of the exact relationship between the track owner and the assignee;
  - (4) A precise identification of the track;
  - (5) A statement as to the competence and ability of the assignee to carry out the duties of the track owner under this part; and

- 
- (6) A statement signed by the assignee acknowledging the assignment to him of responsibility for purposes of compliance with this part.
- (d) The Administrator may hold the track owner or the assignee or both responsible for compliance with this part and subject to penalties under §213.15.
- (e) A common carrier by railroad which is directed by the Surface Transportation Board to provide service over the track of another railroad under 49 U.S.C. 11123 is considered the owner of that track for the purposes of the application of this part during the period the directed service order remains in effect.
- (f) When any person, including a contractor for a railroad or track owner, performs any function required by this part, that person is required to perform that function in accordance with this part.

**§ 213.7 Designation of qualified persons to supervise certain renewals and inspect track.**

- (a) Each track owner to which this part applies shall designate qualified persons to supervise restorations and renewals of track under traffic conditions. Each person designated shall have—
- (1) At least—
- (i) 1 year of supervisory experience in railroad track maintenance; or

- (ii) A combination of supervisory experience in track maintenance and training from a course in track maintenance or from a college level educational program related to track maintenance;
  - (2) Demonstrated to the owner that he or she—
    - (i) Knows and understands the requirements of this part;
    - (ii) Can detect deviations from those requirements; and
    - (iii) Can prescribe appropriate remedial action to correct or safely compensate for those deviations; and
  - (3) Written authorization from the track owner to prescribe remedial actions to correct or safely compensate for deviations from the requirements in this part.
- (b) Each track owner to which this part applies shall designate qualified persons to inspect track for defects. Each person designated shall have—
- (1) At least—
    - (i) 1 year of experience in railroad track inspection; or
    - (ii) A combination of experience in track inspection and training from a course in track inspection or from a college level educational program related to track inspection;

- 
- (2) Demonstrated to the owner that he or she—
    - (i) Knows and understands the requirements of this part;
    - (ii) Can detect deviations from those requirements; and
    - (iii) Can prescribe appropriate remedial action to correct or safely compensate for those deviations; and
  - (3) Written authorization from the track owner to prescribe remedial actions to correct or safely compensate for deviations from the requirements of this part, pending review by a qualified person designated under paragraph (a) of this section.
- (c) Persons not fully qualified to supervise certain renewals and inspect track as outlined in paragraphs (a) and (b) of this section, but with at least one year of maintenance-of-way or signal experience, may pass trains over broken rails and pull aparts provided that—
- (1) The track owner determines the person to be qualified and, as part of doing so, trains, examines, and re-examines the person periodically within two years after each prior examination on the following topics as they relate to the safe passage of trains over broken rails or pull aparts: rail defect identification, crosstie condition, track surface and alinement, gage restraint, rail end mismatch, joint bars, and maximum distance between rail ends over which trains may be

allowed to pass. The sole purpose of the examination is to ascertain the person's ability to effectively apply these requirements and the examination may not be used to disqualify the person from other duties. A minimum of four hours training is adequate for initial training;

- (2) The person deems it safe and train speeds are limited to a maximum of 10 m.p.h. over the broken rail or pull apart;
  - (3) The person shall watch all movements over the broken rail or pull apart and be prepared to stop the train if necessary; and
  - (4) Person(s) fully qualified under § 213.7 of this part are notified and dispatched to the location promptly for the purpose of authorizing movements and effecting temporary or permanent repairs.
- (d) With respect to designations under paragraphs (a), (b), and (c) of this section, each track owner shall maintain written records of—
- (1) Each designation in effect;
  - (2) The basis for each designation; and
  - (3) Track inspections made by each designated qualified person as required by §213.241. These records shall be kept available for inspection or copying by the Federal Railroad Administration during regular business hours.

### § 213.9 Classes of track: operating speed limits.

- (a) Except as provided in paragraph (b) of this section and §§ 213.57(b), 213.59(a), 213.113(a), and 213.137(b) and (c), the following maximum allowable operating speeds apply—

[In miles per hour]

| Over track that meets all of the requirements prescribed in this part for — | The maximum allowable operating speed for freight trains is — | The maximum allowable operating speed for passenger--trains is — |
|---|---|--|
| Excepted track. . .   | 10  | N/A  |
| Class 1 track. . . .  | 10  | 15   |
| Class 2 track. . . .  | 25  | 30   |
| Class 3 track. . . .  | 40  | 60   |
| Class 4 track . . .   | 60  | 80   |
| Class 5 track . . .   | 80  | 90   |

- (b) If a segment of track does not meet all of the requirements for its intended class, it is reclassified to the next lowest class of track for which it does meet all of the requirements of this part. However, if the segment of track does not at least meet the requirements for Class 1 track, operations may continue at Class 1 speeds for a period of not more than 30 days without bringing the track into compliance, under the authority of a person designated under § 213.7(a), who has at least one year of supervisory experience in railroad track maintenance, after that person determines that operations may safely continue

and subject to any limiting conditions specified by such person.

**§ 213.11 Restoration or renewal of track under traffic conditions.**

If during a period of restoration or renewal, track is under traffic conditions and does not meet all of the requirements prescribed in this part, the work on the track shall be under the continuous supervision of a person designated under § 213.7(a) who has at least one year of supervisory experience in railroad track maintenance, and subject to any limiting conditions specified by such person. The term "continuous supervision" as used in this section means the physical presence of that person at a job site. However, since the work may be performed over a large area, it is not necessary that each phase of the work be done under the visual supervision of that person.

**§ 213.13 Measuring track not under load.**

When unloaded track is measured to determine compliance with requirements of this part, the amount of rail movement, if any, that occurs while the track is loaded must be added to the measurements of the unloaded track.

**§ 213.15 Penalties.**

- (a) Any person who violates any requirement of this part or causes the violation of any such requirement is subject to a civil penalty of at least \$550 and not more than \$11,000 per violation, except that: Penalties may be assessed against individu-

als only for willful violations, and, where a grossly negligent violation or a pattern of repeated violations has created an imminent hazard of death or injury to persons, or has caused death or injury, a penalty not to exceed \$27,000 per violation may be assessed. "Person" means an entity of any type covered under 1 U.S.C. 1, including but not limited to the following: a railroad; a manager, supervisor, official, or other employee or agent of a railroad; any owner, manufacturer, lessor, or lessee of railroad equipment, track, or facilities; any independent contractor providing goods or services to a railroad; any employee of such owner, manufacturer, lessor, lessee, or independent contractor; and anyone held by the Federal Railroad Administrator to be responsible under §213.5(d) or § 213.303(c). Each day a violation continues shall constitute a separate offense. See appendix B to this part for a statement of agency civil penalty policy.

- (b) Any person who knowingly and willfully falsifies a record or report required by this part may be subject to criminal penalties under 49 U.S.C. 21311.

### **§ 213.17 Waivers.**

- (a) Any owner of track to which this part applies, or other person subject to this part, may petition the Federal Railroad Administrator for a waiver from any or all requirements prescribed in this part. The filing of such a petition does not affect that person's responsibility for compliance with

that requirement while the petition is being considered.

- (b) Each petition for a waiver under this section shall be filed in the manner and contain the information required by part 211 of this chapter.
- (c) If the Administrator finds that a waiver is in the public interest and is consistent with railroad safety, the Administrator may grant the exemption subject to any conditions the Administrator deems necessary. Where a waiver is granted, the Administrator publishes a notice containing the reasons for granting the waiver.

### **§ 213.19 Information collection.**

- (a) The information collection requirements of this part were reviewed by the Office of Management and Budget pursuant to the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 *et seq.*) and are assigned OMB control number 2130-0010.
- (b) The information collection requirements are found in the following sections: §§ 213.4, 213.5, 213.7, 213.17, 213.57, 213.119, 213.122, 213.233, 213.237, 213.241, 213.303, 213.305, 213.317, 213.329, 213.333, 213.339, 213.341, 213.343, 213.345, 213.353, 213.361, 213.369.

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**Subpart B — Roadbed****§ 213.31 Scope.**

This subpart prescribes minimum requirements for roadbed and areas immediately adjacent to roadbed.

**§ 213.33 Drainage.**

Each drainage or other water carrying facility under or immediately adjacent to the roadbed shall be maintained and kept free of obstruction, to accommodate expected water flow for the area concerned.

**§ 213.37 Vegetation.**

Vegetation on railroad property which is on or immediately adjacent to roadbed shall be controlled so that it does not—

- (a) Become a fire hazard to track-carrying structures;
- (b) Obstruct visibility of railroad signs and signals:
  - (1) Along the right-of-way, and
  - (2) At highway-rail crossings; (This paragraph (b)(2) is applicable September 21, 1999.)
- (c) Interfere with railroad employees performing normal trackside duties;
- (d) Prevent proper functioning of signal and communication lines; or
- (e) Prevent railroad employees from visually inspecting moving equipment from their normal duty stations.



## Subpart C — Track Geometry

### § 213.51 Scope.

This subpart prescribes requirements for the gage, alinement, and surface of track, and the elevation of outer rails and speed limitations for curved track.

### § 213.53 Gage.

- (a) Gage is measured between the heads of the rails at right-angles to the rails in a plane five-eighths of an inch below the top of the rail head.
- (b) Gage shall be within the limits prescribed in the following table—

| Class of track                | The gage must be at least— | But not more than—   |
|-------------------------------|----------------------------|----------------------|
| Excepted track. . . . .       | N/A . . . . .              | 4'10 $\frac{1}{4}$ " |
| Class 1 track . . . . .       | 4'8" . . . . .             | 4'10"                |
| Class 2 and 3 track . . . . . | 4'8" . . . . .             | 4'9 $\frac{3}{4}$ "  |
| Class 4 and 5 track . . . . . | 4'8" . . . . .             | 4'9 $\frac{1}{2}$ "  |

### § 213.55 Alinement.

Alinement may not deviate from uniformity more than the amount prescribed in the following table:

[See Table next page]

56-58

| Class of track          | Tangent track  |  | Curved track   |  |
|-------------------------|--|--|--|--|
|                         | The deviation of the mid-off-set from a 62-foot line <sup>1</sup> may not be more than--- (inches) | The deviation of the mid-ordinate from a 31-foot chord <sup>2</sup> may not be more than--- (inches) | The deviation of the mid-ordinate from a 62-foot chord <sup>2</sup> may not be more than--- (inches) | The deviation of the mid-ordinate from a 31-foot chord <sup>2</sup> may not be more than--- (inches) |
| Class 1 track . . . . . | 5  | 3N/A   | 5  | 3  |
| Class 2 track . . . . . | 3  | 3N/A   | 3  | 1 <sup>3</sup> / <sub>4</sub>  |
| Class 3 track . . . . . | 1 <sup>3</sup> / <sub>4</sub>  | 1 <sup>1</sup> / <sub>4</sub>  | 1 <sup>3</sup> / <sub>4</sub>  | 1 <sup>1</sup> / <sub>2</sub>  |
| Class 4 track . . . . . | 1 <sup>1</sup> / <sub>2</sub>  | 1  | 1 <sup>1</sup> / <sub>2</sub>  | 5/8  |
| Class 5 track . . . . . | 3/4  | 1/2  | 3/4  | 5/8  |

<sup>1</sup> The ends of the line shall be at points on the gage side of the line rail, five-eighths of an inch below the top of the railhead. Either rail may be used as the line rail, however, the same rail shall be used for the full length of that tangential segment of track.

<sup>2</sup> The ends of the chord shall be at points on the gage side of the outer rail, five-eighths of an inch below the top of the railhead.

<sup>3</sup> N/A--Not Applicable.

**§ 213.57 Curves; elevation and speed limitations.**

(a) The maximum crosslevel on the outside rail of a curve may not be more than 8 inches on track Classes 1 and 2 and 7 inches on Classes 3 through 5. Except as provided in § 213.63, the outside rail of a curve may not be lower than the inside rail. (The first sentence of paragraph (a) is applicable September 21, 1999.)

(b)(1) The maximum allowable operating speed for each curve is determined by the following formula—

$$V_{\max} = -\sqrt{\frac{E_a + 3}{0.0007D}}$$

Where—

$V_{\max}$  = Maximum allowable operating speed (miles per hour).

$E_a$  = Actual elevation of the outside rail (inches).<sup>1</sup>

$D$  = Degree of curvature (degrees).<sup>2</sup>

(2) Table 1 of Appendix A is a table of maximum allowable operating speed computed in accordance with this formula for various elevations and degrees of curvature.

(c)(1) For rolling stock meeting the requirements specified in paragraph (d) of this section, the maximum operating speed for each curve may be determined by the following formula—

[For Notes ON <sup>1</sup>&<sup>2</sup> - See next page.]

$$V_{\max} = \sqrt{\frac{E_a + 4}{0.0007D}}$$

Where—

$V_{\max}$  = Maximum allowable operating speed  
(miles per hour).

$E_a$  = Actual elevation of the outside rail (inches).<sup>1</sup>

$D$  = Degree of curvature (degrees).<sup>2</sup>

- (2) Table 2 of Appendix A is a table of maximum allowable operating speed computed in accordance with this formula for various elevations and degrees of curvature.
- (d) Qualified equipment may be operated at curving speeds determined by the formula in paragraph (c) of this section, provided each specific class of equipment is approved for operation by the Federal Railroad Administration and the railroad demonstrates that:
- (1) When positioned on a track with a uniform 4-inch superelevation, the roll angle between the floor of the equipment and the horizontal does not exceed 5.7 degrees; and

---

<sup>1</sup>Actual elevation for each 155 foot track segment in the body of the curve is determined by averaging the elevation for 10 points through the segment at 15.5 foot spacing. If the curve length is less than 155 feet, average the points through the full length of the body of the curve.

<sup>2</sup>Degree of curvature is determined by averaging the degree of curvature over the same track segment as the elevation.

- 
- (2) When positioned on a track with a uniform 6 inch superelevation, no wheel of the equipment unloads to a value of 60 percent of its static value on perfectly level track, and the roll angle between the floor of the equipment and the horizontal does not exceed 8.6 degrees.
  - (3) The track owner shall notify the Federal Railroad Administrator no less than 30 calendar days prior to the proposed implementation of the higher curving speeds allowed under the formula in paragraph (c) of this section. The notification shall be in writing and shall contain, at a minimum, the following information—
    - (i) A complete description of the class of equipment involved, including schematic diagrams of the suspension systems and the location of the center of gravity above top of rail;
    - (ii) A complete description of the test procedure<sup>3</sup> and instrumentation used to qualify the equipment and the maximum values for wheel unloading and roll angles which were observed during testing;

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<sup>3</sup>The test procedure may be conducted in a test facility whereby all the wheels on one side (right or left) of the equipment are alternately raised and lowered by 4 and 6 inches and the vertical wheel loads under each wheel are measured and a level is used to record the angle through which the floor of the equipment has been rotated.

- (iii) Procedures or standards in effect which relate to the maintenance of the suspension system for the particular class of equipment; and
  - (iv) Identification of line segment on which the higher curving speeds are proposed to be implemented.
- (e) A track owner, or an operator of a passenger or commuter service, who provides passenger or commuter service over trackage of more than one track owner with the same class of equipment may provide written notification to the Federal Railroad Administrator with the written consent of the other affected track owners.
- (f) Equipment presently operating at curving speeds allowed under the formula in paragraph (c) of this section, by reason of conditional waivers granted by the Federal Railroad Administration, shall be considered to have successfully complied with the requirements of paragraph (d) of this section.
- (g) A track owner or a railroad operating above Class 5 speeds, may request approval from the Federal Railroad Administrator to operate specified equipment at a level of cant deficiency greater than four inches in accordance with §213.329(c) and (d) on curves in Class 1 through 5 track which are contiguous to the high speed track provided that—
  - (1) The track owner or railroad submits a test plan to the Federal Railroad Administrator

for approval no less than thirty calendar days prior to any proposed implementation of the higher curving speeds. The test plan shall include an analysis and determination of carbody acceleration safety limits for each vehicle type which indicate wheel unloading of 60 percent in a steady state condition and 80 percent in a transient (point by point) condition. Accelerometers shall be laterally-oriented and floor-mounted near the end of a representative vehicle of each type;

- (2) Upon FRA approval of a test plan, the track owner or railroad conducts incrementally increasing train speed test runs over the curves in the identified track segment(s) to demonstrate that wheel unloading is within the limits prescribed in paragraph (g)(1) of this section;
- (3) Upon FRA approval of a cant deficiency level, the track owner or railroad inspects the curves in the identified track segment with a Track Geometry Measurement System (TGMS) qualified in accordance with §213.333 (b) through (g) at an inspection frequency of at least twice annually with not less than 120 days interval between inspections; and
- (4) The track owner or railroad operates an instrumented car having dynamic response characteristics that are representative of other equipment assigned to service or a

portable device that monitors on-board instrumentation on trains over the curves in the identified track segment at the revenue speed profile at a frequency of at least once every 90-day period with not less than 30 days interval between inspections. The instrumented car or the portable device shall monitor a laterally-oriented accelerometer placed near the end of the vehicle at the floor level. If the carbody lateral acceleration measurement exceeds the safety limits prescribed in paragraph (g)(1), the railroad shall operate trains at curving speeds in accordance with paragraph (b) or (c) of this section; and

- (5) The track owner or railroad shall maintain a copy of the most recent exception printouts for the inspections required under paragraphs (g)(3) and (4) of this section.

**§ 213.59 Elevation of curved track; runoff.**

- (a) If a curve is elevated, the full elevation shall be provided throughout the curve, unless physical conditions do not permit. If elevation runoff occurs in a curve, the actual minimum elevation shall be used in computing the maximum allowable operating speed for that curve under §213.57(b).
- (b) Elevation runoff shall be at a uniform rate, within the limits of track surface deviation prescribed in § 213.63, and it shall extend at least the full length of the spirals. If physical conditions do

not permit a spiral long enough to accommodate the minimum length of runoff, part of the runoff may be on tangent track.

**§ 213.63 Track surface.**

Each owner of the track to which this part applies shall maintain the surface of its track within the limits prescribed in the following table: [*See Table next page*]

| Track surface   | Class of Track |            |            |            |            |
|---|----------------|------------|------------|------------|------------|
|   | 1 (inches)     | 2 (inches) | 3 (inches) | 4 (inches) | 5 (inches) |
| The runoff in any 31 feet of rail at the end of a raise may not be more than . . .  | 3 1/2          | 3          | 2          | 1 1/2      | 1          |
| The deviation from uniform profile on either rail at the mid-ordinate of a 62-foot chord may not be more than . . . . .   | 3              | 2 3/4      | 2 1/4      | 2          | 1 1/4      |
| The deviation from zero crosslevel at any point on tangent or reverse crosslevel elevation on curves may not be more than . . . . .   | 3              | 2          | 1 3/4      | 1 1/4      | 1          |
| The difference in crosslevel between any two points less than 62 feet apart may not be more than <sup>*1,2</sup> . . . . .  | 3              | 2 1/4      | 2          | 1 3/4      | 1 1/2      |
| *Where determined by engineering decision prior to the promulgation of this rule, due to physical restrictions on spiral length and operating practices and experience, the variation in crosslevel on spirals per 31 feet may not be more than . . . . . | 2              | 1 3/4      | 1 1/4      | 1          | 3/4        |

<sup>1</sup>Except as limited by §213.57(a), where the elevation at any point in a curve equals or exceeds 6 inches, the difference in cross level within 62 feet between that point and a point with greater elevation may not be more than 1 1/2 inches. (Footnote 1 is applicable September 21, 1999.)

<sup>2</sup>However, to control harmonics on Class 2 through 5 jointed track with staggered joints, the cross level differences shall not exceed 1 1/4 inches in all of six consecutive pairs of joints, as created by 7 low joints. Track with joints staggered less than 10 feet shall not be considered as having staggered joints. Joints within the 7 low joints outside of the regular joint spacing shall not be considered as joints for purposes of this footnote. (Footnote 2 is applicable September 21, 1999.)

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**Subpart D — Track Structure****§ 213.101 Scope.**

This subpart prescribes minimum requirements for ballast, crossties, track assembly fittings, and the physical conditions of rails.

**§ 213.103 Ballast; general.**

Unless it is otherwise structurally supported, all track shall be supported by material which will—

- (a) Transmit and distribute the load of the track and railroad rolling equipment to the subgrade;
- (b) Restrain the track laterally, longitudinally, and vertically under dynamic loads imposed by railroad rolling equipment and thermal stress exerted by the rails;
- (c) Provide adequate drainage for the track; and
- (d) Maintain proper track crosslevel, surface, and alinement.

**§ 213.109 Crossties.**

- (a) Crossties shall be made of a material to which rail can be securely fastened.
- (b) Each 39 foot segment of track shall have—
  - (1) A sufficient number of crossties which in combination provide effective support that will—
    - (i) Hold gage within the limits prescribed in § 213.53(b);

- (ii) Maintain surface within the limits prescribed in § 213.63; and
  - (iii) Maintain alinement within the limits prescribed in § 213.55.
- (2) The minimum number and type of crossties specified in paragraphs (c) and (d) of this section effectively distributed to support the entire segment; and
- (3) At least one crosstie of the type specified in paragraphs (c) and (d) of this section that is located at a joint location as specified in paragraph (f) of this section.
- (c) Each 39 foot segment of: Class 1 track shall have five crossties; Classes 2 and 3 track shall have eight crossties; and Classes 4 and 5 track shall have 12 crossties, which are not:
  - (1) Broken through;
  - (2) Split or otherwise impaired to the extent the crossties will allow the ballast to work through, or will not hold spikes or rail fasteners;
  - (3) So deteriorated that the tie plate or base of rail can move laterally more than  $\frac{1}{2}$  inch relative to the crossties; or
  - (4) Cut by the tie plate through more than 40 percent of a ties' thickness.
- (d) Each 39 foot segment of track shall have the minimum number and type of crossties as indicated in the following table (this paragraph (d) is applicable September 21, 2000). [see Table next page]

| Class of track            | Tangent track and curves $\leq 2$ degrees | Turnouts and curved track over 2 degrees |
|---------------------------|---|--|
| Class 1 track. ....       | 5   | 6  |
| Class 2 track. ....       | 8   | 9  |
| Class 3 track. ....       | 8   | 10                                       |
| Class 4 and 5 track. .... | 12  | 14                                       |

23' - 7 ties -

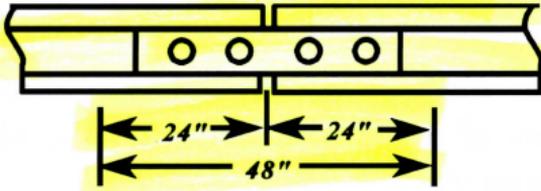
- (e) Crossties counted to satisfy the requirements set forth in the table in paragraph (d) of this section shall not be—
- (1) Broken through;
  - (2) Split or otherwise impaired to the extent the crossties will allow the ballast to work through, or will not hold spikes or rail fasteners;
  - (3) So deteriorated that the tie plate or base of rail can move laterally  $\frac{1}{2}$  inch relative to the crossties; or
  - (4) Cut by the tie plate through more than 40 percent of a crosstie's thickness “(this paragraph (e) is applicable September 21, 2000).”
- (f) Class 1 and Class 2 track shall have one crosstie whose centerline is within 24 inches of each rail joint location, and Classes 3 through 5 track shall have one crosstie whose centerline is within 18 inches of each rail joint location or, two

cross ties whose centerlines are within 24 inches either side of each rail joint location. The relative position of these ties is described in the following diagrams: *{see diagrams on next page}*

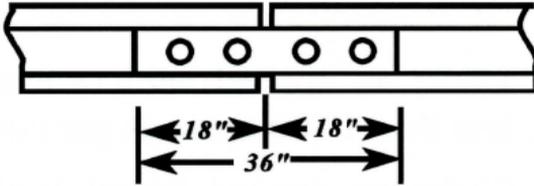
- (g) For track constructed without cross ties, such as slab track, track connected directly to bridge structural components and track over servicing pits, the track structure shall meet the requirements of paragraphs (b)(1)(i), (ii), and (iii) of this section.

### **§ 213.110 Gage restraint measurement systems.**

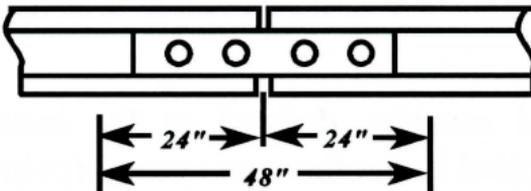
- (a) A track owner may elect to implement a Gage Restraint Measurement System (GRMS), supplemented by the use of a Portable Track Loading Fixture (PTLF), to determine compliance with the cross tie and fastener requirements specified in §§ 213.109 and 213.127 provided that—
  - (1) The track owner notifies the appropriate FRA Regional office at least 30 days prior to the designation of any line segment on which GRMS technology will be implemented; and
  - (2) The track owner notifies the appropriate FRA Regional office at least 10 days prior to the removal of any line segment from GRMS designation.
- (b) Initial notification under paragraph (a)(1) of this section shall include—

*Classes 1 and 2*

Each rail joint in Classes 1 and 2 track shall be supported by at least one cross-tie specified in paragraphs (c) and (d) of this section whose centerline is within 48" shown above.

*Classes 3 through 5*

Each rail joint in Classes 3 through 5 track shall be supported by either at least one cross-tie specified in paragraphs (c) and (d) of this section whose centerline is within 36" shown above, or:



Two cross-ties, one on each side of the rail joint, whose centerlines are within 24" of the rail joint location shown above.

- (1) Identification of the line segment(s) by timetable designation, milepost limits, class of track, or other identifying criteria; and
  - (2) The most recent record of million gross tons of traffic per year over the identified segment(s).
- (c) The track owner shall also provide to FRA sufficient technical data to establish compliance with the minimum design requirements of a GRMS vehicle which specify that—
- (1) Gage restraint shall be measured between the heads of rail —
    - (A) At an interval not exceeding 16 inches;
    - (B) Under an applied vertical load of no less than 10,000 pounds per rail; and
    - (C) Under an applied lateral load which provides for a lateral/vertical load ratio between 0.5 and 1.25, and a load severity greater than 3,000 pounds but less than 8,000 pounds.
- (d) Load severity is defined by the formula—
- $$S=L-cV$$

Where—

S = Load severity, defined as the lateral load applied to the fastener system (pounds).

L = Actual lateral load applied (pounds).

c = Coefficient of friction between rail/tie which is assigned a nominal value of (0.4).

V = Actual vertical load applied (pounds).

- (e) The measured gage values shall be converted to a Projected Loaded Gage 24 (PLG 24) as follows—

$$\text{PLG 24} = \text{UTG} + A \times (\text{LTG} - \text{UTG})$$

Where—

UTG= Unloaded track gage measured by the GRMS vehicle at a point no less than 10 feet from any lateral or vertical load application.

LTG= Loaded track gage measured by the GRMS vehicle at a point no more than 12 inches from the lateral load application point.

A= The extrapolation factor used to convert the measured loaded gage to expected loaded gage under a 24,000 pound lateral load and a 33,000 pound vertical load.

For all track—

$$A = \frac{13.513}{(.001 \times L - .000258 \times V) - .009 \times (.001 \times L - .000258 \times V)^2}$$

Note: The A factor shall not exceed (3.184) under any valid loading configuration.

Where—

L=Actual lateral load applied (pounds).

V=Actual vertical load applied (pounds).

- (f) The measured gage value shall be converted to a Gage Widening Ratio (GWR) as follows —

$$\text{GWR} = \frac{(\text{LTG} - \text{UTG})}{L} \times 16,000$$

- (g) The GRMS vehicle shall be capable of producing output reports that provide a trace, on a constant-distance scale, of all parameters specified in paragraph (l) of this section.
- (h) The GRMS vehicle shall be capable of providing an exception report containing a systematic listing of all exceptions, by magnitude and location, to all the parameters specified in paragraph (l) of this section.
- (i) The exception reports required by this section shall be provided to the appropriate person designated as fully qualified under § 213.7 prior to the next inspection required under § 213.233.
- (j) The track owner shall institute the necessary procedures for maintaining the integrity of the data collected by the GRMS and PTLF systems. At a minimum, the track owner shall—
  - (1) Maintain and make available to the Federal Railroad Administration documented calibration procedures on each GRMS vehicle which, at a minimum, shall specify a daily instrument verification procedure that will ensure correlation between measurements made on the ground and those recorded by the instrumentation with respect to loaded and unloaded gage parameters; and
  - (2) Maintain each PTLF used for determining compliance with the requirements of this section such that the 4,000-pound reading is accurate to within five percent of that reading.

(k) The track owner shall provide training in GRMS technology to all persons designated as fully qualified under § 213.7 and whose territories are subject to the requirements of this section. The training program shall be made available to the Federal Railroad Administration upon request. At a minimum, the training program shall address—

- (1) Basic GRMS procedures;
- (2) Interpretation and handling of exception reports generated by the GRMS vehicle;
- (3) Locating and verifying defects in the field;
- (4) Remedial action requirements;
- (5) Use and calibration of the PTLF; and
- (6) Recordkeeping requirements.

(l) The GRMS record of lateral restraint shall identify two exception levels. At a minimum, the track owner shall initiate the required remedial action at each exception level as defined in the following table—

| GRMS parameter <sup>1</sup>  | If measurement value exceeds | Remedial action required  |
|------------------------------|------------------------------|---|
| <b>First Level Exception</b> |                              |   |
| UTG . . . . .                | 58 inches . . . . .          | (1) Immediately protect the exception location with a 10 mph speed restriction; then verify location; and<br>(2) Restore lateral restraint and maintain in compliance with PTLF criteria as described in paragraph (m) of this section; and<br>(3) Maintain compliance with §213.53(b) of this part as measured with the PTLF |
| LTG . . . . .                | 58 inches . . . . .          |   |
| PLG24 . . . . .              | 59 inches . . . . .          |   |
| GWR . . . . .                | 1.0 inches . . . . .         |   |

## Subpart D

| GRMS parameter <sup>1</sup>      | If measurement value exceeds                                  | Remedial action required  |
|----------------------------------|---|---|
| <b>Second Level Exception</b>    |   |   |
| LTG . . . . .                    | 57 $\frac{3}{4}$ inches on Class 4 and 5 track <sup>2</sup> . | <sup>2</sup> Limit operating speed to no more than the maximum allowable under §213.9 for Class 3 track; then verify location; and<br>(1) Maintain in compliance with PTLF criteria as described in paragraph (m) of this section; and<br>(2) Maintain compliance with §213.53(b) of this part as measured with the PTLF. |
| PLG24 . . . . .<br>GWR . . . . . | 58 inches . . . . .<br>0.75 inches . . . . .                  |   |

<sup>1</sup>Definitions for the GRMS parameters referenced in this table are found in paragraph (p) of this section.

<sup>2</sup>This note recognizes that typical good track will increase in total gage by as much as  $\frac{1}{4}$  inch due to outward rail rotation under GRMS loading conditions. For Class 2 & 3 track, the GRMS LTG values are also increased by  $\frac{1}{4}$  inch to a maximum of 58 inches. However, for any Class of track, GRMS LTG values in excess of 58 inches are considered First Level exceptions and the appropriate remedial actions must be taken by the track owner. This  $\frac{1}{4}$ -inch increase in allowable gage applies only to GRMS LTG. For gage measured by traditional methods, or with the use of the PTLF, the table in §213.53(b) will apply.

(m) Between GRMS inspections, the PTLF may be used as an additional analytical tool to assist fully qualified § 213.7 individuals in determining compliance with the crosstie and fastener requirements of §§ 213.109 and 213.127. When the PTLF is used, whether as an additional analytical tool or to fulfill the requirements of paragraph (1), it shall be used subject to the following criteria—

(1) At any location along the track that the

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PTLF is applied, that location will be deemed in compliance with the crosstie and fastener requirements specified in §§213.109 and 213.127 provided that—

- (i) The total gage widening at that location does not exceed  $\frac{5}{8}$  inch when increasing the applied force from 0 to 4,000 pounds; and
  - (ii) The gage of the track under 4,000 pounds of applied force does not exceed the allowable gage prescribed in §213.53(b) for the class of track.
- (2) Gage widening in excess of  $\frac{5}{8}$  inch shall constitute a deviation from Class 1 standards.
  - (3) A person designated as fully qualified under §213.7 retains the discretionary authority to prescribe additional remedial actions for those locations which comply with the requirements of paragraph (m)(1)(i) and (ii) of this section.
  - (4) When a functional PTLF is not available to a fully qualified person designated under §213.7, the criteria for determining crosstie and fastener compliance shall be based solely on the requirements specified in §§213.109 and 213.127.
  - (5) If the PTLF becomes non-functional or is missing, the track owner will replace or repair it before the next inspection required under § 213.233.

- (6) Where vertical loading of the track is necessary for contact with the lateral rail restraint components, a PTLF test will not be considered valid until contact with these components is restored under static loading conditions.
- (n) The track owner shall maintain a record of the two most recent GRMS inspections at locations which meet the requirements specified in §213.241(b). At a minimum, records shall indicate the following—
  - (1) Location and nature of each First Level exception; and
  - (2) Nature and date of remedial action, if any, for each exception identified in paragraph (n)(1) of this section.
- (o) The inspection interval for designated GRMS line segments shall be such that—
  - (1) On line segments where the annual tonnage exceeds two million gross tons, or where the maximum operating speeds for passenger trains exceeds 30 mph, GRMS inspections must be performed annually at an interval not to exceed 14 months; or
  - (2) On line segments where the annual tonnage is two million gross tons or less and the maximum operating speed for passenger trains does not exceed 30 mph, the interval between GRMS inspections must not exceed 24 months.

(p) As used in this section—

- (1) ***Gage Restraint Measurement System (GRMS)*** means a track loading vehicle meeting the minimum design requirements specified in this section.
- (2) ***Gage Widening Ratio (GWR)*** means the measured difference between loaded and unloaded gage measurements, linearly normalized to 16,000 pounds of applied lateral load.
- (3) ***L/V ratio*** means the numerical ratio of lateral load applied at a point on the rail to the vertical load applied at that same point. GRMS design requirements specify an L/V ratio of between 0.5 and 1.25. GRMS vehicles using load combinations developing L/V ratios which exceed 0.8 must be operated with caution to protect against the risk of wheel climb by the test wheelset.
- (4) ***Load severity*** means the amount of lateral load applied to the fastener system after friction between rail and tie is overcome by any applied gage-widening lateral load.
- (5) ***Loaded Track Gage (LTG)*** means the gage measured by the GRMS vehicle at a point no more than 12 inches from the lateral load application point.
- (6) ***Portable Track Loading Fixture (PTLF)*** means a portable track loading device capable of applying an increasing lateral force from 0 to 4,000 pounds on the web/base fillet of each rail simultaneously.

- (7) ***Projected Loaded Gage (PLG)*** means an extrapolated value for loaded gage calculated from actual measured loads and deflections. PLG 24 means the extrapolated value for loaded gage under a 24,000 pound lateral load and a 33,000 pound vertical load.
- (8) ***Unloaded Track gage (UTG)*** means the gage measured by the GRMS vehicle at a point no less than 10 feet from any lateral or vertical load.

**§ 213.113 Defective rails.**

- (a) When an owner of track to which this part applies learns, through inspection or otherwise, that a rail in that track contains any of the defects listed in the following table, a person designated under § 213.7 shall determine whether or not the track may continue in use. If he determines that the track may continue in use, operation over the defective rail is not permitted until—
  - (1) The rail is replaced; or
  - (2) The remedial action prescribed in the table is initiated. [*See Table on next page*]



Remedial Action Table

| Defect               | Length of defect (inch) |                   | Percent of rail head cross-sectional area weakened by defect |                   | If defective rail is not replaced, take the remedial action prescribed in notes |
|----------------------|-------------------------|-------------------|--|-------------------|---|
|                      | More than               | But not more than | Less than  | But not less than |   |
| Transverse fissure   | .....                   | .....             | .....70  | .....5            | B   |
|                      | .....                   | .....             | .....100   | .....70           | A2  |
| Compound fissure     | .....                   | .....             | .....  | .....100          | A   |
|                      | .....                   | .....             | .....70  | .....5            | B   |
| Detail fracture      | .....                   | .....             | .....100   | .....70           | A2  |
|                      | .....                   | .....             | .....  | .....100          | A   |
| Engine burn fracture | .....                   | .....             | .....25  | .....5            | C   |
|                      | .....                   | .....             | .....80  | .....25           | D   |
| Defective weld       | .....                   | .....             | .....100   | .....80           | [A2] or [E and H]   |
|                      | .....                   | .....             | .....  | .....100          | [A] or [E and H]  |

Remedial Action Table Continued

|                         |  |                       |                       |       |                  |
|-------------------------|--|-----------------------|-----------------------|-------|------------------|
| Horizontal split head   | 1.....   | 2.....                | .....                 | ..... | H and F          |
|                         | 2.....   | 4.....                | .....                 | ..... | I and G          |
| Vertical split head     | 4.....   | .....                 | .....                 | ..... | B                |
|                         | ( <sup>1</sup> ).....                              | ( <sup>1</sup> )..... | ( <sup>1</sup> )..... | ..... | A                |
| Split web               | .....  | .....                 | .....                 | ..... | H and F          |
|                         | ( <sup>1</sup> ).....                              | .....                 | .....                 | ..... | H and G          |
| Head and web separation | $\frac{1}{2}$ .....                                | 1.....                | .....                 | ..... | B                |
|                         | 1.....   | $1\frac{1}{2}$ .....  | .....                 | ..... | A                |
| Bolt hole crack         | $1\frac{1}{2}$ .....                               | .....                 | .....                 | ..... | D                |
|                         | ( <sup>1</sup> ).....                              | ( <sup>1</sup> )..... | ( <sup>1</sup> )..... | ..... | [A] or [E and I] |
| Broken base             | 1.....   | 6.....                | .....                 | ..... | A or E           |
|                         | 6.....   | .....                 | .....                 | ..... | D                |
| Ordinary break.....     | .....  | .....                 | .....                 | ..... | H                |
| Damaged rail.....       | .....  | .....                 | .....                 | ..... |                  |
| Flattened rail.....     | .....  | .....                 | .....                 | ..... |                  |
|                         | Depth $\geq \frac{3}{8}$<br>and<br>Length $\geq 8$ | .....                 | .....                 | ..... |                  |

<sup>1</sup>Break out in rail head.

### Notes

- A. Assign person designated under § 213.7 to visually supervise each operation over defective rail.
- A2. Assign person designated under § 213.7 to make visual inspection. After a visual inspection, that person may authorize operation to continue without continuous visual supervision at a maximum of 10 m.p.h. for up to 24 hours prior to another such visual inspection or replacement or repair of the rail.
- B. Limit operating speed over defective rail to that as authorized by a person designated under §213.7(a), who has at least one year of supervisory experience in railroad track maintenance. The operating speed cannot be over 30 m.p.h. or the maximum allowable speed under § 213.9 for the class of track concerned, whichever is lower.
- C. Apply joint bars bolted only through the outermost holes to defect within 20 days after it is determined to continue the track in use. In the case of Classes 3 through 5 track, limit operating speed over defective rail to 30 m.p.h. until joint bars are applied; thereafter, limit speed to 50 m.p.h. or the maximum allowable speed under § 213.9 for the class of track concerned, whichever is lower. When a search for internal rail defects is conducted under § 213.237, and defects are discovered in Classes 3 through 5 which require remedial action C, the operating speed shall be limited to 50 m.p.h., or the maximum allowable speed under § 213.9 for the class of track concerned, whichever is lower, for a period not to exceed 4 days.

If the defective rail has not been removed from the track or a permanent repair made within 4 days of the discovery, limit operating speed over the defective rail to 30 m.p.h. until joint bars are applied; thereafter, limit speed to 50 m.p.h. or the maximum allowable speed under § 213.9 for the class of track concerned, whichever is lower.

- D. Apply joint bars bolted only through the outermost holes to defect within 10 days after it is determined to continue the track in use. In the case of Classes 3 through 5 track, limit operating speed over the defective rail to 30 m.p.h. or less as authorized by a person designated under §213.7(a), who has at least one year of supervisory experience in railroad track maintenance, until joint bars are applied; thereafter, limit speed to 50 m.p.h. or the maximum allowable speed under § 213.9 for the class of track concerned, whichever is lower.
- E. Apply joint bars to defect and bolt in accordance with § 213.121(d) and (e).
- F. Inspect rail 90 days after it is determined to continue the track in use.
- G. Inspect rail 30 days after it is determined to continue the track in use.
- H. Limit operating speed over defective rail to 50 m.p.h. or the maximum allowable speed under § 213.9 for the class of track concerned, whichever is lower.
- I. Limit operating speed over defective rail to 30 m.p.h. or the maximum allowable speed under § 213.9 for the class of track concerned, whichever is lower.

(b) As used in this section--

- (1) ***Transverse fissure*** means a progressive crosswise fracture starting from a crystalline center or nucleus inside the head from which it spreads outward as a smooth, bright, or dark, round or oval surface substantially at a right angle to the length of the rail. The distinguishing features of a transverse fissure from other types of fractures or defects are the crystalline center or nucleus and the nearly smooth surface of the development which surrounds it.
- (2) ***Compound fissure*** means a progressive fracture originating in a horizontal split head which turns up or down in the head of the rail as a smooth, bright, or dark surface progressing until substantially at a right angle to the length of the rail. Compound fissures require examination of both faces of the fracture to locate the horizontal split head from which they originate.
- (3) ***Horizontal split head*** means a horizontal progressive defect originating inside of the rail head, usually one-quarter inch or more below the running surface and progressing horizontally in all directions, and generally accompanied by a flat spot on the running surface. The defect appears as a crack lengthwise of the rail when it reaches the side of the rail head.
- (4) ***Vertical split head*** means a vertical split through or near the middle of the head, and

- extending into or through it. A crack or rust streak may show under the head close to the web or pieces may be split off the side of the head.
- (5) ***Split web*** means a lengthwise crack along the side of the web and extending into or through it.
  - (6) ***Piped rail*** means a vertical split in a rail, usually in the web, due to failure of the shrinkage cavity in the ingot to unite in rolling.
  - (7) ***Broken base*** means any break in the base of the rail.
  - (8) ***Detail fracture*** means a progressive fracture originating at or near the surface of the rail head. These fractures should not be confused with transverse fissures, compound fissures, or other defects which have internal origins. Detail fractures may arise from shelly spots, head checks, or flaking.
  - (9) ***Engine burn fracture*** means a progressive fracture originating in spots where driving wheels have slipped on top of the rail head. In developing downward they frequently resemble the compound or even transverse fissures with which they should not be confused or classified.
  - (10) ***Ordinary break*** means a partial or complete break in which there is no sign of a fissure, and in which none of the other defects described in this paragraph (b) are found.

- (11) **Damaged rail** means any rail broken or injured by wrecks, broken, flat, or unbalanced wheels, slipping, or similar causes.
- (12) **Flattened rail** means a short length of rail, not at a joint, which has flattened out across the width of the rail head to a depth of  $\frac{3}{8}$  inch or more below the rest of the rail. Flattened rail occurrences have no repetitive regularity and thus do not include corrugations, and have no apparent localized cause such as a weld or engine burn. Their individual length is relatively short, as compared to a condition such as head flow on the low rail of curves.
- (13) **Bolt hole crack** means a crack across the web, originating from a bolt hole, and progressing on a path either inclined upward toward the rail head or inclined downward toward the base. Fully developed bolt hole cracks may continue horizontally along the head/web or base/web fillet, or they may progress into and through the head or base to separate a piece of the rail end from the rail. Multiple cracks occurring in one rail end are considered to be a single defect. However, bolt hole cracks occurring in adjacent rail ends within the same joint must be reported as separate defects.
- (14) **Defective weld** means a field or plant weld containing any discontinuities or pockets, exceeding 5 percent of the rail head area individually or 10 percent in the aggregate, oriented in or near the transverse plane, due

to incomplete penetration of the weld metal between the rail ends, lack of fusion between weld and rail end metal, entrainment of slag or sand, under-bead or other shrinkage cracking, or fatigue cracking. Weld defects may originate in the rail head, web, or base, and in some cases, cracks may progress from the defect into either or both adjoining rail ends.

- (15) **Head and web separation** means a progressive fracture, longitudinally separating the head from the web of the rail at the head fillet area.

**§ 213.115 Rail end mismatch.**

Any mismatch of rails at joints may not be more than that prescribed by the following table—

| Class of track                | Any mismatch of rails at joints may not be more than the following— |   |
|-------------------------------|---|---|
|                               | On the tread of the rail ends<br>(inch)                             | On the gage side of the rail ends<br>(inch) |
| Class 1 track . . . . .       | 1/4   | 1/4   |
| Class 2 track . . . . .       | 1/4   | 3/16  |
| Class 3 track . . . . .       | 3/16  | 3/16  |
| Class 4 and 5 track . . . . . | 1/8   | 1/8   |

**§ 213.119 Continuous welded rail (CWR);  
general.**

Each track owner with track constructed of CWR shall have in effect and comply with a plan that contains written procedures which address: the installation, adjustment, maintenance and inspection of CWR; inspection of joints in CWR; and a training program for the application of those procedures. The plan shall be submitted to the Federal Railroad Administration by March 22, 1999. FRA reviews each plan for compliance with the following—

- (a) Procedures for the installation and adjustment of CWR which include—
  - (1) Designation of a desired rail installation temperature range for the geographic area in which the CWR is located; and
  - (2) De-stressing procedures/methods which address proper attainment of the desired rail installation temperature range when adjusting CWR.
- (b) Rail anchoring or fastening requirements that will provide sufficient restraint to limit longitudinal rail and crosstie movement to the extent practical, and specifically addressing CWR rail anchoring or fastening patterns on bridges, bridge approaches, and at other locations where possible longitudinal rail and crosstie movement associated with normally expected train-induced forces, is restricted.
- (c) Procedures which specifically address maintaining a desired rail installation temperature range when cutting CWR including rail repairs, in-track welding, and in conjunction with adjust-

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ments made in the area of tight track, a track buckle, or a pull-apart. Rail repair practices shall take into consideration existing rail temperature so that—

- (1) When rail is removed, the length installed shall be determined by taking into consideration the existing rail temperature and the desired rail installation temperature range; and
  - (2) Under no circumstances should rail be added when the rail temperature is below that designated by paragraph (a)(1) of this section, without provisions for later adjustment.
- (d) Procedures which address the monitoring of CWR in curved track for inward shifts of alignment toward the center of the curve as a result of disturbed track.
- (e) Procedures which control train speed on CWR track when—
- (1) Maintenance work, track rehabilitation, track construction, or any other event occurs which disturbs the roadbed or ballast section and reduces the lateral or longitudinal resistance of the track; and
  - (2) In formulating the procedures under this paragraph (e), the track owner shall—
    - (i) Determine the speed required, and the duration and subsequent removal of any speed restriction based on the restoration of the ballast, along with sufficient

ballast re-consolidation to stabilize the track to a level that can accommodate expected train-induced forces. Ballast re-consolidation can be achieved through either the passage of train tonnage or mechanical stabilization procedures, or both; and

(ii) Take into consideration the type of cross-ties used.

(f) Procedures which prescribe when physical track inspections are to be performed to detect buckling-prone conditions in CWR track. At a minimum, these procedures shall address inspecting track to identify—

(1) Locations where tight or kinky rail conditions are likely to occur;

(2) Locations where track work of the nature described in paragraph (e)(1) of this section have recently been performed; and

(3) In formulating the procedures under this paragraph (f), the track owner shall—

(i) Specify the timing of the inspection; and

(ii) Specify the appropriate remedial actions to be taken when buckling-prone conditions are found.

(g) Procedures which prescribe the scheduling and conduct of physical track inspections to detect cracks and other indications of incipient failures in joints in CWR. This paragraph is effective January 3, 2006.

- (1) At a minimum, these procedures shall address periodic and special on-foot inspection of joints and of the track adjacent to joints, in order to identify--
  - (i) Joint bars with visible or otherwise detectable cracks;
  - (ii) Loose, bent, or missing joint bolts;
  - (iii) Rail end batter or mismatch that contributes to impact loads and instability of the joint; and
  - (iv) Evidence of excessive longitudinal rail movement in or near the joint, including, but not limited to, wide rail gap, defective joint bolts, disturbed ballast, surface deviations, gap between tie plates and rail, or displaced rail anchors.
- (2) In formulating the procedures under paragraph (g)(1) of this section, the track owner shall--
  - (i) Implement a system for identifying each joint by its location in track with sufficient precision that personnel can return to the joint and identify it without ambiguity;
  - (ii) List each joint in an inventory that will enable personnel to identify joints due for periodic inspection;
  - (iii) Specify the conditions of potential joint failure for which personnel must inspect, including, at a minimum, the

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items listed in paragraph (g)(1) of this section;

- (iv) Specify the appropriate remedial actions, consistent with this part, that should be taken when personnel find conditions of potential joint failure; and
- (v) Specify the timing of the inspections, which should be based on the configuration and condition of the joint. At a minimum, track owners must specify that all joints in CWR in track classes 4 and higher must be inspected before October 31, 2006 and within 190 days of the previous inspection hereafter; and all joints in CWR in track classes 3, and class 2 track on which passenger trains operate, must be inspected before April 30, 2007 and within 370 days of the previous inspection thereafter.

(3) In lieu of the requirements for the inspection of rail joints contained in paragraphs (g)(1) and (2) of this section, a track owner may seek approval from FRA to use alternate procedures.

- (i) The track owner shall submit the alternate procedures and a supporting statement of justification to the Associate Administrator for Safety (Associate Administrator).
- (ii) If the Associate Administrator finds that the alternate procedures provide an

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equivalent or higher level of safety than the requirements in paragraphs (g)(1) and (g)(2) of this section, the Associate Administrator will approve the alternate procedures by notifying the track owner in writing. The Associate Administrator will specify in the written notification the date on which the procedures will become effective, and after that date, the track owner shall comply with the procedures. If the Associate Administrator determines that the alternate procedures do not provide an equivalent level of safety, the Associate Administrator will disapprove the alternate procedures in writing, and the track owner shall continue to comply with the requirements in paragraphs (g)(1) and (2) of this section.

- (iii) While a determination is pending with the Associate Administrator on a request submitted pursuant to paragraph (g)(3) of this section, the track owner shall continue to comply with the requirements contained in paragraphs (g)(1) and (2) of this section.
- (h) The track owner shall have in effect a comprehensive training program for the application of these written CWR procedures, with provisions for periodic re-training, for those individuals designated under § 213.7 as qualified to supervise the installation, adjustment, and maintenance

nance of CWR track and to perform inspections of CWR track.

- (i) The track owner shall prescribe recordkeeping requirements necessary to provide an adequate history of track constructed with CWR. At a minimum, these records must include:
- (1) Rail temperature, location and date of CWR installations. This record shall be retained for at least one year;
  - (2) A record of any CWR installation or maintenance work that does not conform with the written procedures. Such record shall include the location of the rail and be maintained until the CWR is brought into conformance with such procedures;
  - (3) Information on inspection of rail joints.
    - (i) After the initial inspection of each joint in accordance with paragraph (g) of this section, the track owner must include in the record:
      - (A) The location of each joint in CWR with such precision that the joint can be located and identified in the field with no ambiguity;
      - (B) The results of the inspection of each joint; and
      - (C) Any remedial action required under the track owner's CWR plan.
    - (ii) Track owners shall maintain records required by paragraph (i)(3)(i) in accordance with Sec. 213.241.

## (j) As used in this section--

- (1) ***Adjusting/De-stressing*** means the procedure by which a rail's temperature is re-adjusted to the desired value. It typically consists of cutting the rail and removing rail anchoring devices, which provides for the necessary expansion and contraction, and then re-assembling the track.
- (2) ***Buckling Incident*** means the formation of a lateral mis-alinement sufficient in magnitude to constitute a deviation from the Class 1 requirements specified in Sec. 213.55. These normally occur when rail temperatures are relatively high and are caused by high longitudinal compressive forces.
- (3) ***Continuous Welded Rail (CWR)*** means rail that has been welded together into lengths exceeding 400 feet.
- (4) ***Desired Rail Installation Temperature Range*** means the rail temperature range, within a specific geographical area, at which forces in CWR should not cause a buckling incident in extreme heat, or a pull-apart during extreme cold weather.
- (5) ***Disturbed Track*** means the disturbance of the roadbed or ballast section, as a result of track maintenance or any other event, which reduces the lateral or longitudinal resistance of the track, or both.
- (6) ***Mechanical Stabilization*** means a type of procedure used to restore track resistance to

disturbed track following certain maintenance operations. This procedure may incorporate dynamic track stabilizers or ballast consolidators, which are units of work equipment that are used as a substitute for the stabilization action provided by the passage of tonnage trains.

- (7) ***Rail Anchors*** means those devices which are attached to the rail and bear against the side of the crosstie to control longitudinal rail movement. Certain types of rail fasteners also act as rail anchors and control longitudinal rail movement by exerting a downward clamping force on the upper surface of the rail base.
- (8) ***Rail Temperature*** means the temperature of the rail, measured with a rail thermometer.
- (9) ***Tight/Kinky Rail*** means CWR which exhibits minute alinement irregularities which indicate that the rail is in a considerable amount of compression.
- (10) ***Train-induced Forces*** means the vertical, longitudinal, and lateral dynamic forces which are generated during train movement and which can contribute to the buckling potential.
- (11) ***Track Lateral Resistance*** means the resistance provided by the rail/crosstie structure against lateral displacement.
- (12) ***Track Longitudinal Resistance*** means the resistance provided by the rail anchors/rail fasteners and the ballast section to the rail/crosstie structure against longitudinal displacement.

**§213.121 Rail joints.**

- (a) Each rail joint, insulated joint, and compromise joint shall be of a structurally sound design and dimensions for the rail on which it is applied.
- (b) If a joint bar on Classes 3 through 5 track is cracked, broken, or because of wear allows excessive vertical movement of either rail when all bolts are tight, it shall be replaced.
- (c) If a joint bar is cracked or broken between the middle two bolt holes it shall be replaced.
- (d) In the case of conventional jointed track, each rail shall be bolted with at least two bolts at each joint in Classes 2 through 5 track, and with at least one bolt in Class 1 track.
- (e) In the case of continuous welded rail track, each rail shall be bolted with at least two bolts at each joint.
- (f) Each joint bar shall be held in position by track bolts tightened to allow the joint bar to firmly support the abutting rail ends and to allow longitudinal movement of the rail in the joint to accommodate expansion and contraction due to temperature variations. When no-slip, joint-to-rail contact exists by design, the requirements of this paragraph do not apply. Those locations when over 400 feet in length, are considered to be continuous welded rail track and shall meet all the requirements for continuous welded rail track prescribed in this part.

- (g) No rail shall have a bolt hole which is torch cut or burned in Classes 2 through 5 track. (For Class 2 track, this paragraph (g) is applicable September 21, 1999.)
- (h) No joint bar shall be reconfigured by torch cutting in Classes 3 through 5 track.

**§ 213.122 Torch cut rail.**

- (a) Except as a temporary repair in emergency situations no rail having a torch cut end shall be used in Classes 3 through 5 track. When a rail end is torch cut in emergency situations, train speed over that rail end shall not exceed the maximum allowable for Class 2 track. For existing torch cut rail ends in Classes 3 through 5 track the following shall apply—
  - (1) Within one year of September 21, 1998, all torch cut rail ends in Class 5 track shall be removed;
  - (2) Within two years of September 21, 1998, all torch cut rail ends in Class 4 track shall be removed; and
  - (3) Within one year of September 21, 1998, all torch cut rail ends in Class 3 track over which regularly scheduled passenger trains operate, shall be inventoried by the track owner.
- (b) Following the expiration of the time limits specified in paragraphs (a)(1), (2), and (3) of this section, any torch cut rail end not removed from Classes 4 and 5 track, or any torch cut rail end

not inventoried in Class 3 track over which regularly scheduled passenger trains operate, shall be removed within 30 days of discovery. Train speed over that rail end shall not exceed the maximum allowable for Class 2 track until removed.

### **§ 213.123 Tie plates.**

- (a) In Classes 3 through 5 track where timber cross-ties are in use there shall be tie plates under the running rails on at least eight of any 10 consecutive ties.
- (b) In Classes 3 through 5 track no metal object which causes a concentrated load by solely supporting a rail shall be allowed between the base of the rail and the bearing surface of the tie plate. (This paragraph (b) is applicable September 21, 1999.)

### **§ 213.127 Rail fastening systems.**

Track shall be fastened by a system of components which effectively maintains gage within the limits prescribed in § 213.53(b). Each component of each such system shall be evaluated to determine whether gage is effectively being maintained.

### **§ 213.133 Turnouts and track crossings generally.**

- (a) In turnouts and track crossings, the fastenings shall be intact and maintained so as to keep the components securely in place. Also, each switch, frog, and guard rail shall be kept free of obstruc-

tions that may interfere with the passage of wheels.

- (b) Classes 3 through 5 track shall be equipped with rail anchoring through and on each side of track crossings and turnouts, to restrain rail movement affecting the position of switch points and frogs. (For Class 3 track, this paragraph (b) is applicable September 21, 1999.)
- (c) Each flangeway at turnouts and track crossings shall be at least 1½ inches wide.

**§ 213.135 Switches.**

- (a) Each stock rail must be securely seated in switch plates, but care shall be used to avoid canting the rail by overtightening the rail braces.
- (b) Each switch point shall fit its stock rail properly, with the switch stand in either of its closed positions to allow wheels to pass the switch point. Lateral and vertical movement of a stock rail in the switch plates or of a switch plate on a tie shall not adversely affect the fit of the switch point to the stock rail. Broken or cracked switch point rails will be subject to the requirements of § 213.113, except that where remedial actions C, D, or E require the use of joint bars, and joint bars cannot be placed due to the physical configuration of the switch, remedial action B will govern, taking into account any added safety provided by the presence of reinforcing bars on the switch points.

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- (c) Each switch shall be maintained so that the outer edge of the wheel tread cannot contact the gage side of the stock rail.
  - (d) The heel of each switch rail shall be secure and the bolts in each heel shall be kept tight.
  - (e) Each switch stand and connecting rod shall be securely fastened and operable without excessive lost motion.
  - (f) Each throw lever shall be maintained so that it cannot be operated with the lock or keeper in place.
  - (g) Each switch position indicator shall be clearly visible at all times.
  - (h) Unusually chipped or worn switch points shall be repaired or replaced. Metal flow shall be removed to insure proper closure.
  - (i) Tongue & Plain Mate switches, which by design exceed Class 1 and excepted track maximum gage limits, are permitted in Class 1 and excepted track.

### § 213.137 Frogs.

- (a) The flangeway depth measured from a plane across the wheel-bearing area of a frog on Class 1 track shall not be less than  $1\frac{3}{8}$  inches, or less than  $1\frac{1}{2}$  inches on Classes 2 through 5 track.
- (b) If a frog point is chipped, broken, or worn more than five-eighths inch down and 6 inches back, operating speed over the frog shall not be more than 10 m.p.h..

- (c) If the tread portion of a frog casting is worn down more than three-eighths inch below the original contour, operating speed over that frog shall not be more than 10 m.p.h..
- (d) Where frogs are designed as flange-bearing, flangeway depth may be less than that shown for Class 1 if operated at Class 1 speeds.

**§ 213.139 Spring rail frogs.**

- (a) The outer edge of a wheel tread shall not contact the gage side of a spring wing rail.
- (b) The toe of each wing rail shall be solidly tamped and fully and tightly bolted.
- (c) Each frog with a bolt hole defect or head-web separation shall be replaced.
- (d) Each spring shall have compression sufficient to hold the wing rail against the point rail.
- (e) The clearance between the holddown housing and the horn shall not be more than one-fourth of an inch.

**§ 213.141 Self-guarded frogs.**

- (a) The raised guard on a self-guarded frog shall not be worn more than three-eighths of an inch.
- (b) If repairs are made to a self-guarded frog without removing it from service, the guarding face shall be restored before rebuilding the point.

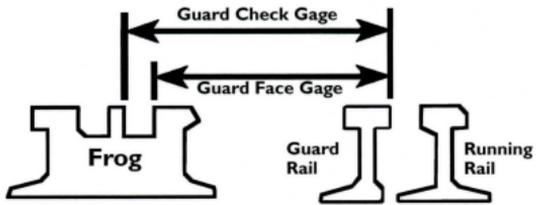
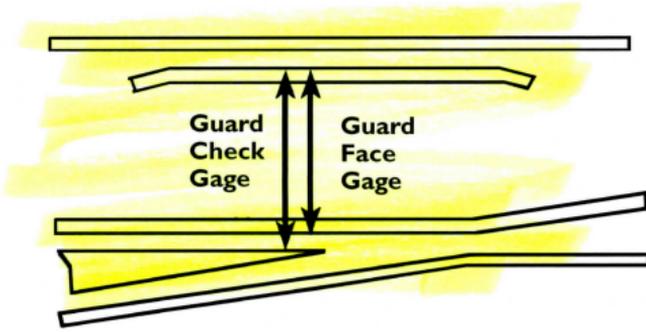
**§ 213.143 Frog guard rails and guard faces; gage.**

The guard check and guard face gages in frogs shall be within the limits prescribed in the following table—[see *Table on next page*]

| Class of track               | <b>Guard check gage</b><br>The distance between the gage line of a frog to the guard line <sup>1</sup> of its guard rail or guarding face, measured across the track at right angles to the gage line <sup>2</sup> , may not be less than— | <b>Guard face gage</b><br>The distance between guard lines <sup>1</sup> , measured across the track at right angles to the gage line <sup>2</sup> , may not be more than— |
|------------------------------|--|---|
| Class 1 track. . . . .       | 4'6 <sup>1</sup> / <sub>8</sub> " . . . . .  | 4'5 <sup>1</sup> / <sub>4</sub> "   |
| Class 2 track. . . . .       | 4'6 <sup>1</sup> / <sub>4</sub> " . . . . .  | 4'5 <sup>1</sup> / <sub>8</sub> "   |
| Class 3 and 4 track. . . . . | 4'6 <sup>3</sup> / <sub>8</sub> " . . . . .  | 4'5 <sup>1</sup> / <sub>8</sub> "   |
| Class 5 track. . . . .       | 4'6 <sup>1</sup> / <sub>2</sub> " . . . . .  | 4'5"  |

<sup>1</sup>A line along that side of the flangeway which is nearer to the center of the track and at the same elevation as the gage line.

<sup>2</sup>A line <sup>5</sup>/<sub>8</sub> inch below the top of the center line of the head of the running rail, or corresponding location of the tread portion of the track structure.





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## **Subpart E—Track Appliances and Track-Related Devices**

### **§ 213.201 Scope.**

This subpart prescribes minimum requirements for certain track appliances and track-related devices.

### **§ 213.205 Derails.**

- (a) Each derail shall be clearly visible.
- (b) When in a locked position, a derail shall be free of lost motion which would prevent it from performing its intended function.
- (c) Each derail shall be maintained to function as intended.
- (d) Each derail shall be properly installed for the rail to which it is applied. (This paragraph (d) is applicable September 21, 1999.)



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## Subpart F—Inspection

### § 213.231 Scope.

This subpart prescribes requirements for the frequency and manner of inspecting track to detect deviations from the standards prescribed in this part.

### § 213.233 Track inspections.

- (a) All track shall be inspected in accordance with the schedule prescribed in paragraph (c) of this section by a person designated under § 213.7.
- (b) Each inspection shall be made on foot or by riding over the track in a vehicle at a speed that allows the person making the inspection to visually inspect the track structure for compliance with this part. However, mechanical, electrical, and other track inspection devices may be used to supplement visual inspection. If a vehicle is used for visual inspection, the speed of the vehicle may not be more than 5 miles per hour when passing over track crossings and turnouts, otherwise, the inspection vehicle speed shall be at the sole discretion of the inspector, based on track conditions and inspection requirements. When riding over the track in a vehicle, the inspection will be subject to the following conditions—
  - (1) One inspector in a vehicle may inspect up to two tracks at one time provided that the inspector's visibility remains unobstructed by any cause and that the second track is not centered more than 30 feet from the track

- upon which the inspector is riding;
- (2) Two inspectors in one vehicle may inspect up to four tracks at a time provided that the inspectors' visibility remains unobstructed by any cause and that each track being inspected is centered within 39 feet from the track upon which the inspectors are riding;
  - (3) Each main track is actually traversed by the vehicle or inspected on foot at least once every two weeks, and each siding is actually traversed by the vehicle or inspected on foot at least once every month. On high density commuter railroad lines where track time does not permit an on track vehicle inspection, and where track centers are 15 foot or less, the requirements of this paragraph (b)(3) will not apply; and
  - (4) Track inspection records shall indicate which track(s) are traversed by the vehicle or inspected on foot as outlined in paragraph (b)(3) of this section.
- (c) Each track inspection shall be made in accordance with the following schedule—

| Class of track                              | Type of track                     | Required frequency   |
|---|-----------------------------------|--|
| Excepted track and Class 1, 2, and 3 track. | Main track and sidings            | Weekly with at least 3 calendar days interval between inspections, or before use, if the track is used less than once a week, or twice weekly with at least 1 calendar day interval between inspections, if the track carries passenger trains or more than 10 million gross tons of traffic during the preceding calendar year. |
| Excepted track and Class 1, 2, and 3 track  | Other than main track and sidings | Monthly with at least 20 calendar days interval between inspections.   |
| Class 4, and 5 track                        | .....                             | Twice weekly with at least 1 calendar day interval between inspections.  |

- (d) If the person making the inspection finds a deviation from the requirements of this part, the inspector shall immediately initiate remedial action.

**Note to § 213.233:** Except as provided in paragraph (b) of this section, no part of this section will in any way be construed to limit the inspector's discretion as it involves inspection speed and sight distance.

**§ 213.235 Inspection of switches, track crossings, and lift rail assemblies or other transition devices on moveable bridges.**

- (a) Except as provided in paragraph (c) of this section, each switch, turnout, track crossing, and moveable bridge lift rail assembly or other transition device shall be inspected on foot at least monthly.
- (b) Each switch in Classes 3 through 5 track that is held in position only by the operating mechanism and one connecting rod shall be operated to all of its positions during one inspection in every 3 month period.
- (c) In the case of track that is used less than once a month, each switch, turnout, track crossing, and moveable bridge lift rail assembly or other transition device shall be inspected on foot before it is used.

**§ 213.237 Inspection of rail.**

- (a) In addition to the track inspections required by §213.233, a continuous search for internal defects shall be made of all rail in Classes 4 through 5 track, and Class 3 track over which passenger trains operate, at least once every 40 million gross tons (mgt) or once a year, whichever interval is shorter. On Class 3 track over which passenger trains do not operate such a search shall be made at least once every 30 mgt or once a year, whichever interval is longer. (This paragraph (a) is applicable January 1, 1999.)

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- (b) Inspection equipment shall be capable of detecting defects between joint bars, in the area enclosed by joint bars.
  - (c) Each defective rail shall be marked with a highly visible marking on both sides of the web and base.
  - (d) If the person assigned to operate the rail defect detection equipment being used determines that, due to rail surface conditions, a valid search for internal defects could not be made over a particular length of track, the test on that particular length of track cannot be considered as a search for internal defects under paragraph (a) of this section. (This paragraph (d) is not retroactive to tests performed prior to September 21, 1998.)
  - (e) If a valid search for internal defects cannot be conducted for reasons described in paragraph (d) of this section, the track owner shall, before the expiration of time or tonnage limits—
    - (1) Conduct a valid search for internal defects;
    - (2) Reduce operating speed to a maximum of 25 miles per hour until such time as a valid search for internal defects can be made; or
    - (3) Remove the rail from service.

### **§ 213.239 Special inspections.**

In the event of fire, flood, severe storm, or other occurrence which might have damaged track structure, a special inspection shall be made of the track involved as soon as possible after the occurrence and, if possible, before the operation of any train over that track.

**§ 213.241 Inspection records.**

- (a) Each owner of track to which this part applies shall keep a record of each inspection required to be performed on that track under this subpart.
- (b) Each record of an inspection under §§ 213.4, 213.119, 213.233, and 213.235 shall be prepared on the day the inspection is made and signed by the person making the inspection. Records shall specify the track inspected, date of inspection, location and nature of any deviation from the requirements of this part, and the remedial action taken by the person making the inspection. The owner shall designate the location(s) where each original record shall be maintained for at least one year after the inspection covered by the record. The owner shall also designate one location, within 100 miles of each state in which they conduct operations, where copies of records which apply to those operations are either maintained or can be viewed following 10 days notice by the Federal Railroad Administration.
- (c) Rail inspection records shall specify the date of inspection, the location and nature of any internal defects found, the remedial action taken and the date thereof, and the location of any intervals of track not tested per §213.237(d). The owner shall retain a rail inspection record for at least two years after the inspection and for one year after remedial action is taken.

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- (d) Each owner required to keep inspection records under this section shall make those records available for inspection and copying by the Federal Railroad Administration.
- (e) For purposes of compliance with the requirements of this section, an owner of track may maintain and transfer records through electronic transmission, storage, and retrieval provided that--
- (1) The electronic system be designed so that the integrity of each record is maintained through appropriate levels of security such as recognition of an electronic signature, or other means, which uniquely identify the initiating person as the author of that record. No two persons shall have the same electronic identity;
  - (2) The electronic storage of each record shall be initiated by the person making the inspection within 24 hours following the completion of that inspection;
  - (3) The electronic system shall ensure that each record cannot be modified in any way, or replaced, once the record is transmitted and stored;
  - (4) Any amendment to a record shall be electronically stored apart from the record which it amends. Each amendment to a record shall be uniquely identified as to the person making the amendment;

- (5) The electronic system shall provide for the maintenance of inspection records as originally submitted without corruption or loss of data;
- (6) Paper copies of electronic records and amendments to those records, that may be necessary to document compliance with this part shall be made available for inspection and copying by the Federal Railroad Administration at the locations specified in paragraph (b) of this section; and
- (7) Track inspection records shall be kept available to persons who performed the inspections and to persons performing subsequent inspections.



Appendix A - Maximum Allowable Curving Speeds

Table 1—Three Inches Unbalance

**Table consists of pages 78 and 79**

| Elevation of outer rail (inches) → | 0  | ½   | 1   | 1½  | 2   | 2½  |
|------------------------------------|--|-----|-----|-----|-----|-----|
| Degree of curvature ↓              | ↓ (12) Maximum allowable operating speed (mph) ↓ |     |     |     |     |     |
| 0°30' . . . . .                    | 93   | 100 | 107 | 113 | 120 | 125 |
| 0°40' . . . . .                    | 80   | 87  | 93  | 98  | 103 | 109 |
| 0°50' . . . . .                    | 72   | 78  | 83  | 88  | 93  | 97  |
| 1°00' . . . . .                    | 66   | 71  | 76  | 80  | 85  | 89  |
| 1°15' . . . . .                    | 59   | 63  | 68  | 72  | 76  | 79  |
| 1°30' . . . . .                    | 54   | 58  | 62  | 66  | 69  | 72  |
| 1°45' . . . . .                    | 50   | 54  | 57  | 61  | 64  | 67  |
| 2°00' . . . . .                    | 46   | 50  | 54  | 57  | 60  | 63  |
| 2°15' . . . . .                    | 44   | 47  | 50  | 54  | 56  | 59  |
| 2°30' . . . . .                    | 41   | 45  | 48  | 51  | 54  | 56  |
| 2°45' . . . . .                    | 40   | 43  | 46  | 48  | 51  | 54  |
| 3°00' . . . . .                    | 38   | 41  | 44  | 46  | 49  | 51  |
| 3°15' . . . . .                    | 36   | 39  | 42  | 45  | 47  | 49  |
| 3°30' . . . . .                    | 35   | 38  | 40  | 43  | 45  | 47  |
| 3°45' . . . . .                    | 34   | 37  | 39  | 41  | 44  | 46  |
| 4°00' . . . . .                    | 33   | 35  | 38  | 40  | 42  | 44  |
| 4°30' . . . . .                    | 31   | 33  | 36  | 38  | 40  | 42  |
| 5°00' . . . . .                    | 29   | 32  | 34  | 36  | 38  | 40  |
| 5°30' . . . . .                    | 28   | 30  | 32  | 34  | 36  | 38  |
| 6°00' . . . . .                    | 27   | 29  | 31  | 33  | 35  | 36  |
| 6°30' . . . . .                    | 26   | 28  | 30  | 31  | 33  | 35  |
| 7°00' . . . . .                    | 25   | 27  | 29  | 30  | 32  | 34  |
| 8°00' . . . . .                    | 23   | 25  | 27  | 28  | 30  | 31  |
| 9°00' . . . . .                    | 22   | 24  | 25  | 27  | 28  | 30  |
| 10°00' . . . . .                   | 21   | 22  | 24  | 25  | 27  | 28  |
| 11°00' . . . . .                   | 20   | 21  | 23  | 24  | 26  | 27  |
| 12°00' . . . . .                   | 19   | 20  | 22  | 23  | 24  | 26  |

## Appendix A - Maximum Allowable Curving Speeds

Table 1—Three Inches Unbalance

**Table consists of pages 78 and 79**

| Elevation of outer rail (inches) → | 3  | 3½  | 4   | 4½  | 5   | 5½  | 6   |
|------------------------------------|--|-----|-----|-----|-----|-----|-----|
| Degree of curvature ↓              | ↓ (12) Maximum allowable operating speed (mph) ↓ |     |     |     |     |     |     |
| 0°30' . . . . .                    | 131  | 136 | 141 | 146 | 151 | 156 | 160 |
| 0°40' . . . . .                    | 113  | 118 | 122 | 127 | 131 | 135 | 139 |
| 0°50' . . . . .                    | 101  | 106 | 110 | 113 | 117 | 121 | 124 |
| 1°00' . . . . .                    | 93   | 96  | 100 | 104 | 107 | 110 | 113 |
| 1°15' . . . . .                    | 83   | 86  | 89  | 93  | 96  | 99  | 101 |
| 1°30' . . . . .                    | 76   | 79  | 82  | 85  | 87  | 90  | 93  |
| 1°45' . . . . .                    | 70   | 73  | 76  | 78  | 81  | 83  | 86  |
| 2°00' . . . . .                    | 66   | 68  | 71  | 73  | 76  | 78  | 80  |
| 2°15' . . . . .                    | 62   | 64  | 67  | 69  | 71  | 74  | 76  |
| 2°30' . . . . .                    | 59   | 61  | 63  | 66  | 68  | 70  | 72  |
| 2°45' . . . . .                    | 56   | 58  | 60  | 62  | 65  | 66  | 68  |
| 3°00' . . . . .                    | 54   | 56  | 58  | 60  | 62  | 64  | 66  |
| 3°15' . . . . .                    | 51   | 54  | 56  | 57  | 59  | 61  | 63  |
| 3°30' . . . . .                    | 50   | 52  | 54  | 55  | 57  | 59  | 61  |
| 3°45' . . . . .                    | 48   | 50  | 52  | 54  | 55  | 57  | 59  |
| 4°00' . . . . .                    | 46   | 48  | 50  | 52  | 54  | 55  | 57  |
| 4°30' . . . . .                    | 44   | 45  | 47  | 49  | 50  | 52  | 54  |
| 5°00' . . . . .                    | 41   | 43  | 45  | 46  | 48  | 49  | 51  |
| 5°30' . . . . .                    | 40   | 41  | 43  | 44  | 46  | 47  | 48  |
| 6°00' . . . . .                    | 38   | 39  | 41  | 42  | 44  | 45  | 46  |
| 6°30' . . . . .                    | 36   | 38  | 39  | 41  | 42  | 43  | 45  |
| 7°00' . . . . .                    | 35   | 36  | 38  | 39  | 40  | 42  | 43  |
| 8°00' . . . . .                    | 33   | 34  | 35  | 37  | 38  | 39  | 40  |
| 9°00' . . . . .                    | 31   | 32  | 33  | 35  | 36  | 37  | 38  |
| 10°00' . . . . .                   | 29   | 31  | 32  | 33  | 34  | 35  | 36  |
| 11°00' . . . . .                   | 28   | 29  | 30  | 31  | 32  | 33  | 34  |
| 12°00' . . . . .                   | 27   | 28  | 29  | 30  | 31  | 32  | 33  |

Appendix A - Maximum Allowable Curving Speeds

Table 2—Four Inches Unbalance

**Table consists of pages 80 and 81**

| Elevation of outer rail (inches) → | 0  | 1/2 | 1   | 1 1/2 | 2   | 2 1/2 |
|------------------------------------|--|-----|-----|-------|-----|-------|
| Degree of curvature ↓              | ↓ (12) Maximum allowable operating speed (mph) ↓ |     |     |       |     |       |
| 0°30'                              | 107  | 113 | 120 | 125   | 131 | 136   |
| 0°40'                              | 93   | 98  | 104 | 109   | 113 | 118   |
| 0°50'                              | 83   | 88  | 93  | 97    | 101 | 106   |
| 1°00'                              | 76   | 80  | 85  | 89    | 93  | 96    |
| 1°15'                              | 68   | 72  | 76  | 79    | 83  | 86    |
| 1°30'                              | 62   | 65  | 69  | 72    | 76  | 79    |
| 1°45'                              | 57   | 61  | 64  | 67    | 70  | 73    |
| 2°00'                              | 53   | 57  | 60  | 63    | 65  | 68    |
| 2°15'                              | 50   | 53  | 56  | 59    | 62  | 64    |
| 2°30'                              | 48   | 51  | 53  | 56    | 59  | 61    |
| 2°45'                              | 46   | 48  | 51  | 53    | 56  | 58    |
| 3°00'                              | 44   | 46  | 49  | 51    | 53  | 56    |
| 3°15'                              | 42   | 44  | 47  | 49    | 51  | 53    |
| 3°30'                              | 40   | 43  | 45  | 47    | 49  | 52    |
| 3°45'                              | 39   | 41  | 44  | 46    | 48  | 50    |
| 4°00'                              | 38   | 40  | 42  | 44    | 46  | 48    |
| 4°30'                              | 36   | 38  | 40  | 42    | 44  | 45    |
| 5°00'                              | 34   | 36  | 38  | 40    | 41  | 43    |
| 5°30'                              | 32   | 34  | 36  | 38    | 39  | 41    |
| 6°00'                              | 31   | 33  | 35  | 36    | 38  | 39    |
| 6°30'                              | 30   | 31  | 33  | 35    | 36  | 38    |
| 7°00'                              | 29   | 30  | 32  | 34    | 35  | 36    |
| 8°00'                              | 27   | 28  | 30  | 31    | 33  | 34    |
| 9°00'                              | 25   | 27  | 28  | 30    | 31  | 32    |
| 10°00'                             | 24   | 25  | 27  | 28    | 29  | 30    |
| 11°00'                             | 23   | 24  | 25  | 27    | 28  | 29    |
| 12°00'                             | 22   | 23  | 24  | 26    | 27  | 28    |

## Appendix A - Maximum Allowable Curving Speeds

Table 2—Four Inches Unbalance

**Table consists of pages 80 and 81**

| Elevation of outer rail (inches) → | 3  | 3½  | 4   | 4½  | 5   | 5½  | 6   |
|------------------------------------|--|-----|-----|-----|-----|-----|-----|
| Degree of curvature ↓              | ↓ (12) Maximum allowable operating speed (mph) ↓ |     |     |     |     |     |     |
| 0°30'                              | 141  | 146 | 151 | 156 | 160 | 165 | 169 |
| 0°40'                              | 122  | 127 | 131 | 135 | 139 | 143 | 146 |
| 0°50'                              | 110  | 113 | 117 | 121 | 124 | 128 | 131 |
| 1°00'                              | 100  | 104 | 107 | 110 | 113 | 116 | 120 |
| 1°15'                              | 89   | 93  | 96  | 99  | 101 | 104 | 107 |
| 1°30'                              | 82   | 85  | 87  | 90  | 93  | 95  | 98  |
| 1°45'                              | 76   | 78  | 81  | 83  | 86  | 88  | 90  |
| 2°00'                              | 71   | 73  | 76  | 78  | 80  | 82  | 85  |
| 2°15'                              | 67   | 69  | 71  | 73  | 76  | 78  | 80  |
| 2°30'                              | 63   | 65  | 68  | 70  | 72  | 74  | 76  |
| 2°45'                              | 60   | 62  | 64  | 66  | 68  | 70  | 72  |
| 3°00'                              | 58   | 60  | 62  | 64  | 65  | 67  | 69  |
| 3°15'                              | 55   | 57  | 59  | 61  | 63  | 65  | 66  |
| 3°30'                              | 53   | 55  | 57  | 59  | 61  | 62  | 64  |
| 3°45'                              | 52   | 53  | 55  | 57  | 59  | 60  | 62  |
| 4°00'                              | 50   | 52  | 53  | 55  | 57  | 58  | 60  |
| 4°30'                              | 47   | 49  | 50  | 52  | 53  | 55  | 56  |
| 5°00'                              | 45   | 46  | 48  | 49  | 51  | 52  | 53  |
| 5°30'                              | 43   | 44  | 46  | 47  | 48  | 50  | 51  |
| 6°00'                              | 41   | 42  | 44  | 45  | 46  | 48  | 49  |
| 6°30'                              | 39   | 41  | 42  | 43  | 44  | 46  | 47  |
| 7°00'                              | 38   | 39  | 40  | 42  | 43  | 44  | 45  |
| 8°00'                              | 35   | 37  | 38  | 39  | 40  | 41  | 42  |
| 9°00'                              | 33   | 35  | 36  | 37  | 38  | 39  | 40  |
| 10°00'                             | 32   | 33  | 34  | 35  | 36  | 37  | 38  |
| 11°00'                             | 30   | 31  | 32  | 33  | 34  | 35  | 36  |
| 12°00'                             | 29   | 30  | 31  | 32  | 33  | 34  | 35  |



## Appendix B to Part 213 - Schedule of Civil Penalties

| Section  | Violation | Willful Violation <sup>1</sup> |
|--|-----------|--------------------------------|
| <b>Subpart A--General:</b>   |           |                                |
| 213.4(a) Excepted track <sup>2</sup> .....   | \$2,500   | \$5,000                        |
| 213.4(b) Excepted track <sup>2</sup> .....   | 2,500     | 5,000                          |
| 213.4(c) Excepted track <sup>2</sup> .....   | 2,500     | 5,000                          |
| 213.4(d) Excepted track <sup>2</sup> .....   | 2,500     | 5,000                          |
| 213.4(e):  |           |                                |
| (1) Excepted track .....   | 5,000     | 7,500                          |
| (2) Excepted track .....   | 7,000     | 10,000                         |
| (3) Excepted track .....   | 7,000     | 10,000                         |
| (4) Excepted track .....   | 5,000     | 7,500                          |
| 213.4(f) Excepted track .....  | 2,000     | 4,000                          |
| 213.7 Designation of qualified persons to supervise certain renewals and inspect track ..... | 1,000     | 2,000                          |
| 213.9 Classes of track: operating speed limits .....   | 2,500     | 2,500                          |
| 213.11 Restoration or renewal of track under traffic conditions .....                        | 2,500     | 2,500                          |
| 213.13 Measuring track not under load  | 1,000     | 2,000                          |
| <b>Subpart B--Roadbed:</b>   |           |                                |
| 213.33 Drainage .....  | 2,500     | 5,000                          |
| 213.37 Vegetation .....  | 1,000     | 2,000                          |
| <b>Subpart C--Track Geometry:</b>  |           |                                |
| 213.53 Gage .....  | 5,000     | 7,500                          |
| 213.55 Alinement. ....   | 5,000     | 7,500                          |
| 213.57 Curves; elevation and speed limitations .....   | 2,500     | 5,000                          |

## Appendix B to Part 213 - Schedule of Civil Penalties

| Section                            | Violation   | Willful Violation <sup>1</sup> |
|------------------------------------|---|--------------------------------|
| 213.59                             | Elevation of curved track; runoff . . . . .       | \$2,500      \$2,500           |
| 213.63                             | Track surface. . . . .                            | 5,000      7,500               |
| <b>Subpart D--Track structure:</b> |   |                                |
| 213.103                            | Ballast; general . . . . .                        | 2,500      5,000               |
| 213.109                            | Crossties   |                                |
| (a)                                | Material used. . . . .                            | 1,000      2,000               |
| (b)                                | Distribution of ties . . . . .                    | 2,500      5,000               |
| (c)                                | Sufficient number of nondefective ties . . . . .  | 1,000      2,000               |
| (d)                                | Joint ties . . . . .                              | 2,500      5,000               |
| (e)                                | Track constructed without crossties. . . . .      | 2,500      5,000               |
| 213.113                            | Defective rails . . . . .                         | 5,000      7,500               |
| 213.115                            | Rail end mismatch . . . . .                       | 2,500      5,000               |
| 213.119                            | Continuous welded rail (a) through (i) . . . . .  | 5,000      7,500               |
| 213.121(a)                         | Rail joints . . . . .                             | 2,500      5,000               |
| 213.121(b)                         | Rail joints . . . . .                             | 2,500      5,000               |
| 213.121(c)                         | Rail joints . . . . .                             | 5,000      7,500               |
| 213.121(d)                         | Rail joints . . . . .                             | 2,500      5,000               |
| 213.121(e)                         | Rail joints . . . . .                             | 2,500      5,000               |
| 213.121(f)                         | Rail joints . . . . .                             | 2,500      5,000               |
| 213.121(g)                         | Rail joints . . . . .                             | 2,500      5,000               |
| 213.121(h)                         | Rail joints . . . . .                             | 5,000      7,500               |
| 213.122                            | Torch cut rail . . . . .                          | 2,500      5,000               |
| 213.123                            | Tie plates . . . . .                              | 1,000      2,000               |
| 213.127                            | Rail fastenings . . . . .                         | 2,500      5,000               |
| 213.133                            | Turnouts and track crossings, generally . . . . . | 1,000      1,000               |

## Appendix B to Part 213 - Schedule of Civil Penalties

| Section  | Violation | Willful Violation <sup>1</sup> |
|--|-----------|--------------------------------|
| 213.135 Switches:  |           |                                |
| (a) through (g) . . . . .                                    | \$2,500   | \$5,000                        |
| (h) chipped or worn points . . . . .                         | 5,000     | 7,500                          |
| 213.137 Frogs . . . . .                                      | 2,500     | 5,000                          |
| 213.139 Spring rail frogs . . . . .                          | 2,500     | 5,000                          |
| 213.141 Self-guarded frogs . . . . .                         | 2,500     | 5,000                          |
| 213.143 Frog guard rails and guard faces; gage . . . . .     | 2,500     | 5,000                          |
| <b>Subpart E—Track appliances and track-related devices:</b> |           |                                |
| 213.205 Derails . . . . .                                    | 2,500     | 5,000                          |
| <b>Subpart F—Inspection:</b>                                 |           |                                |
| 213.233 Track inspections . . . . .                          | 2,000     | 4,000                          |
| 213.235 Switches, crossings, transition devices. . . . .     | 2,000     | 4,000                          |
| 213.237 Inspection of rail . . . . .                         | 2,500     | 5,000                          |
| 213.239 Special inspections. . . . .                         | 2,500     | 5,000                          |
| 213.241 Inspection records . . . . .                         | 1,000     | 1,000                          |

<sup>1</sup>A penalty may be assessed against an individual only for a willful violation. The Administrator reserves the right to assess a penalty of up to \$27,000 for any violation where circumstances warrant. See 49 CFR Part 209, Appendix A.

<sup>2</sup>In addition to assessment of penalties for each instance of noncompliance with the requirements identified by this footnote, track segments designated as excepted track that are or become ineligible for such designation by virtue of noncompliance with any of the requirements to which this footnote applies are subject to all other requirements of Part 213 until such noncompliance is remedied.



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## **Appendix C to Part 213—Statement of Agency Policy on the Safety of Railroad Bridges**

1. The structural integrity of bridges that carry railroad tracks is important to the safety of railroad employees and to the public. The responsibility for the safety of railroad bridges rests with the owner of the track carried by the bridge, together with any other party to whom that responsibility has been assigned by the track owner.
2. The capacity of a bridge to safely support its traffic can be determined only by intelligent application of engineering principles and the laws of physics. Bridge owners should use, as FRA does, those principles to assess the integrity of railroad bridges.
3. The long term ability of a structure to perform its function is an economic issue beyond the intent of this policy. In assessing a bridge's structural condition, FRA focuses on the present safety of the structure, rather than its appearance or long term usefulness.
4. FRA inspectors conduct regular evaluations of railroad bridge inspection and management practices. The objective of these evaluations is to document the practices of the evaluated railroad and to disclose any program weaknesses that could affect the safety of the public or railroad employees. When the evaluation discloses problems, FRA seeks a cooperative resolution. If safety is jeopardized by a bridge owner's failure to resolve a bridge problem, FRA will use

available legal means, including issuance of emergency orders, to protect the safety of railroad employees and the public.

5. This policy statement addresses the integrity of bridges that carry railroad tracks. It does not address the integrity of other types of structures on railroad property (i.e., tunnels or bridges carrying highways) or other features over railroads (i.e., highway overpasses).
6. The guidelines published in this statement are advisory, rather than regulatory, in nature. They indicate those elements FRA deems essential to successful bridge management programs. FRA uses the guidelines when evaluating bridge inspection and management practices.

## **Guidelines**

### **1. Responsibility for safety of railroad bridges**

- (a) **Track owner.** The owner of the track on a bridge, or another person assuming responsibility for the compliance of that track with this Part under provisions of §213.5, is responsible for ensuring that the bridge is capable of safely carrying all railroad traffic operated on that track, and for specifying the maximum loads that may be operated over the bridge.
- (b) **Divided ownership.** Where the owner of the track on a bridge does not own the bridge, the track owner should ensure that the bridge owner is following a program

that will maintain the integrity of the bridge. The track owner either should participate in the inspection of the bridge, or should obtain and review reports of inspections performed by the bridge owner. The track owner should maintain current information regarding loads that may be operated over the bridge, either from its own engineering evaluations or as provided by a competent engineer representing the bridge owner. Information on permissible loads may be communicated by the bridge owner either in terms of specific car and locomotive configurations and weights, or as values representing a standard railroad bridge rating reference system. The most common standard bridge rating reference system incorporated in the Manual for Railway Engineering of the American Railway Engineering and Maintenance of Way Association is the dimensional and proportional load configuration devised by Theodore Cooper. Other reference systems may be used where convenient, provided their effects can be defined in terms of shear, bending and pier reactions as necessary for a comprehensive evaluation and statement of the capacity of a bridge.

- (c) **Other railroads.** The owner of the track on a bridge should advise other railroads operating on that track of the maximum loads permitted on the bridge stated in terms of

car and locomotive configurations and weights. No railroad should operate a load which exceeds those limits without specific authority from, and in accordance with restrictions placed by, the track owner.

## 2. Capacity of Railroad Bridges

- (a) **Determination.** The safe capacity of bridges should be determined by competent engineers using accepted principles of structural design and analysis.
- (b) **Analysis.** Proper analysis of a bridge means knowledge of the actual dimensions, materials and properties of the structural members of the bridge, their condition, and the stresses imposed in those members by the service loads.
- (c) **Rating.** The factors which were used for the design of a bridge can generally be used to determine and rate the load capacity of a bridge provided:
  - (i) The condition of the bridge has not changed significantly, and
  - (ii) The stresses resulting from the service loads can be correlated to the stresses for which the bridge was designed or rated.

## 3. Railroad Bridge Loads

- (a) **Control of loads.** The operating instructions for each railroad operating over bridges should include provisions to restrict

the movement of cars and locomotives whose weight or configuration exceed the nominal capacity of the bridges.

- (b) **Authority for exceptions.** Equipment exceeding the nominal weight restriction on a bridge should be operated only under conditions determined by a competent engineer who has properly analyzed the stresses resulting from the proposed loads.
- (c) **Operating conditions.** Operating conditions for exceptional loads may include speed restrictions, restriction of traffic from adjacent multiple tracks, and weight limitations on adjacent cars in the same train.

#### 4. Railroad Bridge Records

- (a) The organization responsible for the safety of a bridge should keep design, construction, maintenance and repair records readily accessible to permit the determination of safe loads. Having design or rating drawings and calculations that conform to the actual structure greatly simplifies the process of making accurate determinations of safe bridge loads.
- (b) Organizations acquiring railroad property should obtain original or usable copies of all bridge records and drawings, and protect or maintain knowledge of the location of the original records.

## **5. Specifications for Design and Rating of Railroad Bridges**

- (a) The recommended specifications for the design and rating of bridges are those found in the *Manual for Railway Engineering* published by the American Railway Engineering and Maintenance-of-way Association. These specifications incorporate recognized principles of structural design and analysis to provide for the safe and economic utilization of railroad bridges during their expected useful lives. These specifications are continually reviewed and revised by committees of competent engineers. Other specifications for design and rating, however, have been successfully used by some railroads and may continue to be suitable.
- (b) A bridge can be rated for capacity according to current specifications regardless of the specification to which it was originally designed.

## **6. Periodic Inspections of Railroad Bridges**

- (a) Periodic bridge inspections by competent inspectors are necessary to determine whether a structure conforms to its design or rating condition and, if not, the degree of nonconformity.
- (b) The prevailing practice throughout the railroad industry is to inspect railroad bridges at least annually. Inspections at more fre-

quent intervals may be indicated by the nature or condition of a structure or intensive traffic levels.

## **7. Underwater Inspections of Railroad Bridges**

- (a) Inspections of bridges should include measuring and recording the condition of substructure support at locations subject to erosion from moving water.
- (b) Stream beds often are not visible to the inspector. Indirect measurements by sounding, probing, or any other appropriate means are necessary in those cases. A series of records of those readings will provide the best information in the event unexpected changes suddenly occur. Where such indirect measurements do not provide the necessary assurance of foundation integrity, diving inspections should be performed as prescribed by a competent engineer.

## **8. Seismic Considerations**

- (a) Owners of bridges should be aware of the risks posed by earthquakes in the areas in which their bridges are located. Precautions should be taken to protect the safety of trains and the public following an earthquake.
- (b) Contingency plans for seismic events should be prepared in advance, taking into account the potential for seismic activity in an area.

- (c) The predicted attenuation of ground motion varies considerably within the United States. Local ground motion attenuation values and the magnitude of an earthquake both influence the extent of the area affected by an earthquake. Regions with low frequency of seismic events produce less data from which to predict attenuation factors. That uncertainty should be considered when designating the area in which precautions should be taken following the first notice of an earthquake. In fact, earthquakes in such regions might propagate their effects over much wider areas than earthquakes of the same magnitude occurring in regions with frequent seismic activity.

## **9. Special Inspections of Railroad Bridges**

- (a) A special bridge inspection should be performed after an occurrence that might have reduced the capacity of the bridge, such as a flood, an earthquake, a derailment, or an unusual impact.
- (b) When a railroad learns that a bridge might have suffered damage through an unusual occurrence, it should restrict train operations over the bridge until the bridge is inspected and evaluated.

## **10. Railroad Bridge Inspection Records**

- (a) Bridge inspections should be recorded. Records should identify the structure inspected, the date of the inspection, the

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name of the inspector, the components inspected, and their condition.

- (b) Information from bridge inspection reports should be incorporated into a bridge management program to ensure that exceptions on the reports are corrected or accounted for. A series of inspection reports prepared over time should be maintained so as to provide a valuable record of trends and rates of degradation of bridge components. The reports should be structured to promote comprehensive inspections and effective communication between an inspector and an engineer who performs an analysis of a bridge.
- (c) An inspection report should be comprehensible to a competent person without interpretation by the reporting inspector.

## **11. Railroad Bridge Inspectors and Engineers**

- (a) Bridge inspections should be performed by technicians whose training and experience enable them to detect and record indications of distress on a bridge. Inspectors should provide accurate measurements and other information about the condition of the bridge in enough detail so that an engineer can make a proper evaluation of the safety of the bridge.
- (b) Accurate information about the condition of a bridge should be evaluated by an engineer who is competent to determine the capacity

of the bridge. The inspector and the evaluator often are not the same individual. The quality of the bridge evaluation depends on the quality of the communication between them.

## **12. Scheduling Inspections**

- (a) A bridge management program should include a means to ensure that each bridge under the program is inspected at the frequency prescribed for that bridge by a competent engineer.
- (b) Bridge inspections should be scheduled from an accurate bridge inventory list that includes the due date of the next inspection.

## **13. Special Considerations for Railroad Bridges**

Railroad bridges differ from other types of bridges in the types of loads they carry, in their modes of failure and indications of distress, and in their construction details and components. Proper inspection and analysis of railroad bridges require familiarity with the loads, details and indications of distress that are unique to this class of structure. Particular care should be taken that modifications to railroad bridges, including retrofits for protection against the effects of earthquakes, are suitable for the structure to which they are to be applied. Modifications should not adversely affect the serviceability of the bridge nor its accessibility for periodic or special inspection.

**Defect Codes for  
Code of Federal Regulations  
Part 213 Track Safety Standards**

**Subparts A-F**



**Note**

**Note:** Defect codes are entered here for your convenience. They *should only* be used as a guideline. These defect codes are subject to change and The Railway Educational Bureau has no control over when these changes would be available.



**Defect Codes for  
Part 213  
Track Safety Standards**

**Classes 1 Through 5**

- § 213.4      Excepted track**
- 4.01      Excepted track segment not identified in appropriate record.
- 4.02      Excepted track segment located within 30 feet of an adjacent track subject to simultaneous operation at speeds in excess of 10 mph.
- 4.03      Excepted track not inspected in accordance with §§213.233(c) and 213.235 as specified for Class 1 track.
- 4.04      Train speed exceeds 10 mph on excepted track.
- 4.05      Occupied passenger train operated on excepted track.
- 4.06      Freight train operated on excepted track with more than five cars required to be placarded in accordance with 49 CFR Part 172.
- 4.07      Train with a car required to be placarded by 49 CFR Part 172 operated over excepted track within 100 feet of a bridge or in a public street or highway.
- 4.08      Failure to notify FRA of removal of trackage from excepted status.
- § 213.7      Designation of qualified persons to supervise certain renewals and inspect track**
- 7.01      No written record of names of qualified persons to supervise restorations and renewals of track under traffic and/or to inspect track for defects, or to pass trains over broken rails or pull-aparts.

- 7.02 Failure of track owner to provide written authorization to qualified designated individuals.
- 7.03 Failure to use qualified person to pass trains over broken rails or pull aparts.
- 7.04 Train speed exceeds 10 m.p.h. over broken rails or pull aparts.
- 7.05 Failure to promptly notify and dispatch person fully qualified under § 213.7 to the location of the broken rail or pull apart.

**§ 213.9 Classes of track; operating speed limits**

- 9.01 Failure to restore other than excepted track to compliance with Class 1 standards within 30 days after a person designated under § 213.7(a) has determined that operations may safely continue over defect(s) not meeting Class 1 or excepted track standards.
- 9.02 Failure of track owner to enforce, over Class 1 defects, the limiting conditions imposed by person designated under § 213.7(a).
- 9.03 Reserved

**§ 213.11 Restoration or renewal of track under traffic conditions**

- 11.01 Proper qualified supervision not provided at work site during work hours when track is being restored or renewed under traffic conditions.

**§ 213.33 Drainage**

- 33.01 Drainage or water-carrying facility not maintained.
- 33.02 Drainage or water-carrying facility obstructed by debris.
- 33.03 Drainage or water-carrying facility collapsed.
- 33.04 Drainage or water-carrying facility obstructed by vegetation.

- 33.05 Drainage or water-carrying facility obstructed by silting.
- 33.06 Drainage or water-carrying facility deteriorated to allow subgrade saturation.
- 33.07 Uncontrolled water undercutting track structure or embankment.

**§ 213.37 Vegetation**

- 37.01 Combustible vegetation around track-carrying structures.
- 37.02 Vegetation obstructs visibility of railroad signs and fixed signals.
- 37.03 Vegetation obstructs passing of day and night signals by railroad employees.
- 37.04 Vegetation interferes with railroad employees performing normal trackside duties.
- 37.05 Vegetation prevents proper functioning of signal and/or communication lines.
- 37.06 Excessive vegetation at train order office, depot, interlocking plant, a carman's building, etc., prevents employees on duty from visually inspecting moving equipment when their duties so require.
- 37.07 Excessive vegetation at train meeting points prevents proper inspection by railroad employees.
- 37.08 Excessive vegetation in toepaths and around switches where employees are performing normal trackside duties.
- 37.09 Vegetation brushing sides of rolling stock.
- 37.10 Vegetation obstructs visibility of grade crossing warning signs and signals by the traveling public.

**§ 213.53 Gage**

- 53.01 Gage dimension exceeds allowable on tangent track.

- 53.02 Gage dimension is less than allowable on tangent track.
- 53.03 Gage dimension exceeds allowable on curved track.
- 53.04 Gage dimension is less than allowable on curved track.
- 53.05 Gage dimension exceeds allowable for excepted track.

**§ 213.55 Alinement**

- 55.01 Alinement of tangent track exceeds the allowable deviation.
- 55.02 Alinement of curved track exceeds the allowable deviation for a 62-foot chord.
- 55.03 Alinement of curved track exceeds the allowable deviation for a 31-foot chord.

**§ 213.57 Curves; elevation and speed limitations**

- 57.01 Reserved
- 57.02 Operating speed exceeds allowable for 3-inches of unbalance, based on curvature and elevation.
- 57.03 Operating speed exceeds allowable for 4-inches of unbalance, based on curvature and elevation.
- 57.04 Operating speed exceeds allowable for a FRA approved unbalance based on curvature and elevation approved for track contiguous to high speed track.
- 57.05 Reserved
- 57.06 Maximum crosslevel on curve exceeds allowable.

**§ 213.63 Track surface**

- 63.01 Runoff in any 31-feet of rail at end of raise exceeds allowable.
- 63.02 Deviation from uniform profile on either rail exceeds allowable.

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- 63.03 Reserved
  - 63.04 Reserved
  - 63.05 Deviation from zero crosslevel at any point on tangent exceeds allowable.
  - 63.06 Reserved
  - 63.07 Difference in crosslevel between any two points less than 62-feet apart on tangents exceeds allowable.
  - 63.08 Difference in crosslevel between any two points less than 62-feet apart on curves between spirals exceeds allowable.
  - 63.09 Difference in crosslevel between any two points less than 62-feet apart on spirals exceeds allowable.
  - 63.10 Reverse elevation on curve exceeds allowable.
  - 63.11 Variation in crosslevel per 31-feet exceeds allowable on restricted length spiral.
  - 63.12 Difference in crosslevel within 62-feet between a point on a curve that equals or exceeds 6-inches and a point with greater elevation exceed allowable.
  - 63.13 Crosslevel differences for six or more consecutive pairs of staggered joints exceeds allowable.
- § 213.103 Ballast; general**
- 103.01 Insufficient Ballast
  - 103.02 Fouled Ballast
- § 213.109 Crossties**
- 109.01 Reserved
  - 109.02 No effective support ties within the prescribed distance from a joint.

- 109.03 Crossties not effectively distributed to support a 39-foot segment of track.
- 109.04 Fewer than minimum allowable number of non-defective ties per 39 feet for tangent and curved track less than 2 degrees [effective 09/21/00].
- 109.05 Fewer than minimum allowable number of non-defective ties per 39 feet for turnouts and curved track over 2 degrees [effective 09/21/00].
- 109.06 Track constructed without crossties does not effectively support track structure.

**§ 213.110 Gage restraint measurements systems**

- 110.01 Failure to notify FRA at least 30 days prior to the designation of a GRMS line segment.
- 110.02 Failure to notify FRA at least 10 days prior to the removal of a line segment from GRMS designation.
- 110.03 Failure to provide required information identifying a GRMS line segment.
- 110.04 Failure to provide sufficient technical data to establish compliance with minimum GRMS design requirements.
- 110.05 Failure to maintain and operate GRMS within minimum design requirements over designated GRMS line segments.
- 110.06 Failure of GRMS to provide analog trace of specified parameters.
- 110.07 Failure of GRMS to provide exception report listing of specified parameters.
- 110.08 Failure to provide exception report listing to §213.7 individual prior to next inspection required under §213.233.
- 110.09 Failure to maintain and make available documented calibration procedures on GRMS vehicle.

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- 110.10 Failure to initiate a daily instrument verification procedure.
  - 110.11 Failure to maintain PTLF accuracy within five-percent of 4,000-pound reading.
  - 110.12 Failure to make available GRMS training program.
  - 110.13 Failure of GRMS training program to meet minimum requirements,
  - 110.14 Failure to provide GRMS training to §213.7 individual whose territory is subject to requirements of §213.110
  - 110.15 Failure to initiate required remedial action for exceptions listed on GRMS record of lateral restraint.
  - 110.16 Gage widening exceeds allowable measure with PTLF.
  - 110.17 Failure to provide functional PTLF to §213.7 individual whose territory is subject to requirements of §213.110.
  - 110.18 Failure to restore contact between rail and lateral rail restraint components
  - 110.19 Failure to keep GRMS records as required,
  - 110.20 Failure to conduct GRMS inspections at required frequency.
- § 213.113 Defective rails**
- 113.01 Transverse Fissure
  - 113.02 Compound Fissure
  - 113.03 Horizontal Split Head
  - 113.04 Vertical Split Head
  - 113.05 Split Web
  - 113.06 Piped Rail
  - 113.07 Bolt-Hole Crack
  - 113.08 Head Web Separation

- 113.09 Broken Base
- 113.10 Detail Fracture
- 113.11 Engine Burn Fracture
- 113.12 Ordinary Break
- 113.13 Broken or Defective Weld
- 113.14 Damaged Rail
- 113.15 Flattened Rail
- 113.16 Rail defect originating from bond wire attachment

**§ 213.115 Rail end mismatch**

- 115.01 Rail-end mismatch on tread of rail exceeds allowable
- 115.02 Rail end mismatch on gage side of rail exceeds allowable

**§ 213.119 Continuous welded rail (CWR); general**

- 119.01 Failure of track owner to develop and implement written CWR procedures.
- 119.02 Failure to comply with written CWR procedures.
- 119.03 Failure of track owner to develop a training program for the implementation of their written CWR procedures.
- 119.04 Failure to keep CWR records as required.

**§ 213.121 Rail joints**

- 121.01 Rail joint not of structurally sound design and dimension.
- 121.02 Cracked or broken joint bar in Classes 3 through 5 track (other than center-break).
- 121.03 Center cracked or broken joint bar.
- 121.04 Worn joint bar allows excessive vertical movement of rail in joint in Classes 3 through 5 track.

- 121.05 Less than 2 bolts per rail at each joint for conventional jointed rail in Classes 2 through 5 track.
  - 121.06 Less than 1 bolt per rail at each joint for conventional jointed rail in Class 1 track.
  - 121.07 Less than 2 bolts per rail at any joint in continuous welded rail.
  - 121.08 Loose joint bars.
  - 121.09 Torch-cut or burned-bolt hole in rail in Classes 2 through 5 track.
  - 121.10 Joint bar reconfigured by torch cutting in Classes 3 through 5 track.
- § 213.122 Torch cut rail**
- 122.01 Torch cut rail applied in Class 3 through 5 track for other than emergency.
  - 122.02 Failure to remove torch cut rails within specified time frame.
  - 122.03 Failure to remove non-inventoried torch cut rail within 30 days of discovery.
  - 122.04 Train speed exceeds allowable over non-inventoried torch cut rail.
- § 213.123 Tie Plates**
- 123.01 Insufficient tie plates in Class 3 through 5 track.
  - 123.02 Object between base of rail and the bearing surface of the tie plate causing concentrated load.
- § 213.127 Rail Fastenings**
- 127.01 Insufficient fasteners in a 39-foot track segment.
- § 213.133 Turnouts and Track Crossing Generally**
- 133.01 Loose, worn, or missing switch clips.
  - 133.02 Loose, worn, or missing clip bolts (transit, side jaw, eccentric, vertical).
  - 133.03 Loose, worn, or defective connecting rod.

- 133.04 Loose, worn, or defective connecting rod fastening.
- 133.05 Loose, worn, or defective switch rod.
- 133.06 Loose, worn, or missing switch rod bolts.
- 133.07 Worn or missing cotter pins.
- 133.08 Loose or missing rigid rail braces.
- 133.09 Loose or missing adjustable rail braces.
- 133.10 Missing switch, frog, or guard rail plates.
- 133.11 Loose or missing switch point stops.
- 133.12 Loose, worn, or missing frog bolts.
- 133.13 Loose, worn, or missing guard rail bolts.
- 133.14 Loose, worn or missing guard rail clamps, wedge, separator block, end block, or other components.
- 133.15 Obstruction between switch point and stock rail.
- 133.16 Obstruction in flangeway of frog.
- 133.17 Obstruction in flangeway of guard rail.
- 133.18 Insufficient anchorage to restrain rail movement.
- 133.19 Flangeway less than 1½ inches wide.
- 133.20 Turnout or track crossing fastenings not intact or maintained.

**§ 213.135 Switches**

- 135.01 Stock rail not securely seated in switch plates.
- 135.02 Stock rail canted by overtightening rail braces.
- 135.03 Improper fit between switch point and stock rail.
- 135.04 Outer edge of wheel contacting gage side of stock rail.
- 135.05 Excessive lateral or vertical movement of switch point.

- 135.06 Heel of switch insecure.
- 135.07 Insecure switch stand or switch machine.
- 135.08 Insecure connecting rod.
- 135.09 Throw lever operable with switch lock or keeper in place.
- 135.10 Switch position indicator not clearly visible.
- 135.11 Unusually chipped or worn switch point.
- 135.12 Improper switch closure due to metal flow.
- 135.13 Use of tongue and plane mate where speeds exceed class one.

**§ 213.137 Frogs**

- 137.01 Insufficient flangeway depth.
- 137.02 Frog point chipped, broken, or worn in excess of allowable.
- 137.03 Tread portion of frog worn in excess of allowable.
- 137.04 Use of flange bearing frog where speed exceeds that permitted by Class 1.
- 137.99 Severe frog condition not otherwise provided. [Advisory only cannot be used solely to recommend violation]

**§ 213.139 Spring Rail Frogs**

- 139.01 Outer edge of wheel contacting side of spring wing rail.
- 139.02 Toe of wing rail not fully bolted and tight.
- 139.03 Ties under or wing rail not solidly tamped.
- 139.04 Bolt-hole defect in frog.
- 139.05 Head and web separation in frog.
- 139.06 Insufficient tension in spring to hold wing rail against point rail.
- 139.07 Excessive clearance between hold-down housing and horn.

**§ 213.141 Self-Guarded Frogs**

- 141.01 Raised guard worn excessively.
- 141.02 Frog point rebuilt before restoring guarding face.

**§ 213.143 Frog Guard Rails and Guard Faces; Gage**

- 143.01 Guard check gage less than allowable.
- 143.02 Guard face gage exceeds allowable.
- 143.03 Cracked or broken guard rail.

**§ 213.205 Derails**

- 205.01 Derail not clearly visible.
- 205.02 Derail operable when locked.
- 205.03 Reserved.
- 205.04 Improper size derail.
- 205.05 Improperly installed derail.
- 205.06 Loose, worn, or defective parts of derail.

**§ 213.233 Track inspections**

- 233.01 Track inspected by other than qualified designated individual.
- 233.02 Track being inspected at excessive speed.
- 233.03 Failure to inspect at required frequency.
- 233.04 Failure to initiate remedial action for deviations found.
- 233.05 One Inspector inspecting more than two tracks.
- 233.06 Two Inspectors inspecting more than four tracks.
- 233.07 Inspection performed on track outside of maximum allowable track center distances.
- 233.08 Main track not traversed within the required frequency.
- 233.09 Siding track not traversed within the required frequency.

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**§ 213.235 Inspection of switches, track crossings, and lift rail assemblies or other transition devices on moveable bridges**

- 235.01 Failure to inspect turnouts at required frequency.
- 235.02 Failure to inspect track crossings at required frequency.
- 235.03 Failure to inspect lift rail assemblies or other transition devices on moveable bridges at required frequency
- 235.04 Failure to operate specified switches in Classes 3 through 5.

**§ 213.237 Inspection of Rail**

- 237.01 Failure to inspect rail for internal defects at required frequency.
- 237.02 Failure of equipment to inspect rail at joints.
- 237.03 Defective rail not marked properly.
- 237.04 Failure to reduce operating speed until valid rail inspection is performed.

**§ 213.239 Special Inspections**

- 239.01 Failure to conduct special inspections when required.

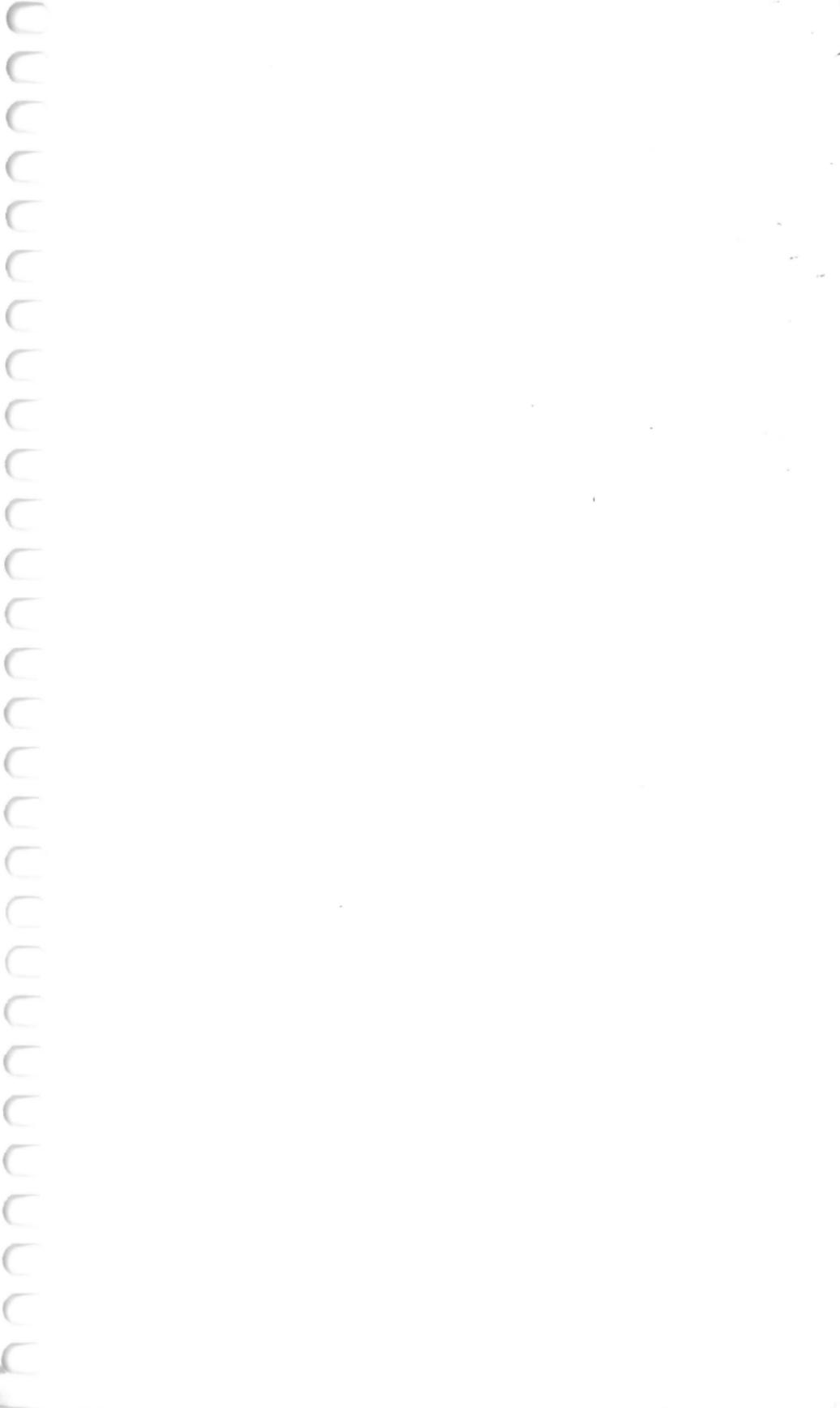
**§ 213.241 Inspection records**

- 241.01 Failure to keep records as required.
- 241.02 Failure of Inspector to complete report at time of inspection.
- 241.03 Failure of Inspector to sign report.
- 241.04 Failure of Inspector to provide required information.
- 241.05 Failure of rail inspection record to provide required information.
- 241.06 Failure to make records available for copying and inspection.

## Defect Codes A-F

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- 241.07 Electronic system does not maintain the integrity of each record.
- 241.08 Electronic system allows record or amendments to be modified.
- 241.09 Electronic amendments not stored separately from record.
- 241.10 Person making electronic amendment not identified.
- 241.11 Electronic system corrupts or losses data.
- 241.12 Paper copies of records not made available for inspection and copying.
- 241.13 Inspection reports not available to Inspector or subsequent Inspectors.
- 241.14 Electronic storage not initiated within 24 hours.









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