brightline

49 CFR Part 213
Track Safety Standards
Subparts A - F

Student Workbook

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Track Safety Standards
Student Workbook

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About this Student Workbook

Student Name: _____

Instructor Name: _____

Training Date: _____

Notes: _____

_____

_____

_____

_____

_____

✓Safety ✓Respect ✓Thoughtfulness
✓Curiosity ✓Optimism ✓Courage

Job Safety Briefing

Fill in the appropriate information

Location: _____

Emergency Procedures: _____

911 Caller(s): _____

CPR Qualified Employee: _____

AED/ Defibrillator: _____

Nearest Hospital: _____

Rule(s) of the Day: _____

Job Task: _____

Associated Hazards/ Risks: _____

_____

_____

_____

Introduction to Track Safety Standards

This course is designed for all railroad employees, managers and supervisors responsible for compliance with 49 CFR Part 213 Track Safety Standards (TSS) on Brightline property. This multi-day course is designed to provide each student with an informative and practical mix of classroom instruction and hands-on field training. Course work will acquaint students with the Track Safety Standards prescribed by Federal Regulation, as well as the means to detect deviations from these standards and prescribed appropriate remedial action to correct or safely compensate for these deviations.

Please note that this particular workbook and corresponding course are for Subparts A through F of the 213 regulations, which covers class of tracks 1 – 5. Subpart G is for Classes of track 6 and higher and is covered in a separate Workbook and presentation.

Course Goal

Upon successful completion of this course, students will understand minimum safety requirements for railroad track to comply with 49 CFR Part 213 and will have practiced the skills necessary to inspect track for compliance to keep their railroad operating safely.

Course Objectives

By the end of this course, YOU will be able to:

- Develop a clear understanding of the Federal Track Safety Standards
- Apply various components of 213 requirements to your class of track
- Recognize who is responsible for compliance and qualification requirements
- Know minimum drainage requirements for roadbed and area immediately adjacent to roadbed
- Learn how to measure and calculate track parameters, including gage, alignment, and surface
- Apply track inspection techniques on the job
- Identify various types of rail defects
- Know the appropriate remedial actions to enact for non-compliance issues

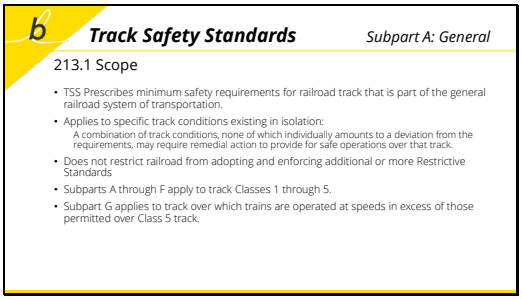
Course Outline

This course:

- Consists of 6 Sections that follow the Subparts A – F of 49 CFR Part 213
- Includes class exercises
- Includes field practice
- Includes a final exam (25 questions)
- Requires a passing grade of 80% to earn Certification of Completion

Subpart A – General

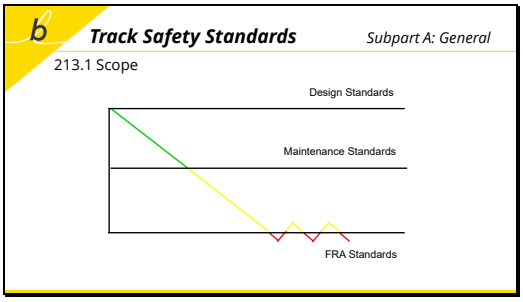
213.1 Scope



Fill in the blank.

The ***minimum*** safety standards for track are found in

_____.



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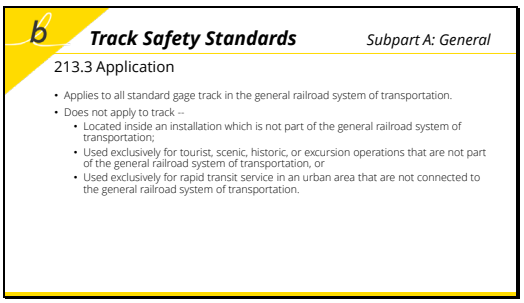
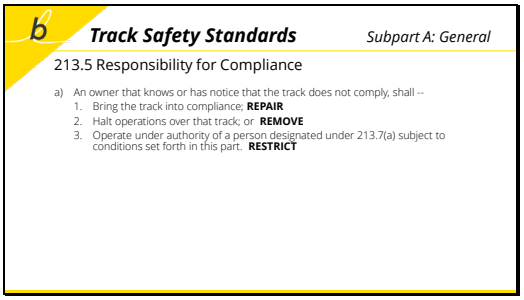




213.5 Responsibility for Compliance

Circle the correct answer. Track owners have responsibility to comply with Track Safety Standards (TSS). Once a track owner knows that track is not in compliance with the TSS, the owner must do what?

a. Notify the track inspector to file a report

b. Bring track into compliance by repairing/removing the defect, restricting the speed, or removing the track from service

c. Contact the FRA using appropriate letterhead

d. All of the above

Track Safety Standards *Subpart A: General*

213.5 Responsibility for Compliance

(c) If an owner of track assigns responsibility for the track to another person written notification must be provided to the appropriate FRA Regional Office. The notification must include the following:

(1) The name and address of the track owner;

(2) The name and address of the assignee;

(3) A statement of the exact relationship between parties;

(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; and

(6) A statement signed by the assignee acknowledging the assignment.

Track Safety Standards *Subpart A: General*

213.5 Responsibility for Compliance

(d) The Administrator may hold the track owner or the assignee or both responsible for compliance.

(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

(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.

Track Safety Standards *Subpart A: General*

213.5 Responsibility for Compliance

FRA inspector will not:

- Adjust, repair, correct any component; or authorize, suggest, recommend any movement

Track Safety Standards *Subpart A: General*

213.7 Designation of Qualified Persons to Supervise Certain Renewals and Inspect Track

a) Owners shall designate qualified persons to **supervise restorations and renewals** under traffic conditions. Each person designated must have --

1. At least --
   a. 1 year **experience** in track maintenance under traffic conditions; or
   b. A combination of experience in track maintenance and training from a course in track maintenance or college program;
2. Demonstrated to the owner that he --
   a. Knows and understands the requirements of this part;
   b. Can detect deviations from those requirements;
   c. 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.

Track Safety Standards *Subpart A: General*

213.7 Designation of Qualified Persons to Supervise Certain Renewals and Inspect Track

(b) Owner 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 inspection experience and inspection training;

(2) Demonstrated to the owner that he --

(i) Knows and understands the requirements;

(ii) Can detect deviations;

(iii) Can prescribe appropriate remedial action to correct or safely compensate for those deviations; and

(3) Written authorization from the owner to prescribe remedial actions to compensate for deviations, pending review by person under (a).

Track Safety Standards *Subpart A: General*

213.7 Designation of Qualified Persons to Supervise Certain Renewals and Inspect Track

(c) Individuals designated under paragraphs (a) or (b) of this section that inspect Continuous Welded Rail (CWR) track or supervise the installation, adjustment, and maintenance of CWR track in accordance with the written procedures of the track owner shall have:

(1) Current qualifications under either paragraph (a) or (b) of this section;

(2) Successfully completed a comprehensive **training course** for the application of written **CWR procedures;**

(3) Demonstrated to the track owner that the individual:

(i) Knows and understands the requirements;

(ii) Can detect deviations, and;

(iii) Can prescribe appropriate remedial action.

(4) Written authorization from the track owner to prescribe remedial action and successfully completed a recorded examination.

Track Safety Standards *Subpart A: General*

213.7 Designation of Qualified Persons to Supervise Certain Renewals and Inspect Track

(d) Persons not fully qualified as outlined in (a) and (b), but with at **least one year of MW or signal experience,** may be qualified to pass trains over broken rails and pull-aparts provided that --

(1) The person is trained, examined, and re-examined within 2 years on the following topics in relation to the safe passage of trains over broken rails or pull-aparts, rail defect identification, crosstie condition, track surface and alignment, gage restraint, rail end mismatch, joint bars, and maximum distance between rail ends over which trains may be allowed to pass.

The purpose of the examination will be to ascertain the person's ability to effectively apply these requirements. A minimum of four hours will be deemed adequate for initial training.

Track Safety Standards *Subpart A: General*

213.7 Designation of Qualified Persons to Supervise Certain Renewals and Inspect Track

(2) The person deems it safe, and speeds are limited to a maximum of 10 mph over the broken rail or pull apart;

(3) The person must 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 are notified and dispatched to the location promptly to authorize movements and effecting temporary or permanent repairs.

Track Safety Standards *Subpart A: General*

213.7 Designation of Qualified Persons to Supervise Certain Renewals and Inspect Track

213.7 Designation of qualified persons (Summary)

- Fully qualified
  - 213.7(a) Supervising track maintenance
  - 213.7(b) Inspecting track
  - 213.7(c) CWR
- Partially qualified
  - 213.7(d) Passing trains over broken rails and pull-aparts
  - Owner must maintain a list of designated persons
  - Must retain track inspections performed by designated persons per § 213.241

Track Safety Standards *Subpart A: General*

213.7 Designation of Qualified Persons to Supervise Certain Renewals and Inspect Track

(e) With respect to designations under paragraphs (a) through (d) of this section, each track owner must maintain records of:

(1) Each designation in effect

(2) The date each designation was made;

(3) The basis for each designation including method used to determine the designated person is qualified.

(f) Each track owner shall keep designated records required readily available for inspection or copying by the FRA during regular business hours.

Track Safety Standards *Subpart A: General*

213.9 Class of Track - Operating Speed Limits

(a) Except as provided in paragraphs (b) of this section and 213.57(b), [unbalance], 213.59(a) [elevation runoff in a curve], and 213.113(a), [rail defects] and 213.137(b) and (c) [frogs], the following maximum allowable operating speeds apply –

(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.

Track Class	Maximum Speed	
	Freight	Passenger
Excepted	10	N/A
1	10	15
2	25	30
3	40	60
4	60	80
5	80	90

Section 213.9 Exercise

Instructions: Determine the appropriate class of track for each of the following maximum track speeds using the 49 CFR Part 213 Regulation.

49 MPH Freight _____

15 MPH Passenger _____

59 MPH Passenger _____

60 MPH Freight _____

75 MPH Passenger _____

80 MPH Passenger _____

20 MPH Freight _____

88 MPH Passenger _____

5 MPH Passenger _____

35 MPH Passenger _____

25 MPH Freight _____

10 MPH Passenger _____

35 MPH Passenger _____

45 MPH Passenger _____

45 MPH Freight _____

50 MPH Passenger _____

55 MPH Passenger _____

70 MPH Passenger _____

65 MPH Passenger _____

29 MPH Passenger _____

Track Safety Standards *Subpart A: General*

213.9 NON – Class Track Defects

Ballast – No specific requirement for the material used. Just needs to provide the requirements of TSS, holding surface, gage, alignment, etc.

Vegetation – Vegetation may get in a switch or cause issues with an employee performing their duties. but no specific requirement measurements about vegetation.

Drainage – No specific measurements for not having ballast or what type of ballast, just needs to provide surface, drainage so that track does not have adequate stability, crosslevel, surface, alignment, etc.

Defect cannot be made compliant with a speed restriction

Track Safety Standards *Subpart A: General*

Categories of Defects

- *Class specific:*
  - Defect may be made compliant by placing slow order on track
  - Examples: gage, alignment, mismatch
- *Non-class specific:*
  - Defect cannot be made compliant by a slow order
  - Examples: drainage, vegetation, switch issue
- *Speed defined:*
  - Defect type requires specific limiting speed
  - Example: rail defect, minimum curve elevation

Track Safety Standards *Subpart A: General*

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 must be under the continuous supervision of a person designated under §213.7(a) and, as applicable, §213.7(c), and subject to any limiting conditions specified by such person.

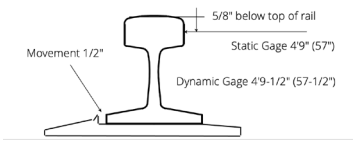
The operating speed cannot be more than the maximum allowable speed under § 213.9 for the class of track concerned.

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.

Track Safety Standards *Subpart A: General*

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.



Track Safety Standards *Subpart A: General*

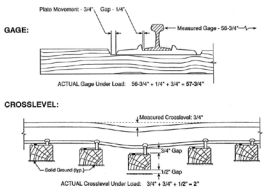
213.13 Measuring Track Not Under Load

Vertical Load

Lateral Load

Track Safety Standards *Subpart A: General*

213.13 Measuring Track Not Under Load



Track Safety Standards *Subpart A: General*

213.14 Application of requirements to curved track.

Unless otherwise provided in this part, requirements specified for curved track apply only to track having a curvature greater than 0.25 degree.

Track Safety Standards *Subpart A: General*

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 $919 and not more than $30,058 per violation, except that: Penalties may be assessed against individuals 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 $120,231 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 FRA to be responsible under 213.5(d) or 213.303(c) [Responsibility For Compliance]. Each day a violation continues shall constitute a separate offense.

Track Safety Standards *Subpart A: General*

213.15 Penalties

(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.

Subpart B – Roadbed

Track Safety Standards

Track Safety Standards (TSS)
49 CFR Part 213
Subpart B – Roadbed

Track Safety Standards *Subpart B: Roadbed*

- Scope
- Drainage
  - Ditches, Pipes and Culverts
- Vegetation
  - Brush and Weed Control

_____

_____

_____

_____

Track Safety Standards *Subpart B: Roadbed*

213.31 Scope

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

_____

_____

_____

_____

Track Safety Standards *Subpart B: Roadbed*

213.33 Drainage

Track Safety Standards *Subpart B: Roadbed*

213.33 Drainage

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

Track Safety Standards *Subpart B: Roadbed*

213.37 Vegetation

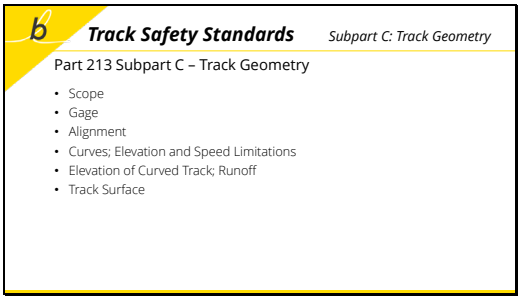
Track Safety Standards *Subpart B: Roadbed*

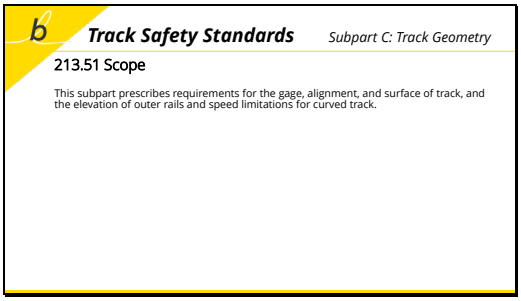
213.37 Vegetation

Vegetation must be controlled so that it does not --

(a) Become a fire hazard;
(b) Obstruct visibility of railroad signs and signals:
  (1) Along the right-of-way, and
  (2) At highway-rail crossing
(c) Interfere with employees performing duties;
(d) Prevent proper functioning of signal and communication lines; or
(e) Prevent railroad employees from visually inspecting moving equipment.

Subpart C – Track Geometry





Track Safety Standards *Subpart C: Track Geometry*

213.53 Gage

(a) Gage is measured between the heads of the rails at right-angles to the rails in a plane 5/8" below the top of the rail head.

(b) Gage must be within the limits prescribed as follows --

Track Class	Gage	
	Minimum	Maximum
Excepted	-----	4'10-1/4" (58-1/4")
1	4'8" (56")	4'10" (58")
2 – 3	4'8" (56")	4'9-3/4" (57-3/4")
4 - 5	4'8" (56")	4'9-1/2" (57-1/2")

Excepted =Can have a greater deviation from what the standard is!

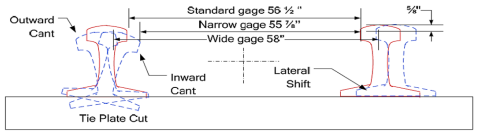
Class 1 = Max deviation from the standard is 1 ½ "

Class 2 - 3 = Max deviation from the standard is 1 ¼"

Class 4-5 = Max deviation from the standard is 1"

Track Safety Standards *Subpart C: Track Geometry*

213.53 Gage



Section 213.53 Exercise

Instructions: Calculate the maximum gage for each measurement and determine the appropriate class of track for each using the 49 CFR Part 213 Regulation.

Measurement	Gage	Class
56-13/16” static, 5/16 movement under load	_____	_____
57-7/16" static, 1/8" movement under load	_____	_____
57-11/16" static, 3/16” movement under load	_____	_____
57-9/16" static, 1/8” movement under load	_____	_____
57-3/8" static, 1/16” movement under load	_____	_____
57-15/16" static, 0” movement under load	_____	_____
57-7/8" static, 1/16” movement under load	_____	_____
57-3/8" static, 5/16” movement under load	_____	_____
57-3/16” static, 1/4“movement under load	_____	_____
57-13/16” static, 3/16" movement under load	_____	_____
56-5/8" static, 0” movement under load	_____	_____
57-3/16" static, 7/16” movement under load	_____	_____
58-3/16" static, 0” movement under load	_____	_____
55-3/4”, static, 3/16” movement under load	_____	_____
57-3/8" static, 5/16” movement under load	_____	_____
57-7/16" static, 1/2" movement under load	_____	_____
58-1/2" static, 0” movement under load	_____	_____
57-11/16" static, 3/8” movement under load	_____	_____

Track Safety Standards *Subpart C: Track Geometry*

213.53 Gage

Track Safety Standards *Subpart C: Track Geometry*

213.55 Alignment

Alignment may not deviate from uniformity as follows --

Class	Tangent Track	Curved Track	
	Max. deviation of the mid-offset from a 62' line [1]	Max. deviation of the mid-offset from 31' chord [2]	Max. deviation of the mid-offset from 62' chord [2]
1	5"	N/A	5"
2	3"	N/A	3"
3	1-3/4"	1-1/4"	1-3/4"
4	1-1/2"	1"	1-1/2"
5	3/4"	1/2"	5/8"

[1] The ends of the line must be 5/8" below the top of the railhead on the gage side of the line rail. Either rail may be used as the line rail, however, the same rail must be used for the full length of that tangential segment.
[2] The ends of the chord must be at points on the gage side of the outer rail, 5/8" below the top of the railhead.

Section 213.55 Exercise

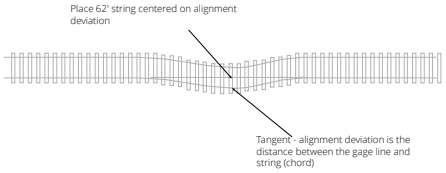
Instructions: *PART 1* – Using 49 CFR Part 213, determine the maximum class of track for each alignment deviation below:

Measurement	**Class of Track**
2-13/16" on tangent track	_____
4-1/8" on tangent track	_____
1-5/8" on tangent track	_____
Curved track: 1-1/8” using a 31’ chord, 2-11/16" using a 62’ chord	_____
Curved track: 7/16” using a 31’ chord, 1-5/8" using a 62’ chord	_____
Curved track: 15/16" using a 31' chord, 1-5/16” using a 62’ chord	_____
11/16" on tangent track	_____
Curved track: 1-3/8" using a 31’ chord, 2-5/8" using a 62' chord	_____
Curved track: 7/16” using a 31' chord, 11/16" using a 62' chord	_____
7/16" on tangent track	_____
5-1/4" on tangent track	_____
Curved track: 1-13/16” using a 31’ chord, 1-1/2" using a 62’ chord	_____
Curved track: 13/16” using a 31’ chord, 1/2” using a 62’ chord	_____
Curved track: 7/8“using a 31’ chord, 2” using a 62’ chord	_____

Track Safety Standards *Subpart C: Track Geometry*

213.55 Alignment

Tangent Track Example Measurement



Track Safety Standards *Subpart C: Track Geometry*

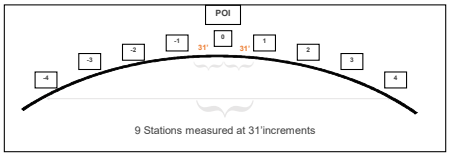
213.55 Alignment

62' Chord Concept

Track Safety Standards *Subpart C: Track Geometry*

213.55 Alignment

62' Chord Concept



Note: All measurements must be taken at every interval. Do not use multiplier effect of quartered station measurements gathered at 31' intervals. These numbers now are averaged only to identify the degree of curvature.

Track Safety Standards *Subpart C: Track Geometry*

213.55 Alignment

Curve Averaging 62' Chord Concept

62' Chord, 9 - 31' stations required to determine average alignment classes 1 through 5.

Obtained using 62' chord

Average of 9 Stations 31' apart

Sta.	Measured Alignment		Avg.	Dev.
-4	3/8"	0.375"		
-3	5/16"	0.313"		
-2	1/4"	0.250"		
-1	3/16"	0.188"		
0	9/16"	0.563"	0.340"	0.223"
1	5/16"	0.313"		
2	3/8"	0.375"		
3	1/2"	0.500"		
4	3/16"	0.188"		
		0.340 "		

Worst Spot Deviation – difference between measured & average

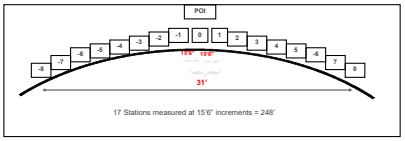
Track Safety Standards *Subpart C: Track Geometry*

213.55 Alignment

Track Safety Standards *Subpart C: Track Geometry*

213.55 Alignment

Curve Averaging 31' Chord Concept

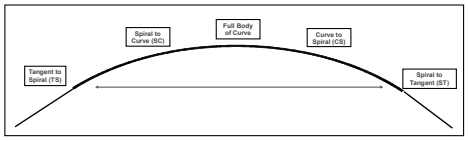


Note: All measurements must be taken at every interval. Do not quarter station measurements gathered at 31' intervals when mapping 62' chord numbers.

Track Safety Standards *Subpart C: Track Geometry*

213.55 Alignment

Parts of a Curve



Track Safety Standards *Subpart C: Track Geometry*

213.55 Alignment

Curve Averaging 31' Chord Concept

Sta.	Measured		Avg.	Dev.	Sta.	Measured		Avg.	Dev.
-8	1/4	0.250			1	3/8	0.375		
-7	3/8	0.375			2	1/4	0.250		
-6	1/4	0.250			3	3/16	0.188		
-5	3/16	0.188			4	1/8	0.125		
-4	1/8	0.125			5	1/4	0.250		
-3	5/16	0.313			6	1/8	0.125		
-2	1/2	0.500			7	3/16	0.188		
-1	9/16	0.563			8	1/4	0.250		
0	5/8	0.625	0.29	0.335			0.290		

Worst spot: "Critical Measurement"

Average of 17 Stations 15'6" apart

Section 213.55 Exercise

Instructions: *PART 2* – You noticed a suspicious looking deviation appearing in the full body of a curve during your inspection. You decide to take some measurements. Using the measurements below, calculate the deviations accordingly. After the deviations have been calculated, answer questions 1 - 6 using 49 CFR Part 213. The posted speed for this curve is 20 MPH Freight Only.

Station (31-ft)	MCO, 62-ft chord (inches)	Deviation
-4	3	
-3	2 15/16	
-2	3 1/8	
-1	5	
0	6 1/16	
1	4 3/4	
2	3 3/4	
3	3 2/16	
4	3	

1. What class of track is this prior to taking measurements? _____
2. What is the average MCO for this segment? _____
3. What is the maximum alinement deviation? _____
4. What station is the maximum alinement deviation located at? _____
5. Is the maximum deviation allowable for the class of track? _____
6. If question 5 is no, what is the permitted track class? _____

Section 213.55 Exercise

Instructions: *PART 3* – You found another suspicious looking deviation appearing in the full body of a curve during your inspection. You decide to take some measurements. Using the measurements below, calculate the deviations accordingly. After the deviations have been calculated, answer questions 1 - 6 using 49 CFR Part 213. The posted track speed is 65 MPH Freight only.

Station (15.5 ft)	MCO, 62-ft chord (inches)	MCO, 31-ft chord (inches)	Deviation, 62-ft chord	Deviation, 31-ft chord (inches)
-8	2 3/16	10/16		
-7		11/16		
-6	2 7/16	11/16		
-5		14/16		
-4	2 4/16	9/16		
-3		10/16		
-2	2 10/16	12/16		
-1		10/16		
0	3 10/16	14/16		
1		14/16		
2	3 1/16	11/16		
3		10/16		
4	2 8/16	11/16		
5		9/16		
6	2 4/16	8/16		
7		10/16		
8	2 8/16	11/16		

Questions on Next Page

1. What is the average MCO for this curve using a 62’ chord?

   _____

2. What is the average MCO for this curve using a 31’ chord?

   _____

3. What is the maximum alinement deviation found with the 62’ chord?

   _____

4. What is the maximum alinement deviation found with the 31’ chord?

   _____

5. Are the maximum alinement deviations allowable for the track class?

   _____

6. If you answered “NO” to question 5, what is the permitted track class?

   _____

Track Safety Standards *Subpart C: Track Geometry*

213.57 Curves; Elevation & Speed Limitations

Conventional Equipment - 3" Unbalance

(a) The maximum cross level on the outside rail of a curve may not be more than 8" on track Classes 1 and 2 and 7" on Classes 3 through 5. Except as provided in 213.63 (track surface), the outside rail of a curve may not be lower than the inside rail.

Note: Regardless of the elevation permitted in table 213.63, the absolute cross level at any point is limited as indicated above.

Track Safety Standards *Subpart C: Track Geometry*

213.57 Curves; Elevation & Speed Limitations

Conventional Equipment - 3" Unbalance

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

Actual elevation in inches [1] — Unbalance

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

Maximum allowable operating speed (mph) — Degree of curvature [2]

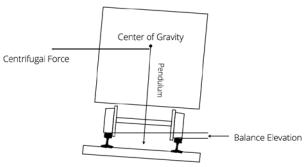
[1] Actual elevation for each 155' track segment in the body of the curve is determined by averaging the elevation for 10 points through the segment at 15.5' spacing. If the curve length is less than 155' - full body.

[2] Degree of curvature is determined by averaging the degree of curvature over the same track segment as the elevation.

Track Safety Standards *Subpart C: Track Geometry*

213.57 Curves; Elevation & Speed Limitations

Super-elevation Formula



Elevation = 0.0007 x Degree x Speed

Track Safety Standards *Subpart C: Track Geometry*

213.57 Curves; Elevation & Speed Limitations (Example)

Stations Spaced 15.5'

Points	Elevation	MCO	Degree
-5	0.625"	1.000"	1.000"
-4	0.500"	0.875"	0.875"
-3	0.500"	1.000"	1.000"
-2	0.375"	0.875"	0.875"
-1	0.750"	0.750"	0.750"
0	0.250"	0.625"	0.625"
1	0.333"	0.875"	0.875"
2	0.375"	0.875"	0.875"
3	0.375"	0.875"	0.875"
4	0.375"	1.125"	1.125"
5	0.375"	0.750"	0.750"
Total	4.833"	9.625"	9.625"
Average	0.439"		0.875

Unbalance when speed is known

$$75^2 \times 0.0007 \times 0.875 - 0.439 = 3$$

Speed — Average Curvature — Average Elevation — Approved Unbalance

$$\sqrt{\frac{0.439 + 3}{0.875 \times 0.0007}} = 75 \text{ mph}$$

Max. Speed

Average Elevation — Average Curvature

Note: For 31' chord each ¼" equals 1 degree

Section 213.57 Exercise

Instructions: *Part 1.* You have just finished measuring a curve within a 155' section in the full body. The measurements are as follows:

62' MCO Readings: 6-15/16, 7, 7-1/16, 7-1/16, 7, 6-15/16, 6-7/8, 6-15/16, 7, 6-15/16, 7

Elevation Readings: 3, 2-7/8, 2-7/8, 2-13/16, 2-7/8, 2-15/16, 2-15/16, 3, 3-1/8, 3-1/16, 3

1. Using the readings above, determine the average degree of curvature and average elevation.

   Average Degree _____ Average Elevation _____

2. What is the maximum allowable timetable speed for this curve using the 3" unbalanced parameters? You can use VMAX and/or the tables in the back of 49 CFR Part 213. If you feel comfortable calculating the speed using the Vmax formula, try it and compare the differences between your math and the table.

   VMAX Calculation = _____ 3" Unbalance Table Speed _____

VMAX Explanation

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

Where:

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

E_a = *Actual elevation of the outside rail (inches).*[1]

D = *Degree of curvature (degrees).*[2]

Step by Step Process for using VMAX.

Step 1 – Start by taking your average elevation from the curve from above. _____

Step 2 – You then add the average elevation to 3 because you are using a 3-inch unbalance calculation. This becomes your top number:

*Top Number*_____*+3 =* _____

Step 3 – You will now multiply 0.0007 x the degree of curvature you determined above. This becomes your bottom number.

Step 4 – You will now divide the top number by the bottom number.

Step 5 – After you hit equal on your calculator, hit the square root button which will give you the speed the curve is good for.

Track Safety Standards *Subpart C: Track Geometry*

213.57 Curves; Elevation & Speed Limitations

Stations	Elev.	Degree
-5	2 ½	2 ¾
-4	3 1/8	3 ½
-3	2 7/8	3
-2	3 1/16	2 7/8
-1	2 15/16	3 1/16
0	2 ¾	3 ¼
1	2 7/8	2 ¾
2	3 ½	3
3	3 ¼	2 15/16
4		
5		
Total	26 7/8	27 1/8
Average	2 71/72	3 1/72

Stations Spaced 15.5'

10 points plus spot of concern = 11 points (Total/11 = average)

Speed should be 53 MPH and class of track would be 3 frt. and 2 Pass.

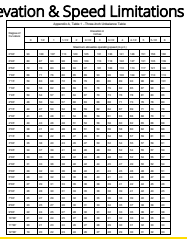
3" Elevation

3 Degrees

Track Safety Standards *Subpart C: Track Geometry*

213.57 Curves; Elevation & Speed Limitations

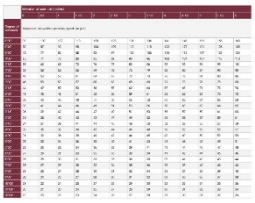
Average Elevation & Degree of Curve



Track Safety Standards *Subpart C: Track Geometry*

213.57 Curves; Elevation & Speed Limitations

(c) All vehicles are considered qualified for operating on track with a cant deficiency, E_u, not exceeding 3 inches, table 1 of appendix A to this part is a table of speeds computed in accordance with the formula in paragraph (b) of this section, when E_u equals 3 inches, for various elevations and degrees of curvature.



Track Safety Standards *Subpart C: Track Geometry*

213.57 Curves; Elevation & Speed Limitations

(d) Each vehicle type must be approved by FRA to operate on track with a qualified cant deficiency greater than 3". Each vehicle type must demonstrate, in a ready-for-service load condition, compliance with the requirements of either paragraph (d)(1) or (2) of this section.

(1) When positioned on a track with a uniform superelevation equal to the proposed cant deficiency:

(i) No wheel of the vehicle type unloads to a value less than 60 percent of its static value on perfectly level track; and

(ii) For passenger cars, the roll angle between the floor of the equipment and the horizontal does not exceed 8.6 degrees; or

(2) When operating through a constant radius curve at a constant speed corresponding to the proposed cant deficiency, and a test plan is submitted to and approved by FRA in accordance with § 213.345(e) and (f):

(i) The steady-state (average) load on any wheel, throughout the body of the curve, is not less than 60 percent of its static value on perfectly level track; and

(ii) For passenger cars, the steady-state (average) lateral acceleration measured on the floor of the carbody does not exceed 0.15g.

Track Safety Standards *Subpart C: Track Geometry*

213.57 Curves; Elevation & Speed Limitations

(c) The track owner or railroad shall transmit the results of the testing specified in paragraph (d) of this section to FRA's Associate Administrator for Railroad Safety/Chief Safety Officer (FRA) requesting approval for the vehicle type to operate at the desired curving speeds allowed under the formula in paragraph (b) of this section. The request shall be made in writing and contain, at a minimum, the following information -

(1) A description of the vehicle type involved, including schematic diagrams of the suspension system(s) and the estimated location of the center of gravity above top of rail;

(2) The test procedure,[a] including the load condition under which the testing was performed, and description of the instrumentation used to qualify the vehicle type, as well as the maximum values for wheel unloading and roll angles or accelerations that were observed during testing; and

(3) For vehicle types not subject to parts 229 or 238 of this chapter, procedures or standards in effect that relate to the maintenance of all safety-critical components of the suspension system(s) for the particular vehicle type. Safety-critical components of the suspension system are those that impact or have significant influence on the roll of the carbody and the distribution of weight on the wheels.

Track Safety Standards *Subpart C: Track Geometry*

213.57 Curves; Elevation & Speed Limitations

(f) In approving the request made pursuant to paragraph (e) of this section, FRA may impose conditions necessary for safely operating at the higher curving speeds. Upon FRA approval of the request, the track owner or railroad shall notify FRA in writing no less than 30 calendar days prior to the proposed implementation of the approved higher curving speeds allowed under the formula in paragraph (b) of this section. The notification shall contain, at a minimum, identification of the track segment(s) on which the higher curving speeds are to be implemented.

(g) The documents required by this section must be provided to FRA by:

(1) The track owner; or

(2) A railroad that provides service with the same vehicle type over trackage of one or more track owner(s), with the written consent of each affected track owner.

Track Safety Standards *Subpart C: Track Geometry*

213.57 Curves; Elevation & Speed Limitations

(h)

(1) Vehicle types permitted by FRA to operate at cant deficiencies, E_u, greater than 3 inches but not more than 5 inches shall be considered qualified under this section to operate at those permitted cant deficiencies for any track segment. The track owner or railroad shall notify FRA in writing no less than 30 calendar days prior to the proposed implementation of such curving speeds in accordance with paragraph (f) of this section.

(2) Vehicle types permitted by FRA to operate at cant deficiencies, E_u, greater than 5 inches shall be considered qualified under this section to operate at those permitted cant deficiencies only for the previously operated or identified track segments(s).

Track Safety Standards *Subpart C: Track Geometry*

213.57 Curves; Elevation & Speed Limitations

(i) For vehicle types intended to operate at any curving speed producing more than 5 inches of cant deficiency, the following provisions of subpart G of this part shall apply: §§ 213.333(a) through (g), (j)(1), (k) and (m), 213.345, and 213.369(f).

(j) As used in this section -

(1) ***Vehicle*** means a locomotive, as defined in § 229.5 of this chapter; a freight car, as defined in § 215.5 of this chapter; a passenger car, as defined in § 238.5 of this chapter; and any rail rolling equipment used in a train with either a freight car or a passenger car.

(2) ***Vehicle type*** means like vehicles with variations in their physical properties, such as suspension, mass, interior arrangements, and dimensions that do not result in significant changes to their dynamic characteristics.

Section 213.57 Exercise

Instructions: *Part 2.* What is the maximum allowable track speed for the following conditions using the 3 inch unbalance chart? Values given are averages per the measurement procedure. You do not have to compute the average degree of curvature or elevation instead use each measurement isolated as if you found it in the field during an inspection.

Speed	MCO 62’	Elevation
_____	2.01”	1.78”
_____	9.27”	3.98”
_____	0.67”	1.02”
_____	3.74”	2.20”
_____	5.98”	3.02”
_____	8.05”	3.47”
_____	4.49”	1.95”
_____	10.95”	4.78”

Track Safety Standards *Subpart C: Track Geometry*

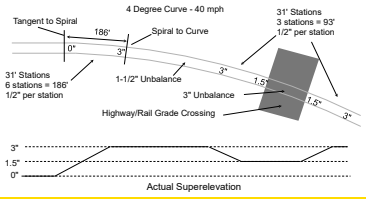
213.59 Elevation of Curved Track; Runoff

a) If a curve is elevated, the full elevation must be provided throughout the curve, unless physical conditions do not permit. If elevation runoff occurs in a curve, the actual minimum elevation must be used in computing the maximum allowable operating speed for that curve under 213.57 (b).

b) Elevation runoff must be at a uniform rate, within the limits of track surface deviation prescribed in 213.63, and it must 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.

Track Safety Standards *Subpart C: Track Geometry*

213.59 Elevation of Curved Track; Runoff (Example)

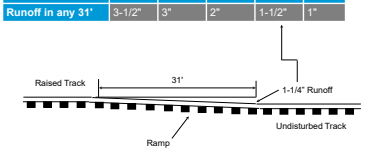


Track Safety Standards *Subpart C: Track Geometry*

213.63 Track Surface

(Runoff)

Track Surface Parameter	Track Class				
	1	2	3	4	5
Runoff in any 31'	3-1/2"	3"	2"	1-1/2"	1"



Track Safety Standards *Subpart C: Track Geometry*

213.63 Track Surface

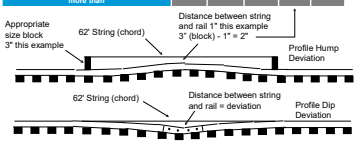
(Runoff)

Track Safety Standards *Subpart C: Track Geometry*

213.63 Track Surface

(Profile)

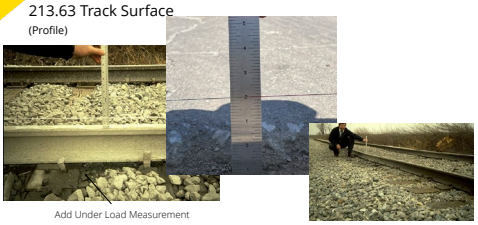
Track Surface Parameter	Track Class				
	1	2	3	4	5
Deviation from uniform profile on either rail at the mid-ordinate of 62' chord may not be more than	3"	2-3/4"	2-1/4"	2"	1-1/4"



Track Safety Standards *Subpart C: Track Geometry*

213.63 Track Surface

(Profile)



Add Under Load Measurement

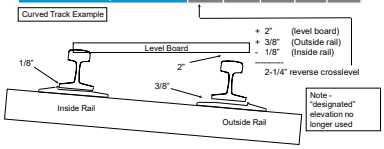
Track Safety Standards *Subpart C: Track Geometry*

213.63 Track Surface

(Crosslevel Deviation/ Reverse Elevation)

Track Surface Parameter	Track Class				
	1	2	3	4	5
The deviation from zero crosslevel at any point on tangent or reverse crosslevel elevation on curve may not be more than	3"	2"	1-3/4"	1-1/4"	1"

Curved Track Example



Track Safety Standards *Subpart C: Track Geometry*

213.63 Track Surface

(Cross-level Deviation/Reverse Elevation)

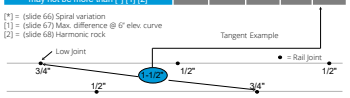
Track Safety Standards *Subpart C: Track Geometry*

213.63 Track Surface

(Cross-level Difference)

Track Surface Parameter	Track Class				
	1	2	3	4	5
The difference (warp) in crosslevel between any two point less than 62' apart may not be more than [*] [1] [2]	3"	2-1/4"	2"	1-3/4"	1-1/2"

[*] = (slide 66) Spiral variation
[1] = (slide 67) Max. difference @ 6' elev. curve
[2] = (slide 68) Harmonic rock

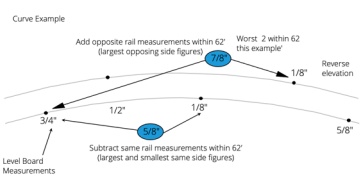


Note - Difference (warp) parameter now applies to tangent, curves, and spirals

Track Safety Standards *Subpart C: Track Geometry*

213.63 Track Surface

(Cross-level Difference - Continued)



Track Safety Standards *Subpart C: Track Geometry*

213.63 Track Surface

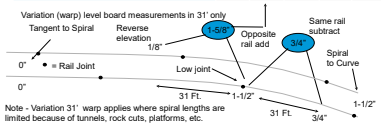
(Cross-level Difference - Continued)

Track Safety Standards *Subpart C: Track Geometry*

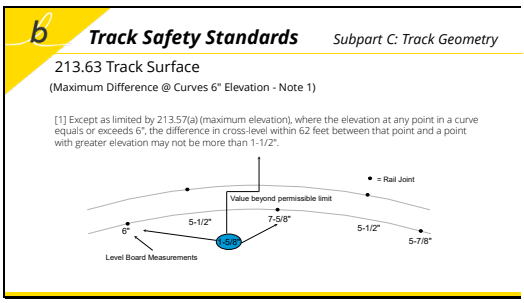
213.63 Track Surface

(Spiral Variation*)

Track Surface Parameter	Track Class				
	1	2	3	4	5
[*] 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 (warp) in crosslevel on spirals per 31' may not be more than	2"	1-3/4"	1-1/4"	1"	3/4"



Note - Variation 31' warp applies where spiral lengths are limited because of tunnels, rock cuts, platforms, etc.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Track Safety Standards
Subpart C: Track Geometry
213.63 Track Surface
(Maximum Difference @ Curves 6" Elevation - Note 1)
[1] Except as limited by 213.57(a) (maximum elevation), where the elevation at any point in a curve equals or exceeds 6", 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".
= Rail Joint
Value beyond permissible limit
6"
5-1/2"
7-5/8"
5-1/2"
5-7/8"
Level Board Measurements

Section 213.63 Exercise

Instructions: You have just finished taking measurements during your track inspection. Using 49 CFR Part 213, determine the class of track for each of the following deviations. The measurements were calculated under load.

_____ Runoff at the end of a surfacing operation is 2 13/16" within 31'

_____ 2 ½" deviation from uniform profile at a muddy location.

_____ 9/16" deviation from zero cross level on tangent track.

_____ 15/16" deviation from zero cross level on tangent track.

_____ 1-1/16" difference in cross level over 31' in a curve

_____ Runoff at the end of a highway crossing rehab is 4-1/2" in 62'.

_____ Cross level on the right rail on tangent track is 1-15/16".

_____ Profile of 1-5/8" at an area where the ballast is washed out.

_____ Cross level on a tangent track at the end of a spiral is 1-1/2"

_____ The outside rail in a curve is elevated 4" at one location, and 1- 7/8" 44' away.

_____ In a curve, the outside rail is elevated 4-1/2" at one point. 40' away it is 3-1/8".

_____ Runoff at the end of a ballast raise is 1-1/4" in 31'.

_____ In tangent track, a warp of 1-7/8" was measured within 45'.

_____ The west rail on a tangent track is 2" low. The east rail 55' away is ¾ low.

_____ The difference in cross level in 6 consecutive pairs of joints is 1-1/2"

_____ The difference in cross level on tangent track is 2-1/2" measured within 60'.

_____ A curve has 1 5/8" of reverse elevation.

Track Safety Standards *Subpart C: Track Geometry*

213.65 Combined Track Alinement & Surface Deviations

On any curved track where operations are conducted at a qualified cant deficiency, E_q, greater than 5 inches, the combination of alinement and surface deviations for the same chord length on the outside rail in the curve, as measured by a TGMS, shall comply with the following formula:

$$\frac{3}{4} \times \left| \frac{A_m}{A_L} + \frac{S_m}{S_L} \right| \leq 1$$

Where—

A_m = measured alinement deviation from uniformity (outward is positive, inward is negative).

A_L = allowable alinement limit as per §213.55(b) (always positive) for the class of track.

S_m = measured profile deviation from uniformity (down is positive, up is negative).

S_L = allowable profile limit as per §213.63(b) (always positive) for the class of track.

$\left| \frac{A_m}{A_L} + \frac{S_m}{S_L} \right|$ = the absolute (positive) value of the result of $\frac{A_m}{A_L} + \frac{S_m}{S_L}$

Subpart D – Track Structure

Track Safety Standards

Track Safety Standards (TSS)
49 CFR Part 213
Subpart D – Track Structure

Track Safety Standards *Subpart D: Structure*

Part 213 Subpart D – Track Structure

- Scope
- Ballast; General
- Crossties
- Gage restraint measurement systems
- Defective rails
- Rail-end mismatch
- CWR
- Rail joints
- Torch cut rail
- Tie plates
- Rail fastening systems
- Turnouts and track crossings
- Switches
- Frogs
- Spring rail frogs
- Self-guarded frogs
- Frog guard rails and guard faces; Gage

Track Safety Standards *Subpart D: Structure*

213.101 Scope

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

Track Safety Standards *Subpart D: Structure*

213.103 Ballast; General

Unless it is otherwise structurally supported, all track must 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 alignment

Track Safety Standards *Subpart D: Structure*

213.103 Ballast; General



Track Safety Standards *Subpart D: Structure*

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 per 213.53(b);
(ii) Maintain surface per 213.63; and
(iii) Maintain alignment per 213.55.

(2) The minimum number/type crossties per (b)(4) and (c) or (d) of this section effectively distributed to support the entire segment;

Track Safety Standards *Subpart D: Structure*

213.109 Crossties
(Continued)

(3) At least one crosstie as described in paragraphs (c) and (d) that is located as specified in paragraph (e), and:

(4) The minimum number of crossties as indicated in the following table:

Track Class	Tangent & Curves 2° & Less	Turnouts & Curves greater than 2°
1	5	6
2	8	9
3	8	10
4 - 5	12	14

Track Safety Standards *Subpart D: Structure*

213.109 Crossties
(Continued)

(c) Crossties, other than concrete, counted to satisfy the requirements set forth in paragraph (b)(4) 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 1/2" relative to the crossties; or

(4) Cut by the tie plate through more than 40% of a crosstie's thickness.

Track Safety Standards *Subpart D: Structure*

213.109 Crossties
(Continued)

(d) Concrete crossties counted to satisfy the requirements set forth in paragraph (b)(4) of this section shall not be:

(1) Broken through or deteriorated to the extent that prestressing material is visible;

(2) Deteriorated or broken off in the vicinity of the shoulder or insert so that the fastener assembly can either pull out or move laterally more than $\frac{3}{8}$ inch relative to the crosstie;

(3) Deteriorated such that the base of either rail can move laterally more than $\frac{3}{8}$ inch relative to the crosstie on curves of 2 degrees or greater; or can move laterally more than $\frac{1}{2}$ inch relative to the crosstie on tangent track or curves of less than 2 degrees;

Track Safety Standards *Subpart D: Structure*

213.109 Crossties
(Continued)

(d) Concrete crossties counted to satisfy the requirements set forth in paragraph (b)(4) of this section shall not be:

(4) Deteriorated or abraded at any point under the rail seat to a depth of $\frac{1}{2}$ inch or more;

(5) Deteriorated such that the crosstie's fastening or anchoring system, including rail anchors (see §213.127(b)), is unable to maintain longitudinal rail restraint, or maintain rail hold down, or maintain gage due to insufficient fastener toeload; or

(6) Configured with less than two fasteners on the same rail except as provided in §213.127(c).

Track Safety Standards *Subpart D: Structure*

213.109 Crossties
(Continued)

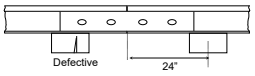
Track Safety Standards *Subpart D: Structure*

213.109 Crossties
(Continued)

Track Safety Standards *Subpart D: Structure*

213.109 Crossties
(Continued)

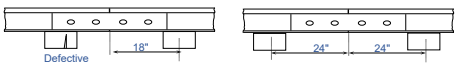
(e) **Class 1 and Class 2** track shall have one crosstie whose centerline is within 24" of the rail joint end location, and (Continued)

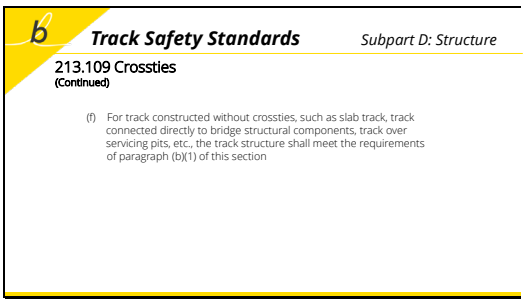


Track Safety Standards *Subpart D: Structure*

213.109 Crossties
(Continued)

(e) **Classes 3 through 5 track** shall have one crosstie whose centerline is within 18" of the rail joint location, or two crossties, one on each side of the rail joint, whose centerlines are within 24" either side of the rail joint location.

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Track Safety Standards
Subpart D: Structure
213.109 Crossties
(Continued)
(f) For track constructed without crossties, such as slab track, track connected directly to bridge structural components, track over servicing pits, etc., the track structure shall meet the requirements of paragraph (b)(1) of this section

Section 213.109 Exercise

Instructions: *Part 1* - The tie condition on your territory is in bad shape. You have just finished inspecting for defects and found the following conditions. Using 49 CFR Part 213 determine the class of track and permitted speed for each location. Each location measured is for a 39' segment of track. You have made the determination the ties are effectively distributed.

Class	MPH	Condition
_____	_____	9 good ties in tangent track and 1 good tie 16" from a joint.
_____	_____	14 good ties in tangent track and 1 good tie 10" from a joint.
_____	_____	15 good ties in tangent track and 1 good tie 22" from a joint.
_____	_____	6 good ties in 3° curved track and 1 good tie 12" from a joint.
_____	_____	20 good ties in 5° curved track and 2 joint ties 20" from a joint.
_____	_____	8 good ties in 9° curved track and 2 good ties 18" from a joint.
_____	_____	17 good ties in tangent track and 1 good tie 22" from a joint.
_____	_____	12 good ties in 1° curved track and 2 good ties 23" from a joint.
_____	_____	4 good ties in tangent track and 1 good tie 12" from a joint.
_____	_____	10 good ties in 2° curved track and 1 good tie 18" from a joint.

Track Safety Standards *Subpart D: Structure*

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 crosstie 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.

Track Safety Standards *Subpart D: Structure*

213.110 Gage restraint measurement systems.

(b) Initial notification under paragraph (a)(1) of this section shall include -

(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).

Track Safety Standards *Subpart D: Structure*

213.110 Gage restraint measurement systems.

(c)(1) The track owner shall also provide to FRA sufficient technical data to establish compliance with the following minimum design requirements of a GRMS vehicle:

(2) Gage restraint shall be measured between the heads of rail -

(i) At an interval not exceeding 16 inches;

(ii) Under an applied vertical load of no less than 10 kips per rail; and

(iii) Under an applied lateral load that provides for a lateral/vertical load ratio of between 0.5 and 1.25, and a load severity greater than 3 kips but less than 8 kips per rail.

Track Safety Standards *Subpart D: Structure*

213.110 Gage restraint measurement systems.

(d) Load severity is defined by the formula:

$$S = L - cV$$

(e) Measured gage values shall be converted to a Projected Loaded Gage 24 (PLG 24) as follows:

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

For all track:

$$A = \frac{13.513}{(L - 0.258\,x\,V) - .009\,x\,(L - 0.258\,x\,V)^2}$$

S = Load severity
L = Actual lateral load applied (kips)
c = Coefficient of friction between rail/tie
V = Actual vertical load applied (kips), or static vertical wheel load if vertical load is not measured
UTG = Unloaded track gage
LTG = Loaded track gage
A = The extrapolation factor used to convert the measured loaded gage to expected loaded gage under a 24-kip lateral load and a 33-kip vertical load

Track Safety Standards *Subpart D: Structure*

213.110 Gage restraint measurement systems.

(f) The measured gage and load values shall be converted to a Gage Widening Projection (GWP) as follows:

$$GWP = (LTG - UTG) \times \frac{8.26}{L - 0.258 \times V}$$

(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.

Track Safety Standards *Subpart D: Structure*

213.110 Gage restraint measurement systems.

(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.

(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.

Track Safety Standards *Subpart D: Structure*

213.110 Gage restraint measurement systems.

(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 parameters[1]	If measurement value exceeds	Remedial action required
First Level Exception		
UTG	58 inches	(1) Immediately protect the exception location with a 10 m.p.h. speed restriction, then verify location. (2) Restore lateral restraint and maintain in compliance with PTLF criteria as described in paragraph (m) of this section; and (3) Maintain compliance with § 213.53(b) as measured with the PTLF.
LTG	58 inches	
PL624	58 inches	
GWP	1 inch	
Second Level Exception		
LTG	57 3/4 inches on Class 4 and 5 track[2]	(1) Limit operating speed to no more than the maximum allowable under § 213.9 for Class 3 track, then verify location. (2) Maintain in compliance with PTLF criteria as described in paragraph (m) of this section; and (3) Maintain compliance with § 213.53(b) as measured with the PTLF.
PL624	58 inches	
GWP	0.75 inch	

Track Safety Standards *Subpart D: Structure*

213.110 Gage restraint measurement systems.

(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 (l), it shall be used subject to the following criteria

(1) At any location along the track that the 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 exceed58 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.

Track Safety Standards *Subpart D: Structure*

213.110 Gage restraint measurement systems.

(m)

(2) Gage widening in excess of⅝ 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.

Track Safety Standards *Subpart D: Structure*

213.110 Gage restraint measurement systems.

(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.

Track Safety Standards *Subpart D: Structure*

213.110 Gage restraint measurement systems.

(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 Projection (GWP)*** means the measured gage widening, which is the difference between loaded and unloaded gage, at the applied loads, projected to reference loads of 16 kips of lateral force and 33 kips of vertical force.

(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.

(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.

Track Safety Standards *Subpart D: Structure*

213.110 Gage restraint measurement systems.

(p) As used in this section:

(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.

Track Safety Standards *Subpart D: Structure*

213.113 Defective Rails

(a) When an owner of track learns that a rail in the track contains any of the defects listed in the table contained in paragraph (c) of this section, a person designated under 213.7 shall determine whether the track may continue in use. If the person determines that the track may continue in use, operation over the defective rail is not permitted until --

(1) The rail is replaced or repaired; or

(2) The remedial action prescribed in the table contained in paragraph (c) of this section is initiated.

Track Safety Standards *Subpart D: Structure*

213.113 Defective Rails

(b) When an owner of track learns that a rail in the track contains an indication of any defects listed in the table contained in paragraph (c) of this section, the track owner must verify the indication. Except as provided in 213.240, the track owner must verify the indication within 4 hours, unless the track owner has an indication of the existence of a defect that requires remedial action A, A2, or B identified in the table contained in paragraph (c) of this section, in which case the track owner must immediately verify the indication. If the indication is verified, the track owner must--

(1) Replace or repair the rail; or

(2) The remedial action prescribed in the table contained in paragraph (c) of this section is initiated.

Track Safety Standards *Subpart D: Structure*

213.113 Defective Rails

(c) A track owner who learns that a rail contains one of the following defects shall prescribe the remedial action specified if the rail is not replaced or repaired, in accordance with this paragraph's table:

Track Safety Standards *Subpart D: Structure*

Defect	Length of Defect (inches)		Percent of rail head cross-sectional area weakened by defect		If defective rail is not replaced or repaired, take the remedial action prescribed in note
	More than	But not more than	Less than	But not less than	
Compound fissure			70 100	5 70 100	B. A2. A.
Transverse Fissure Detail fracture Engine burn fracture Defective weld			25 60 100	5 25 80 100	C. D. A2 or [E and H]. A or [E and H].
Horizontal split head Vertical split head Split web Pipet rail Head web separation Defective weld (long.)	1 2 4 (*)	2 4 (*)			H and F. I and G. B. A.
Bolt hole crack	½ 1 1 ⅛ (*)	1 1 ⅛ (*)			H and F. H and G. B. A.
Broken base	1 6(*)	6			D. A or [E and I]
Ordinary break					A or E.
Damaged rail					C.
Flattened rail Crushed head	Depth ≥ 7/16 and Length ≥ 8				H.

Track Safety Standards *Subpart D: Structure*

213.113 Defective Rails

Notes:

A. Assign a person designated under §213.7 to visually supervise each operation over the defective rail.

A2. Assign a person designated under §213.7 to make a visual inspection. After visual inspection, that person may authorize operation to continue without continuous visual supervision at a maximum of 10 m.p.h. for us to 24 hours prior to another such visual inspection or replacement or repair of the rail.

B. Limit operating speed over the defective rail to that as authorized by a person designated under §213.7(a), who has at least 1 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 calls of track concerned, whichever is lower.

Track Safety Standards *Subpart D: Structure*

213.113 Defective Rails

Notes:

C. Apply joint bars bolted only through the outermost holes to the defect within 10 days after it is determined to continue the track in use.
- When joint bars have not been applied within 10 days, the speed must be limited to 10 MPH until joints bars are applied.

D. Apply joint bars bolted only through the outermost holes to the defect within 7 days after it is determined to continue the track in use.
- When joint bars have not been applied within 7 days, the speed must be limited to 10 MPH until joints bars are applied.

E. Apply joint bars to the defect and bolt in accordance with § 213.121(d) an (e).

Track Safety Standards *Subpart D: Structure*

213.113 Defective Rails

Notes:

F. Inspect the rail within 90 days after it is determined to continue the track in use. If the rail remains in the track and is not replaced or repaired, the reinspection cycle starts over with each successive reinspection unless the reinspection reveals the rail defect to have increased in size and therefore become subject to a more restrictive remedial action. This process continues indefinitely until the rail is removed from the track or repaired. If not inspected within 90 days, limit speed to that for class 2 track or the maximum allowable speed under § 213.9 for the class of track concerned, whichever is lower, until it is inspected.

G. Inspect the rail within 30 days after it is determined to continue the track in use. If the rail remains in the track and is not replaced or repaired, the re-inspection cycle starts over with each successive re-inspection unless the re-inspection reveals the rail defect to have increased in size and therefore become subject to a more restrictive remedial action. This process continues indefinitely until the rail is removed from the track or repaired. If not inspected within 30 days, limit speed to that for class 2 track or the maximum allowable speed under § 213.9 for the class of track concerned, whichever is lower, until it is inspected.

Track Safety Standards *Subpart D: Structure*

213.113 Defective Rails

Notes:

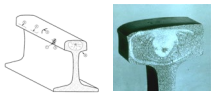
H. Limit operating speed over the defective rail to 50 m.p.h or the maximum allowable speed under § 213.19 for the class of track concerned, whichever is lower.

I. Limit operating speed over the defective rail to 30 m.p.h or the max allowable speed under § 213.19 for the class of track concerned, whichever is lower.

Track Safety Standards *Subpart D: Structure*

213.113 Defective Rails
Transverse Fissure

- Defect starts inside the rail
- Defect not usually visible on the rail surface
- Defect still requires remediation action



Track Safety Standards *Subpart D: Structure*

213.113 Defective Rails
Transverse Fissure

- 5-24%

"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 mph until angle bars are applied; thereafter, limit speed to 50 mph 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 mph, 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 mph until joint bars are applied; thereafter, limit speed to 50 mph or the maximum allowable speed under 213.9 for the class of track concerned, whichever is lower.

Track Safety Standards *Subpart D: Structure*

213.113 Defective Rails
Transverse Fissure (Continued)

- 25-59%

"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 mph or less as authorized by a person designated under 213.7(a), until angle bars are applied; thereafter, limit speed to 50 mph or the maximum allowable speed under 213.9 for the class of track concerned, whichever is lower.

Track Safety Standards *Subpart D: Structure*

213.113 Defective Rails
Transverse Fissure (Continued)

- 60-99%

"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 mph for up to 24 hours prior to another such visual inspection or replacement or repair of the rail.

--or--

"E" Apply joint bars to defect and bolt in accordance with 213.121(d) and (e); and

"H" Limit operating speed over defective rail to 50 mph or the maximum allowable speed under 213.9 for the class of track concerned, whichever is lower.

- 100%

"A" Assign person designated under 213.7 to visually supervise each operation over defective rail.

-- or --

"E" and "H" (see above)

Track Safety Standards *Subpart D: Structure*

213.113 Defective Rails
Compound Fissure

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.

Track Safety Standards *Subpart D: Structure*

213.113 Defective Rails
Compound Fissure

- 5-69%

  "B" Limit operating speed over defective rail to that as authorized by a person designated under 213.7(a). The operating speed cannot be over 30 mph or the maximum allowable speed under 213.9 for the class of track concerned, whichever is lower.
- 70-99%

  "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 mph for up to 24 hours prior to another such visual inspection or replacement or repair of the rail.
- 100%

  "A" Assign person designated under 213.7 to visually supervise each operation over defective rail.

Track Safety Standards *Subpart D: Structure*

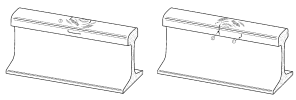
213.113 Defective Rails
Detail/Engine Burn Fracture, Defective Weld

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.

Track Safety Standards *Subpart D: Structure*

213.113 Defective Rails
Detail/Engine Burn Fracture, Defective Weld (Continued)

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.



Track Safety Standards *Subpart D: Structure*

213.113 Defective Rails
Detail/Engine Burn Fracture, Defective Weld (Continued)

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.

Track Safety Standards *Subpart D: Structure*

213.113 Defective Rails
Detail/Engine Burn Fracture, Defective Weld (Continued)

- 5-24%

"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 mph until angle bars are applied; thereafter, limit speed to 50 mph 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 mph, 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 mph until joint bars are applied; thereafter, limit speed to 50 mph or the maximum allowable speed under 213.9 for the class of track concerned, whichever is lower.

Track Safety Standards *Subpart D: Structure*

213.113 Defective Rails
Detail/Engine Burn Fracture, Defective Weld (Continued)

- 25-59%

"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 mph or less as authorized by a person designated under 213.7(a), until angle bars are applied; thereafter, limit speed to 50 mph or the maximum allowable speed under 213.9 for the class of track concerned, whichever is lower.

Track Safety Standards *Subpart D: Structure*

213.113 Defective Rails
Detail/Engine Burn Fracture, Defective Weld (Continued)

- 60-99%

"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 mph for up to 24 hours prior to another such visual inspection or replacement or repair of the rail.

--or--

"E" Apply joint bars to defect and bolt in accordance with 213.121(d) and (e); and

"H" Limit operating speed over defective rail to 50 mph or the maximum allowable speed under 213.9 for the class of track concerned, whichever is lower.

- 100%

"A" Assign person designated under 213.7 to visually supervise each operation over defective rail.

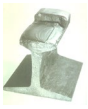
-- or --

"E" and "H" (see above)

Track Safety Standards *Subpart D: Structure*

213.113 Defective Rails
Horizontal/Vertical Split Head, Split Web, Piped Rail, & Head Web Separation

Horizontal Split Head means a horizontal progressive defect originating inside of the rail head, usually 1/4" 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.

Track Safety Standards *Subpart D: Structure*

213.113 Defective Rails
Horizontal/Vertical Split Head, Split Web, Piped Rail, & Head Web Separation

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.


Track Safety Standards *Subpart D: Structure*

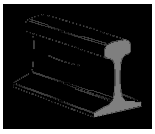
213.113 Defective Rails
Horizontal/Vertical Split Head, Split Web, Piped Rail, & Head Web Separation

Vertical Split Head


Track Safety Standards *Subpart D: Structure*

213.113 Defective Rails
Horizontal/Vertical Split Head, Split Web, Piped Rail, & Head Web Separation

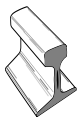
Split Web means a lengthwise crack along the side of the web and extending into or through it.




Track Safety Standards *Subpart D: Structure*

213.113 Defective Rails
Horizontal/Vertical Split Head, Split Web, Piped Rail, & Head Web Separation

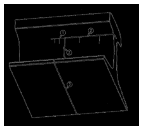
Piped Rail means a vertical split in a rail, usually in the web, due to failure of the shrinkage cavity in the ingot to unite in rolling.



Track Safety Standards *Subpart D: Structure*

213.113 Defective Rails
Horizontal/Vertical Split Head, Split Web, Piped Rail, & Head Web Separation

Head and Web Separation means a progressive fracture, longitudinally separating the head from the web of the rail at the head fillet area.



Track Safety Standards *Subpart D: Structure*

213.113 Defective Rails
Horizontal/Vertical Split Head, Split Web, Piped Rail, & Head Web Separation

- Greater than 1" to 2 "

  "H" Limit operating speed over defective rail to 50 mph or the maximum allowable speed under 213.9 for the class of track concerned, whichever is lower.

  --and --

  "F" Inspect rail 90 days after it is determined to continue the track in use.

- Greater than 2" to 4"

  "I" Limit operating speed over defective rail to 30 mph or the maximum allowable speed under 213.9 for the class of track concerned, whichever is lower.

  -- and --

  "G" Inspect rail 30 days after it is determined to continue the track in use.

Track Safety Standards *Subpart D: Structure*

213.113 Defective Rails
Horizontal/Vertical Split Head, Split Web, Piped Rail, & Head Web Separation

- Greater than 4"

  "B" Limit operating speed over defective rail to that as authorized by a person designated under 213.7(a). The operating speed cannot be over 30 mph or the maximum allowable speed under 213.9 for the class of track concerned, whichever is lower.

- Breakout in Railhead

  "A" Assign person designated under 213.7 to visually supervise each operation over defective rail.

Track Safety Standards *Subpart D: Structure*

213.113 Defective Rails
Horizontal/Vertical Split Head, Split Web, Piped Rail, & Head Web Separation

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.

Track Safety Standards *Subpart D: Structure*

213.113 Defective Rails
Bolt Hole Crack

- Greater than 1/2" to 1"

  "H" Limit operating speed over defective rail to 50 mph or the maximum allowable speed under 213.9 for the class of track concerned, whichever is lower.

  -- and --

  "F" Inspect rail 90 days after it is determined to continue the track in use.

- Greater than 1" to 1-1/2"

  "H" Limit operating speed over defective rail to 50 mph or the maximum allowable speed under 213.9 for the class of track concerned, whichever is lower.

  -- and --

  "G" Inspect rail 30 days after it is determined to continue the track in use.

Track Safety Standards *Subpart D: Structure*

213.113 Defective Rails
Bolt Hole Crack

- Greater than 1" - 1/2"

  "B" Limit operating speed over defective rail to that as authorized by a person designated under 213.7(a). The operating speed cannot be over 30 mph or the maximum allowable speed under 213.9 for the class of track concerned, whichever is lower.

- Breakout in Railhead

  "A" Assign person designated under 213.7 to visually supervise each operation over defective rail.

Track Safety Standards *Subpart D: Structure*

213.113 Defective Rails
Broken Base

Broken Base means any break in the base of the rail.

Track Safety Standards *Subpart D: Structure*

213.113 Defective Rails
Broken Base

- Greater than 1" to 6"
  "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 mph or less as authorized by a person designated under 213.7(a), until angle bars are applied; thereafter, limit speed to 50 mph or the maximum allowable speed under 213.9 for the class of track concerned, whichever is lower.

- Greater than 6"
  "A" Assign person designated under 213.7 to visually supervise each operation over defective rail.
  -- or --
  "E" Apply joint bars to defect and bolt in accordance with 213.121(d) and (e); and "I" Limit operating speed over defective rail to 30 mph or the maximum allowable speed under 213.9 for the class of track concerned, whichever is lower.

Track Safety Standards *Subpart D: Structure*

213.113 Defective Rails
Ordinary Break

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 are found.

- Can this can be drilled and bolted?
- Under what FRA regulation?

Track Safety Standards *Subpart D: Structure*

213.113 Defective Rails
Ordinary Break

"A" Assign person designated under 213.7 to visually supervise each operation over defective rail.

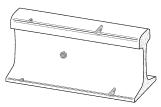
-- or –

"E" Apply joint bars to defect and bolt in accordance with 213.121(d) and (e).

Track Safety Standards *Subpart D: Structure*

213.113 Defective Rails
Ordinary Break

Damaged Rail means any rail broken or injured by wrecks, broken, flat, or unbalanced wheels, slipping, or similar causes.



Track Safety Standards *Subpart D: Structure*

213.113 Defective Rails
Damaged Rail

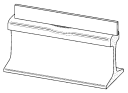
"C" Apply joint bars bolted only through the outermost holes to defect within 10 days after it is determined to continue the track in use.

In the case of Classes 3 through 5 track, limit operating speed over the defective rail to 30 mph until joint bars are applied; thereafter, limit the speed to 50 m.p.h. or the maximum allowable speed under § 213.9 for the class of track concerned, whichever is lower.

Track Safety Standards *Subpart D: Structure*

213.113 Defective Rails
Flattened Rail

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 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.

Track Safety Standards *Subpart D: Structure*

213.113 Defective Rails
Flattened Rail

Depth 3/8" and greater plus length 8" and greater

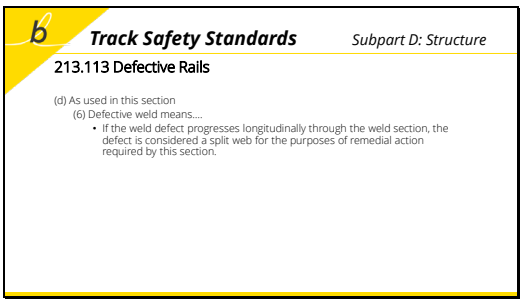
"H" Limit operating speed over defective rail to 50 mph or the maximum allowable speed under 213.9 for the class of track concerned, whichever is lower.

Track Safety Standards *Subpart D: Structure*

213.113 Defective Rails

(d) As used in this section

(4) Crushed head means a short length of rail, not at a joint, which has drooped or sagged across the width of the rail head to a depth of 3/8" or more below the rest of the rail head and 8" or more in length. Unlike flattened rail where the depression is visible on the rail head only, the sagging or drooping is also visible in the head/web fillet area.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Track Safety Standards
Subpart D: Structure
213.113 Defective Rails
(d) As used in this section
(6) Defective weld means....
• If the weld defect progresses longitudinally through the weld section, the defect is considered a split web for the purposes of remedial action required by this section.

Section 213.113 Exercise

Instructions: Using the remedial action table in 49 CFR Part 213.113, decide what the required remedial action is for each of the following defects if they are not removed from the track.

_____ Compound fissure with 50% of the rail head weakened.

_____ Transverse fissure with 20% of the rail" head weakened.

_____ Vertical split head 3 inches long.

_____ Bolt hole crack 1-1/2 inches long.

_____ Corrugated rail with 2" wavelength and 1/16" depth.

_____ Ordinary break 4 inches long.

_____ A 3-inch split in the rail web.

_____ 3/16-inch rail end batter at a joint

_____ A vertical split head with a breakout in the rail head.

_____ Flattened rail 10 inches long and 1/2 inch deep.

_____ Fracture affecting 50% of the rail head at an engine burn.

_____ A defective field weld with rail head weakened 90%.

_____ A vertical split head 1/2-inch long.

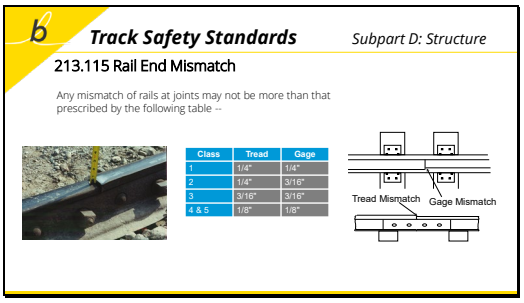
_____ A head-web separation 3-1/2 inches long.

_____ Bolt hole crack 3/4 inches long.

_____ A rail broken in half for no apparent reason.

_____ A 7" long horizontal split in the rail head.

_____ A shelly spot 3/32" deep and 2" long.


Track Safety Standards
Subpart D: Structure
213.115 Rail End Mismatch
Any mismatch of rails at joints may not be more than that prescribed by the following table --
Class | Tread | Gage
1 | 1/4" | 1/4"
2 | 1/4" | 3/16"
3 | 3/16" | 3/16"
4 & 5 | 1/8" | 1/8"
Tread Mismatch
Gage Mismatch

Section 213.115 Exercise

Instructions: You have just taken some rail end mismatch measurements. Using 49 CFR Part 213.115 determine the class of track for each measurement.

Class	Measurement
_____	¼" tread and ¼" gage mismatch
_____	¼" tread and 0" gage mismatch
_____	1/8" tread and ¼" gage mismatch
_____	¼" tread and 3/16" gage mismatch
_____	0" tread and 1/8" gage mismatch
_____	½" tread and 1/8" gage mismatch
_____	3/16" tread and ¼" gage mismatch
_____	1/16" tread and 1/8" gage mismatch
_____	1/8" tread and 3/16" gage mismatch
_____	1/16" tread and 1/16" gage mismatch

Track Safety Standards *Subpart D: Structure*

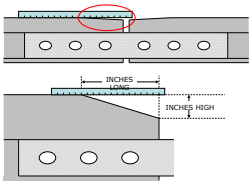


Figure 1. Method for measuring RAIL END BATTER. Measurement to be made on each rail end. (NOT TO SCALE)

Track Safety Standards *Subpart D: Structure*

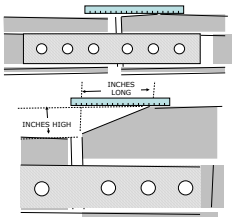


Figure 2. Method for measuring RAIL END RAMP. (NOT TO SCALE)

Track Safety Standards *Subpart D: Structure*

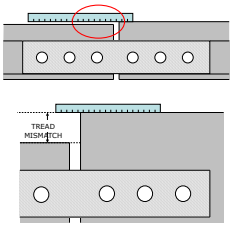


Figure 3. Method for measuring TREAD MISMATCH. (NOT TO SCALE)

Track Safety Standards *Subpart D: Structure*

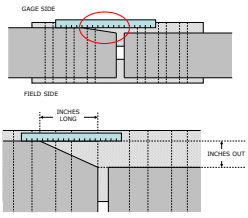


Figure 4. Method for measuring GAGE RAMP. (NOT TO SCALE)

Track Safety Standards *Subpart D: Structure*

213.118 Continuous Welded Rail; Plan Review and Approval

(a) Each track owner with track constructed of Continuous Welded Rail (CWR) shall have in effect written procedures which address the installation, adjustment, maintenance and inspection of CWR; inspection of CWR joints; and a training program for the application of those procedures.

(b) The track owner shall file its CWR plan with the FRA. Within 30 days of receipt of the submission, FRA will review the Plan for compliance with this subpart. FRA will approve, disapprove or conditionally approve the plan and will provide written notice of its determination.

Track Safety Standards *Subpart D: Structure*

213.118 Continuous Welded Rail; Plan Review and Approval

(c) The track owner's existing plan shall remain in effect until the new plan is approved or conditionally approved and is effective per paragraph (d);

(d) The track owner shall, upon receipt of FRA's approval or conditional approval, establish the Plan's effective date. The track owner shall advise in writing FRA and all affected employees of the effective date.

Track Safety Standards *Subpart D: Structure*

213.118 Continuous Welded Rail; Plan Review and Approval

(e) FRA, for cause stated, may, subsequent to plan approval or conditional approval, require revisions to the plan to bring the plan into conformity with this subpart. Notice of a revision requirement shall be made in writing and specify the basis of FRA's requirement. The track owner may, within 30 days of the revision requirement, respond and provide written submissions in support of the original plan. FRA renders a final decision in writing. Not more than 30 days following any final decision requiring revisions to a CWR plan, the track owner shall amend the plan in accordance with FRA's decision and resubmit the conforming plan. The conforming plan becomes effective upon its submission to the FRA.

Track Safety Standards *Subpart D: Structure*

Buckled Track Prevention Training

Procedures for Installation, Adjustment, Maintenance, and Inspection of CWR

Track Safety Standards *Subpart D: Structure*

Track Buckling Can Be Prevented

Track Safety Standards *Subpart D: Structure*

Heat & Cold – We must know what to do!

Track Safety Standards *Subpart D: Structure*

213.119 Continuous Welded Rail Plan Contents

(l) As used in this section-

Adjusting/de-stressing means a procedure by which a rail's neutral 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.
Annual re-training means training every calendar year.

Buckling Incident means the formation of a lateral misalignment sufficient in magnitude to constitute a deviation from the Class 1 requirements specified in §213.55. These normally occur when rail temperatures are relatively high and are caused by high longitudinal compressive forces.

Buckling-prone condition means a track condition that can result in the track being laterally displaced due to high compression forces caused by critical rail temperature combined with insufficient track strength and/or train dynamics.

Track Safety Standards *Subpart D: Structure*

213.119 Continuous Welded Rail Plan Contents

Continuous welded rail (CWR) means rail that has been welded together into lengths exceeding 400 feet. Rail installed as CWR remains CWR, regardless of whether a joint or plug is installed into the rail at a later time.

Corrective actions mean those actions which track owners specify in their CWR plans to address conditions of actual or potential joint failure, including, as applicable, repair, restrictions on operations, and additional on-foot inspections.

CWR joint means any joint directly connected to CWR.

Track Safety Standards *Subpart D: Structure*

213.119 Continuous Welded Rail Plan Contents

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.

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.

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.

Track Safety Standards *Subpart D: Structure*

213.119 Continuous Welded Rail Plan Contents

Pull apart or stripped joint means a condition when no bolts are mounted through a joint on the rail end, rending the joint bar ineffective due to excessive expansive or contractive forces.

Pull-apart prone condition means a condition when the actual rail temperature is below the rail neutral temperature at or near a joint where longitudinal tensile forces may affect the fastenings at the joint.

Rail anchors mean 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.

Track Safety Standards *Subpart D: Structure*

213.119 Continuous Welded Rail Plan Contents

Rail neutral temperature is the temperature at which the rail is neither in compression nor tension.

Rail temperature means the temperature of the rail, measured with a rail thermometer.

Remedial actions means those actions which track owners are required to take as a result of requirements of this part to address a non-compliant condition.

Tight/kinky rail means CWR which exhibits minute alinement irregularities which indicate that the rail is in a considerable amount of compression.

Track Safety Standards *Subpart D: Structure*

213.119 Continuous Welded Rail Plan Contents

Tourist, scenic, historic, or excursion operations mean railroad operations that carry passengers with the conveyance of the passengers to a particular destination not being the principal purpose.

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 of the rail.

Unscheduled detour operation means a short-term, unscheduled operation where a track owner has no more than 14 calendar days' notice that the operation is going to occur.

Track Safety Standards *Subpart D: Structure*

213.119 Continuous Welded Rail Plan Contents

Track Lateral Resistance means the resistance provided to the rail/crosstie structure against lateral displacement.

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.

Track Safety Standards *Subpart D: Structure*

213.121 Rail Joints

(a) Each rail joint, insulated joint, and compromise joint must be of a structurally sound design and dimensions for the rail on which it is applied.

Track Safety Standards *Subpart D: Structure*

213.121 Rail Joints

(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 must be replaced.

Track Safety Standards *Subpart D: Structure*

213.121 Rail Joints

(c) If a joint bar is cracked or broken between the middle two bolt holes it must be replaced.

Track Safety Standards *Subpart D: Structure*

213.121 Rail Joints

(d) In the case of conventional jointed track, each rail must 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.

Track Safety Standards *Subpart D: Structure*

213.121 Rail Joints

(e) In the case of continuous welded rail track, each rail must be bolted with at least two bolts at each joint.

Track Safety Standards *Subpart D: Structure*

213.121 Rail Joints

(f) Each joint bar must 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' in length, are considered to be continuous welded rail track and must meet all the requirements for continuous welded rail track prescribed in this part.

Track Safety Standards *Subpart D: Structure*

213.121 Rail Joints

(g) No rail shall have a bolt hole which is torch cut or burned in Classes 2 through 5 track.

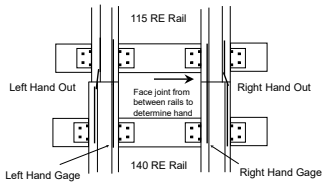
Track Safety Standards *Subpart D: Structure*

213.121 Rail Joints

(h) No joint bar shall be reconfigured by torch cutting in Classes 3 through 5 track.

Track Safety Standards *Subpart D: Structure*

213.121 Rail Joints
Compromise Joint Example



Track Safety Standards *Subpart D: Structure*

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, speed over that rail end must 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 the effective date of this rule, all torch cut rail ends in Class 5 track must be removed;

(2) Within two years of the effective date of this rule, all torch cut rail ends in Class 4 track must be removed; and

(3) Within one year of the effective date of this rule, all torch cut rail ends in Class 3 track over which regularly scheduled passenger trains operate, must be inventoried by the track owner.

Track Safety Standards *Subpart D: Structure*

213.122 Torch Cut Rail

(b) Following the expiration of the time limits specified in (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, must be removed within 30 days of discovery. Speed over that rail end must not exceed the maximum allowable for Class 2 track until removed.

Track Safety Standards *Subpart D: Structure*

213.127 Rail Fastening Systems

(a) Track shall be fastened by a system of components that 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.

(b) If rail anchors are applied to concrete crossties, the combination of the crossties, fasteners, and rail anchors must provide effective longitudinal restraint.

(c) Where fastener placement impedes insulated joints from performing as intended, the fastener may be modified or removed, provided that the crosstie supports the rail.

Track Safety Standards *Subpart D: Structure*

213.127 Rail Fastening Systems


Track Safety Standards *Subpart D: Structure*

213.133 Turnouts and Track Crossings Generally

(a) In turnouts and track crossings, the fastenings must be intact and maintained so as to keep the components securely in place. Also, each switch, frog, and guard rail must be kept free of obstructions that may interfere with the passage of wheels.


Track Safety Standards *Subpart D: Structure*

213.133 Turnouts and Track Crossings Generally

(b) Classes 3 through 5 track must 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.


Track Safety Standards *Subpart D: Structure*

213.133 Turnouts and Track Crossings Generally

(c) Each flangeway at turnouts and track crossings must be at least 1-1/2" wide.


Track Safety Standards *Subpart D: Structure*

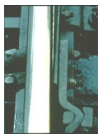
213.135 Switches

(a) Each stock rail must be securely seated in switch plates, but care must be used to avoid canting the rail by overtightening the rail braces.

Track Safety Standards *Subpart D: Structure*

213.135 Switches

(b) Each switch point must 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 must not adversely affect the fit of the switch point to the stock rail.

Track Safety Standards *Subpart D: Structure*

213.135 Switches

(b) (Continued) 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.

Track Safety Standards *Subpart D: Structure*

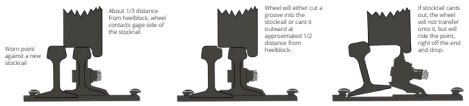
213.135 Switches

(c) Each switch must be maintained so that the outer edge of the wheel tread cannot contact the gage side of the stock rail.


Track Safety Standards *Subpart D: Structure*

213.135 Switches

(c) Each switch must be maintained so that the outer edge of the wheel tread cannot contact the gage side of the stock rail.



Track Safety Standards *Subpart D: Structure*

213.135 Switches

(d) The heel of each switch rail must be secure and the bolts in each heel must be kept tight.

Track Safety Standards *Subpart D: Structure*

213.135 Switches

(e) Each switch stand and connecting rod must be securely fastened and operable without excessive lost motion.


Track Safety Standards *Subpart D: Structure*

213.135 Switches

(f) Each throw lever must be maintained so that it cannot be operated with the lock or keeper in place.

(g) Each switch position indicator must be clearly visible at all times.

Track Safety Standards *Subpart D: Structure*

213.135 Switches

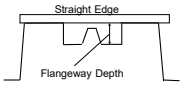
(h) Unusually chipped or worn switch points must be repaired or replaced. Metal flow must be removed to insure proper closure.

(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.

Track Safety Standards *Subpart D: Structure*

213.137 Frogs

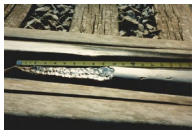
(a) Except as provided in paragraph (e) of this section, the flangeway depth measured from a plane across the wheel-bearing area of a frog on Class 1 track may not be less than 1-3/8", or less than 1-1/2" on Classes 2 through 5 track.



Track Safety Standards *Subpart D: Structure*

213.137 Frogs

(b) If a frog point is chipped, broken, or worn more than 5/8" down and 6" back, operating speed over the frog may not be more than 10 mph.



Track Safety Standards *Subpart D: Structure*

213.137 Frogs

(c) If the tread portion of a frog casting is worn down more than 3/8" below the original contour, operating speed over that frog may not be more than 10 mph.

(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.

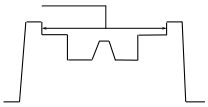
(e) The flange depth requirements in paragraph (a) do not apply to a frog designed as a flange-bearing frog (FBF) used in a crossing diamond in Classes 2 through 5 track, provided that the crossing angle is greater than 20 degrees unless movable guard rails are used.

Track Safety Standards *Subpart D: Structure*

213.141 Self-Guarded Frogs

(a) The raised guard on a self-guarded frog may not be worn more than 3/8"

(b) If repairs are made to a self-guarded frog without removing it from service, the guarding face must be restored before rebuilding the point.



Track Safety Standards *Subpart D: Structure*

213.143 Frog Guard Rails & Guard Faces; Gage

(a) The guard check and guard face gages in frogs must be within the limits --

Class	Minimum Check	Maximum Face
1	4'6-1/8" (54-1/8")	4'5-1/4" (53-1/4")
2	4'6-1/4" (54-1/4")	4'5-1/8" (53-1/8")
3, 4	4'6-3/8" (54-3/8")	4'5-1/8" (53-1/8")
5	4'6-1/2" (54-1/2")	4'5" (53")

Track Safety Standards *Subpart D: Structure*

213.143 Frog Guard Rails & Guard Faces; Gage

(b) For any heavy-point frog (HPF) on Class 5 track, the guard check gage may be less than 4'6 1/2" but not be less than 4'6 3/8", provided that:

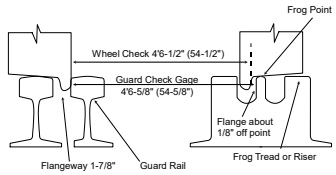
(1) Each HPF and guard rails on both rails through the turnout are equipped with at least three serviceable through-gage plates with elastic rail fasteners and guard rail braces that permit adjustment of the guard check gage without removing spikes or other fasteners from the crossties; and

(2) Each HPF bears an identifying mark applied by either the track owner, railroad, or the frog manufacturer that identifies the frog as an HPF.

Track Safety Standards *Subpart D: Structure*

213.143 Frog Guard Rails & Guard Faces; Gage

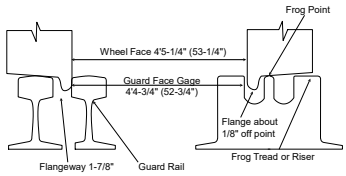
Check Gage Design Values



Track Safety Standards *Subpart D: Structure*

213.143 Frog Guard Rails & Guard Faces; Gage

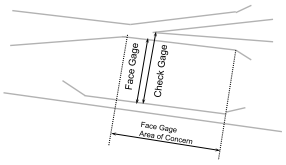
Face Gage Design Values



Track Safety Standards *Subpart D: Structure*

213.143 Frog Guard Rails & Guard Faces; Gage

Measuring



Section 213.143

Instructions: Using 49 CFR Part 213.143 decide what class of track the following deviations are good for.

_____ Guard check gage is 54 7/16”

_____ Guard check gage is 54 5/8”

_____ Guard check gage is 54 3/16”

_____ Guard face gage is 53 ½”

_____ Guard face gage is 53 1/16”

_____ Guard face gage is 53 3/16”

_____ Guard check gage is 54 3/8" and guard face gage is 53 3/16"

_____ Guard check gage is 54 9/16" and guard face gage is 53 1/8"

_____ Guard check gage is 54 1/8" and guard face gage is 53"

_____ Guard check gage is 54 7/16" and guard face gage is 53 1/16"

_____ Gage is 57 9/16”, guard check gage is 55 1/16” and guard face gage is 53 3/16"

_____ Gage is 56 3/16”, guard check gage is 54 5/16" and guard face gage is 53 7/16"

Subpart E – Track Appliances

Track Safety Standards

Track Safety Standards (TSS)
49 CFR Part 213
Subpart E – Appliances

Track Safety Standards *Subpart E: Appliances*

- Scope
- Derails

_____

_____

_____

_____

Track Safety Standards *Subpart E: Appliances*

Scope

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

_____

_____

_____

_____

Track Safety Standards *Subpart E: Appliances*

213.205 Derails

(a) Each derail must be clearly visible.

(b) When in a locked position, a derail must be free of lost motion which would prevent it from performing its intended function.

(c) Each derail must be maintained to function as intended.

(d) Each derail must be properly installed for the rail to which it is applied.

Track Safety Standards *Subpart E: Appliances*

213.205 Derails



Subpart F – Inspections

Track Safety Standards

Track Safety Standards (TSS)
49 CFR Part 213
Subpart F – Inspection

Track Safety Standards *Subpart F: Inspection*

- Scope
- Visual Track Inspections
- Automated inspection of track constructed with concrete cross ties
- Inspection of switches, track crossings, and lift rail assemblies or other transition devices on moveable bridges
- Inspection of Rail
- Qualified Operator
- Special Inspections
- Continuous Rail Testing
- Inspection Records

_____

_____

_____

_____

Track Safety Standards *Subpart F: Inspection*

213.231 Scope

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

_____

_____

_____

_____

Track Safety Standards *Subpart F: Inspection*

213.233 Track Inspections

(a) All track must be inspected in accordance with the schedule prescribed in paragraph (c) of this section by a person designated under 213.7.

(b) Each inspection must be made on foot or by traversing 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 mph when traversing 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 traversing the track in a vehicle, the inspection will be subject to the following conditions --

Track Safety Standards *Subpart F: Inspection*

213.233 Track Inspections

(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' from the track the inspector traverses;

(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' from the track the inspectors traverse.

Track Safety Standards *Subpart F: Inspection*

213.233 Track Inspections

(3) Each main track must be traversed by the vehicle or inspected on foot at least once every two weeks, and each siding must be traversed by the vehicle or inspected on foot at least once every month; and

(4) Track inspection records must indicate which track(s) are traversed by the vehicle or inspected on foot as outlined in (b)(3) above.

Track Safety Standards *Subpart F: Inspection*

213.233 Track Inspections

(c) Each track inspection must be made in accordance with the following schedule --

Class	Type of Track	Frequency
Excepted 1,2, & 3	Main Track & Sidings	Weekly[1] 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[2] or more than 10 million gross tons of traffic during the preceding calendar year.
Excepted 1,2, & 3	Other than main track and sidings	Monthly with at least 20 calendar days interval between inspections.
4 & 5	-----	Twice weekly with at least 1 calendar day interval between inspections.

Track Safety Standards *Subpart F: Inspection*

213.233 Track Inspections

[1] An inspection week is defined as a seven (7) day period beginning on Sunday and ending on Saturday.

[2] "Twice weekly" inspection requirement for track carrying regularly scheduled passenger trains does not apply where passengers train service consists solely of tourist, scenic, historic, or excursion operations as defined in 49 CFR 238.5 and the following conditions are met for an inspection week: (1) No passenger service is operated during the inspection week, or (2) if passenger service is operated during the inspection week: (i) The passenger service is operated only on a weekend or a 3-day extended weekend (weekend plus a contiguous Monday or Friday), and (ii) an inspection is conducted no more than 1 calendar day before a weekend or 3-day extended weekend on which passenger service is to be operated.

Track Safety Standards *Subpart F: Inspection*

213.233 Track Inspections

(d) If the §213.7 qualified person making the inspection finds a deviation from the requirements of this part, the inspector shall immediately initiate remedial action. Any subsequent movements to facilitate repairs on track that is out of service must be authorized by a §213.7 qualified person.

Note:
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.

Track Safety Standards *Subpart F: Inspection*

213.234 Automated Inspection of Track Constructed with Concrete Crossties

- Automated technology shall be used (once or twice per year depending on tonnage) as a supplement to visual inspection on Class 3, 4, & 5 main track constructed with concrete crossties over which regularly scheduled passenger service trains operate.
- On Class 3, 4, and 5 main track with exclusively passenger service, either an automated inspection or walking inspection must be conducted once per year.
- Annual training shall also be provided to 213.7 qualified employees for handling rail seat deterioration exceptions.

Track Safety Standards *Subpart F: Inspection*

213.235 Switch, Track Crossing, & Lift Rail Assembly/Transition Device Inspections

(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.

Track Safety Standards *Subpart F: Inspection*

213.235 Switch, Track Crossing, & Lift Rail Assembly/Transition Device Inspections

(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.

Auxiliary Lock

One Rod and Mechanism

Track Safety Standards *Subpart F: Inspection*

213.235 Switch, Track Crossing, & Lift Rail Assembly/Transition Device Inspections

(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.

Track Safety Standards *Subpart F: Inspection*

213.237 Inspection of Rail

(a) In addition to the inspections required by § 213.233, each track owner shall conduct internal rail inspections sufficient to maintain service failure rates per rail inspection segment in accordance with this paragraph (a) for a 12-month period, as determined by the track owner and calculated within 45 days of the end of the period. These rates shall not include service failures that occur in rail that has been replaced through rail relay since the time of the service failure. Rail used to repair a service failure defect is not considered relayed rail. The service failure rates shall not exceed -

(1) 0.1 service failure per year per mile of track for all Class 4 and 5 track;

(2) 0.09 service failure per year per mile of track for all Class 3, 4, and 5 track that carries regularly-scheduled passenger trains or is a hazardous materials route; and

(3) 0.08 service failure per year per mile of track for all Class 3, 4, and 5 track that carries regularly-scheduled passenger trains and is a hazardous materials route.

Track Safety Standards *Subpart F: Inspection*

213.237 Inspection of Rail

(b) Each rail inspection segment shall be designated by the track owner no later than March 25, 2014 for track that is Class 4 or 5 track, or Class 3 track that carries regularly-scheduled passenger trains or is a hazardous materials route and is used to determine the milepost limits for the individual rail inspection frequency.

(1) To change the designation of a rail inspection segment or to establish a new segment pursuant to this section, a track owner must submit a detailed request to the FRA Associate Administrator for Railroad Safety/Chief Safety Officer (Associate Administrator). Within 30 days of receipt of the submission, FRA will review the request. FRA will approve, disapprove, or conditionally approve the submitted request, and will provide written notice of its determination.

(2) The track owner's existing designation shall remain in effect until the track owner's new designation is approved or conditionally approved by FRA.

(3) The track owner shall, upon receipt of FRA's approval or conditional approval, establish the designation's effective date. The track owner shall advise in writing FRA and all affected railroad employees of the effective date.

Track Safety Standards *Subpart F: Inspection*

213.237 Inspection of Rail

(c) Internal rail inspections on Class 4 and 5 track, or Class 3 track with regularly-scheduled passenger trains or that is a hazardous materials route, shall not exceed a time interval of 370 days between inspections or a tonnage interval of 30 million gross tons (mgt) between inspections, whichever is shorter. Internal rail inspections on Class 3 track that is without regularly-scheduled passenger trains and not a hazardous materials route must be inspected at least once each calendar year, with no more than 18 months between inspections, or at least once every 30 mgt, whichever interval is longer, but in no case may inspections be more than 5 years apart.

(1) Any rail used as a replacement plug rail in track that is required to be tested in accordance with this section must have been tested for internal rail flaws.

(2) The track owner must verify that any plug rail installed after March 25, 2014 has not accumulated more than a total of 30 mgt in previous and new locations since its last internal rail flaw test, before the next test on the rail required by this section is performed.

(3) If plug rail not in compliance with this paragraph (c) is in use after March 25, 2014, trains over that rail must not exceed Class 2 speeds until the rail is tested in accordance with this section.

Track Safety Standards *Subpart F: Inspection*

213.237 Inspection of Rail

(d) If the service failure rate target identified in paragraph (a) of this section is not achieved, the track owner must inform FRA of this fact within 45 days of the end of the defined 12-month period in which the performance target is exceeded. In addition, the track owner may provide to FRA an explanation as to why the performance target was not achieved and provide a remedial action plan.

(1) If the performance target rate is not met for two consecutive years, then for the area where the greatest number of service failures is occurring, either:

(i) The inspection tonnage interval between tests must be reduced to 10 mgt; or

(ii) The class of track must be reduced to Class 2 until the target service failure rate is achieved.

(2) In cases where a single service failure would cause the rate to exceed the applicable service failure rate as designated in paragraph (a) of this section, the service failure rate will be considered to comply with paragraph (a) of this section unless a second such failure occurs within a designated 12-month period. For the purposes of this paragraph (d)(2), a period begins no earlier than January 24, 2014.

Track Safety Standards *Subpart F: Inspection*

213.237 Inspection of Rail

(e) Each defective rail shall be marked with a highly visible marking on both sides of the web and base except that, where a side or sides of the web and base are inaccessible because of permanent features, the highly visible marking may be placed on or next to the head of the rail.

(f) Inspection equipment must be capable of detecting defects between joint bars, in the area enclosed by joint bars.

(g) 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 213.237(a). [This paragraph (d) is not retroactive to tests performed prior to 9/21/98)]

Track Safety Standards *Subpart F: Inspection*

213.237 Inspection of Rail

(h) If a valid search for internal defects cannot be conducted for reasons described in paragraph (d), 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 mph until such time as a valid search for internal defects can be made; or

(3) Remove the rail from service.

(i) The person assigned to operate the rail defect detection equipment must be a qualified operator as defined in § 213.238 and have demonstrated proficiency in the rail flaw detection process for each type of equipment the operator is assigned.

Track Safety Standards *Subpart F: Inspection*

213.237 Inspection of Rail

(j) As used in this section -

(1) ***Hazardous materials route*** means track over which a minimum of 10,000 car loads or intermodal portable tank car loads of hazardous materials as defined in 49 CFR 171.8 travel over a period of one calendar year; or track over which a minimum of 4,000 car loads or intermodal portable tank car loads of the hazardous materials specified in 49 CFR 172.820 travel, in a period of one calendar year.

(2) ***Plug rail*** means a length of rail that has been removed from one track location and stored for future use as a replacement rail at another location.

(3) ***Service failure*** means a broken rail occurrence, the cause of which is determined to be a compound fissure, transverse fissure, detail fracture, or vertical split head.

(4) ***Valid search*** means a continuous inspection for internal rail defects where the equipment performs as intended and equipment responses are interpreted by a qualified operator as defined in § 213.238.

Track Safety Standards *Subpart F: Inspection*

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.

Track Safety Standards *Subpart F: Inspection*

213.240 Continuous rail testing

(a) Track owners may elect to use continuous rail testing to satisfy the requirements for conducting internal rail inspections under § 213.237 or § 213.339. When a track owner utilizes the continuous rail test inspection process under the requirements of this section, the track owner is exempt from the requirements of § 213.113(b); all other requirements of § 213.113 apply.

(b) Track owners shall adopt the necessary procedures for conducting continuous testing. At a minimum, the procedures must conform to the requirements of this section and ensure the following:

(1) Test data is timely and accurately transmitted and analyzed;

(2) Suspect locations are accurately identified for field verification;

(3) Suspect locations are categorized and prioritized according to their potential severity;

(4) Suspect locations are accurately field-verified; and

(5) Suspect locations will be designated following field verification.

Track Safety Standards *Subpart F: Inspection*

213.240 Continuous rail testing

(c) The track owner must designate and record the type of rail test (continuous or stop-and-verify) to be conducted prior to commencing the test over a track segment and make those records available to FRA upon request during regular business hours following reasonable notice. If the type of rail test changes following commencement of the test, the change must be documented and include the time the test was started and when it was changed, and the milepost where the test started and where it was changed. If the track owner intends to conduct a continuous test, the track owner must designate and record whether the test is being conducted to satisfy the requirements for an internal rail inspection under §213.237 or §213.339. This documentation must be provided to FRA upon request during regular business hours following reasonable notice.

Track Safety Standards *Subpart F: Inspection*

213.240 Continuous rail testing

(d)(1) Continuous rail test inspection vehicle operators must be qualified under §213.238, with the exception of §213.238(b)(3).

(2) Internal rail inspection data collected during continuous rail tests must be reviewed and interpreted by a person qualified to interpret the equipment responses. Each employer of a person qualified to interpret equipment responses shall maintain written or electronic records of each qualification in effect, including the name of the employee, the equipment to which the qualification applies, the date of qualification, and the date of the most recent reevaluation of the qualification, if any. Records concerning these qualifications, including copies of training programs, training materials, and recorded examinations shall be kept and available for inspection and copying by FRA during regular business hours, following reasonable notice.

(3) All suspect locations must be field-verified by a person qualified under §213.238.

Track Safety Standards *Subpart F: Inspection*

213.240 Continuous rail testing

(e) At a minimum, the continuous rail test process must produce a report containing a systematic listing of all suspected locations that may contain any of the defects listed in the table in §213.113(c), identified so that a person qualified under §213.238 can accurately locate and field-verify each suspected defect.

(1) Except as provided in paragraph (e)(6) of this section, and subject to the requirements of paragraphs (e)(2) and (3) of this section, if the continuous rail test inspection vehicle indicates a suspect location, field verification must be conducted within 84 hours of the indication of the suspect location.

(2) Except as provided in paragraph (e)(6) of this section, and subject to the requirements of paragraph (e)(3) of this section, if the continuous rail test inspection vehicle indicates a suspect location containing a suspected defect that, if verified, requires remedial action A, A2, or B identified in the table contained in § 213.113(c), the track owner must field-verify the suspect location no more than 36 hours from indication of the suspect location.

(3) If the continuous rail test inspection vehicle indicates a broken rail with rail separation, the track owner must have procedures to ensure that adequate protection is immediately implemented.

Track Safety Standards *Subpart F: Inspection*

213.240 Continuous rail testing

(e) At a minimum, the continuous rail test process must produce a report containing a systematic listing of all suspected locations that may contain any of the defects listed in the table in §213.113(c), identified so that a person qualified under §213.238 can accurately locate and field-verify each suspected defect.

(4) A suspect location is not considered a defect under §213.113(c) until it has been field-verified by a person qualified under § 213.238. After the suspect location is field-verified and determined to be a defect, the track owner must immediately perform all required remedial actions prescribed in §213.113(a).

(5) Any suspected location not field-verified within the time required under paragraphs (e)(1) and (2) of this section must be protected by applying the most restrictive remedial action under §213.113(c) for the suspected type and size of the suspected defect. The remedial action must be applied over a sufficient segment of track to assure coverage of the suspected defect location until field-verified.

(6) A continuous rail test that is not conducted to satisfy the requirements for an internal rail inspection under §213.237 or §213.339, and has been properly designated and recorded by the track owner under paragraph (c) of this section, is exempt from the requirements of paragraphs (e)(1), (2), and (5) of this section.

Track Safety Standards *Subpart F: Inspection*

213.240 Continuous rail testing

(f) Each suspect location must be recorded with repeatable accuracy that allows for the location to be accurately located for subsequent verification and, as necessary, remedial action.

Track Safety Standards *Subpart F: Inspection*

213.240 Continuous rail testing

(g) Within 45 days following the end of each calendar year, each track owner utilizing continuous rail testing must provide the FRA with an annual report, in a reasonably usable format, or its native electronic format, containing at least the following information for each track segment requiring internal rail inspection under §213.237 or §213.339:

(1) The track owner's name;
(2) The railroad division and subdivision;
(3) The segment identifier, milepost limits, and length of each segment;
(4) The track number;
(5) The class of track;
(6) The annual million gross tons over the track;
(7) The total number of stop-and-verify rail tests and the total number of continuous rail tests over each track segment;
(8) The total number of defects identified over each track segment; and
(9) The total number of service failures on each track segment.

Track Safety Standards *Subpart F: Inspection*

213.241 Inspection Records

(a) Each owner of track to which this part applies shall keep a record of each inspection.

(b) Each record of an inspection under 213.4 [excepted track], 213.1119 [CWR], 213.233 [inspections], and 213.235 [switch & crossing inspections] shall be prepared on the day the inspection is made and signed or certified by the person making the inspection. Records must specify the author of record, type of track inspected, date and location 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.

Track Safety Standards *Subpart F: Inspection*

213.241 Inspection Records

(c) Records of internal rail inspections required by §213.237 shall specify the -
(1) Date of inspection;
(2) Track inspected, including beginning and end points;
(3) Location and type of defects found under §213.113;
(4) Size of defects found under §213.113, if not removed prior to the next train movement;
(5) Initial remedial action taken and the date thereof; and
(6) Location of any track not tested pursuant to §213.237(g).

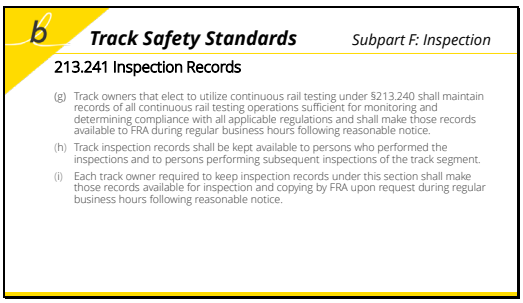
(d) Each owner shall retain inspection records under paragraph (c) of this for at least 2 years after inspection and for 1 year after initial remedial action is taken.

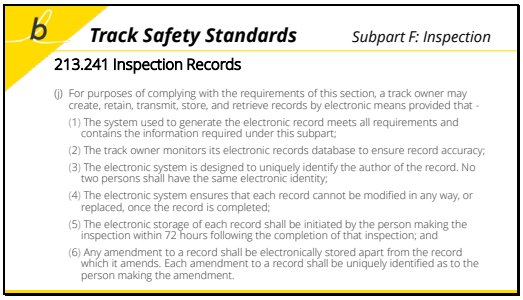
(e) Owner shall maintain records sufficient to demonstrate means by which it computes the service failure rate on all track segments for purposes of determining compliance with applicable service failure rate target.

Track Safety Standards *Subpart F: Inspection*

213.241 Inspection Records

(f) Records of continuous rail testing under 213.240 shall --
(1) Include all information required under §213.240(e);
(2) State whether the test is being conducted to satisfy the requirements for an internal rail inspection under §213.237;
(3) List the date(s) and time(s) of the continuous rail test data collection, including the date and time of the start and end of the test run, and the date and time each suspect location was identified and field-verified;
(4) Include the determination made after field verification of each suspect location, including the:
(i) Location and type of defect found;
(ii) Size of defect; and
(iii) Initial remedial action taken, if required, and the date thereof; and
(5) Be retained for at least two years after the inspection and for at least one year after initial remedial action is taken, whichever is later.


Track Safety Standards
Subpart F: Inspection
213.241 Inspection Records
(g) Track owners that elect to utilize continuous rail testing under §213.240 shall maintain records of all continuous rail testing operations sufficient for monitoring and determining compliance with all applicable regulations and shall make those records available to FRA during regular business hours following reasonable notice.
(h) Track inspection records shall be kept available to persons who performed the inspections and to persons performing subsequent inspections of the track segment.
(i) Each track owner required to keep inspection records under this section shall make those records available for inspection and copying by FRA upon request during regular business hours following reasonable notice.


Track Safety Standards
Subpart F: Inspection
213.241 Inspection Records
(j) For purposes of complying with the requirements of this section, a track owner may create, retain, transmit, store, and retrieve records by electronic means provided that -
(1) The system used to generate the electronic record meets all requirements and contains the information required under this subpart;
(2) The track owner monitors its electronic records database to ensure record accuracy;
(3) The electronic system is designed to uniquely identify the author of the record. No two persons shall have the same electronic identity;
(4) The electronic system ensures that each record cannot be modified in any way, or replaced, once the record is completed;
(5) The electronic storage of each record shall be initiated by the person making the inspection within 72 hours following the completion of that inspection; and
(6) 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.

Section 213.233 Exercise

Instructions: Using 49 CFR Part 213.233 provide the required frequency of inspection and interval. Traffic is daily unless otherwise noted.

Frequency/Interval

_____ Yard thoroughfare track; freight only; 15 mph

_____ Branch line; freight only; 20 mph; operations once every 10 days

_____ Main line; freight only; 30 mph

_____ Branch line; freight only; 20 mph; tri-weekly operation

_____ Branch line; excepted status

_____ Main line; tri-weekly passenger service; 59 mph

_____ Branch line; weekend excursion service; 25 mph

_____ Industrial lead; operation every 14 days; excepted status

_____ Branch line; weekly freight train of 10,000 gross tons; 25 mph

_____ Turnout in yard track; 10 mph speed limit; freight only

_____ Passing siding of 10 mph along freight only mainline of 49 mph

_____ Mainline; freight only; 50 mph

_____ Mainline; freight only; 35 mph

_____ Depot track; passenger trains; 10mph

_____ Turnout; through route of 50mph, diverging route of 25 mph; freight only

_____ Mine lead; 15 mph; 1,000-unit coal trains a year, each weighing 10,000 tons

_____ Yard bypass track; 45 mph speed limit; freight only

_____ Engine servicing track; 5 mph

_____ Granary lead; 10 mph; operated daily July-October

_____ Branch line; 35 mph; regular excursion type passenger service

_____ Main track; 40 mph; freight only; 15 million gross tons of freight traffic per year

_____ Track crossing between two class 3 main tracks

_____ Track crossing between main track of 10 mph and main track of 49 mph

_____ 10 mph storage track along 49 mph main track; freight only

Combination of Defects – Final Exercise

Instructions: The following conditions are found during a routine track inspection. Assume all gaps indicate movement which must be included. Using the 49 CFR 213 book and your training from this week, calculate the total measurement for each scenario and determine the class of track.

1. At a joint in tangent track, the west rail is 1-1/2 inches lower than the east rail. There is a 3/8-inch gap visible between the bottom of the rail and the top of the tie plate.

2. At a location in curved track, the outside rail is 2-1/2 inches higher than the inside rail. There is a visible gap and markings to indicate that the outside end of the tie sinks 3/4 inches when a train passes over that spot.

3. At a point on a tangent, the west rail is 1/2-inch low. There is a 3/4-inch gap between the bottom of the tie under the west rail and the ballast. The tie end under the east rail has a 2-inch gap between the bottom and the ballast.

4. The measured track gage at a joint in a curve is 56-13/16 inches. The tie shows fresh wear marks of 3/8 inch along the field side of the outside rail's tie plate. The single shoulder tie plates show a 1/8-inch gap between the rail base and plate shoulder.

5. At a soft spot in the track bed, the inspector stretches a 62-foot string between two points on the rail head. Measurement shows a 2-1/2-inch gap between the string center and the top of the rail. Mud below the rail base is flattened, indicating contact by the rail when a train passes. The distance between the rail base and mud surface is 1-1/4 inches.

6. Gage of 56-3/4 inches is measured in a switch. The switch plates under the straight stock rail show outward lateral movement of 3/8 inch. There is a 1/8-inch gap between the adjustable rail braces and the field side of the rail.

7. A curve is checked for alignment. The mid-ordinate is measured to be 6- 1/2 inches. However, the ties show gaps averaging 1-3/4 inches between the outside ends and the ballast.

8. A joint shows 5/16 inch of tread mismatch on the rail tread. Both rails are new and of the same section, and the joint bars are correct, but very loose.

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