Federal Railroad Administration

Track and Rail and Infrastructure Integrity Compliance Manual

Volume I General

Chapter 1 Introduction/General Guidance

January 2014

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CHAPTER 1 Introduction and General Guidance

Introduction to the Compliance Manual

The Track and Rail and Infrastructure Integrity Compliance Manual provides technical guidance to Federal and State Track Inspectors. The Compliance Manual provides guidance for enforcement of 49 CFR Part 213 Track Safety Standards (TSS), Part 214 Railroad Workplace Safety, and Part 237 Bridge Safety Standards. The guidance provided in this manual may be revoked or modified without notice by memorandum of the Associate Administrator for Railroad Safety/Chief Safety Officer. This manual does not modify, alter, or revise the regulatory provisions in the above referenced in any way.

Comments, additions, and suggestions for future changes should be directed to Regional Track Specialists for consideration.

Inspectors should refer to this manual as often as necessary for clarification of FRA regulation interpretation and policy. When an inspector is unsure of meaning or intent in this manual, the inspector should promptly contact a Regional Track Specialist for guidance. The individual chapters of the manual can be viewed and printed from FRA's e-Library (URL: http://www.fra.dot.gov/eLib/Find#p1_z50_ICM_s66_s43_s67_kcompliance%20manual)

Safety

The first priority of the Federal Railroad Administration (FRA) is safety. Therefore, all activities are to be conducted with personal safety and the safety of accompanying personnel in mind. Inspectors shall conduct activities in accordance with the safety instructions contained in the General Manual. Guidance for Roadway Worker Protection (RWP), bridge worker safety, and on-track roadway maintenance machine safety is contained in the Track and Rail and Infrastructure Integrity Compliance Manual, Volume III. Railroad Bridge Safety guidance is contained in the Track and Rail and Infrastructure Integrity Compliance Manual, Volume IV.

Track Inspections

An Inspector's primary duty is to conduct inspections to determine whether the railroads are complying with the TSS and railroad workplace safety (bridge worker safety, RWP, and roadway maintenance machine safety). Effective inspection requires identification, evaluation, and reporting of conditions and practices that fail to meet minimum Federal compliance requirements.

Since the purpose of regular inspection activity is to evaluate the performance of the carrier and the carrier's representatives in conducting thorough inspections and complying with the TSS, an inspection of track inspection records maintained by the carrier, as required by 49 CFR 213.241 and 213.369, is necessary. Determine the adequacy of the carrier's inspections by evaluating what is recorded on the carrier's inspection reports, and determine if these reports reflect the actual conditions of the track structure.

To conduct a thorough inspection, the following preparations are suggested:

- Obtain the names and locations of the supervisor's territory to be inspected.

- Advise the supervisor of the territory to be inspected and invite them to have a railroad representative accompany you.
- Set a date, time, and location for the inspection.
- If you must change the date, time, or location, make every effort to contact the carrier as soon as possible to advise them.
- Determine what, if any, transportation will be furnished by the carrier.
- Always have a copy of the TSS and the Compliance Manual as reference.
- Carry properly calibrated track measuring equipment (tape measure, level board, string line).
- If possible, have the following information before the inspection:
    - Timetables and special instruction for speeds and restrictions.
    - Current slow orders.
    - Recent carrier track inspection reports.
    - Train, tonnage, and hazardous material information.
    - Current and recent program work.
    - Current carrier RWP program.
    - Current continuous welded rail (CWR) program (if required).

For information on general FRA policy, in addition to this chapter, inspectors should also reference the General Manual, Chapter 2, for guidance about issues such as property entry, refusal to permit inspections, forcible interference with official duties, and release for entry and strike or labor disputes.

Opening Conference

Before starting an inspection, inspectors should introduce themselves to all present and obtain a list of individuals participating in the inspection. An inspector may then explain the reason for the inspection as:

- Regular – to ensure the carrier's inspection process is adequate in finding, reporting, and remedying non-TSS-compliant conditions.
- Followup – or "re-inspection" of a regular inspection to ensure proper remedial action.
- Complaint – of unsafe conditions by an individual, group, or entity. Caution must be used to not to identify the complainant. It is not mandatory to divulge that you are on a complaint investigation, as it may compromise the investigation. Inspectors should consult with the Regional Track Safety Specialist.
- Accident – investigations caused by derailments or accidents, etc.
- Waiver – investigation for relief from TSS.
- Automated Track Inspection Program (ATIP) – FRA geometry car inspections (Chapter 3).
- Special Inspections – such as focused inspections or program enforcement.

During the Workplace Safety Briefing prior to the inspection, all parties involved should understand that FRA’s goal is to help the carrier improve safety, and we welcome suggestions and ideas.

Closing Conference

Upon completion of an inspection, the inspector shall provide the carrier representative a report with all conditions that do not meet minimum safety requirements. Field reporting is discussed in Vol. I, Chapter 2. The reporting of exceptions to the standards is discussed in Vol. I, Chapter 4.

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Track and Rail and Infrastructure Integrity Compliance Manual

Volume I General

Chapter 2 Field Reporting Procedures and Forms

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CHAPTER 2 Field Reporting Procedures and Forms

Introduction

Inspectors must record each field inspection on a Track Inspection Report Form, F6180.96 (also called "Form 96"). Inspection reports shall be completed and promptly submitted, even when an inspection is free of defect observations. The data contained in each F6180.96 form (including a railroad's reply to corrective action items) transfers to FRA's safety database for processing in order to permit the generation of several management reports. This data helps to determine the effectiveness of the overall inspection program, the degree of compliance, and the effect of the Track Safety Standards (TSS) on reducing track-related accidents.

The information obtained by inspection activities also plays a key role in the development of FRA's National Inspection Plan. This plan is a critical tool in providing for efficient allocation of FRA's resources throughout the Nation in order to ensure the safety and viability of the general system of rail transportation.

Track Inspection Report Form, FRA F6180.96

General Instructions

This section describes the methods used to prepare an inspection report. Since January 1995, Track inspectors have been recording their inspection activities on a multidiscipline form, FRA F6180.96. The purpose of the form is to record inspections and defects for placement into FRA's safety database.

The Railroad Inspection System for Personal Computers (RISPC) provides inspectors with the capability to enter inspection data via their PCs. This program allows inspectors to maintain electronic records, which facilitates data analysis. Throughout RISPC, help instructions are available to assist in the navigation and use of the software (by using the menu's "Help" selection or the question mark icon).

Each inspector engaged in field inspection activities must complete Form 96 the day of the inspection, generating complete and legible information, and submit Form 96 to the railroad representative. Electronic RISPC-generated track inspection report entries are the preferred method to be used. Inspectors can use the hand-printed F6180.96 forms when necessary (e.g., computer failure). Inspectors must make hand-printed entries with a black ballpoint pen, applying sufficient pressure to ensure legibility of copies. If additional space is required, inspectors must use the 96a continuation sheet and number each page in the upper right corner of the report. When using a hand-written report, inspectors should enter the information into the RISPC as soon as practicable.

Inspectors shall provide notice of defective conditions found on the day of the inspection by either: 1) an electronic PDF copy of the F6180.96 inspection report (email or other electronic medium) or 2) a hand-delivered paper copy. If F6180.96 reports contain line items recommending a civil penalty, then a hand-delivered paper copy, signed by the inspector, shall be provided to the railroad representative.

For special instructions on the completion of each field in the F6180.96 report, refer to Appendix C - Instruction, F6180.96 Track Inspection.

Special Instructions–Inspections from/to State Lines

Complete an inspection report that begins within a State and terminates at the State line, as follows: Enter the name of the community (if not originating in a community, use the county) nearest the inspection starting point in the "From City" block on the inspection form and the State line name from the drop-down menu in the "Destination City" block to indicate the State line. A four-digit artificial identifier code, starting with the digits "99," to indicate a State line, followed by the two-digit State code for the adjacent State, is in the drop-down menu. For example, an inspection conducted from Erie, Pennsylvania, to Ashtabula, Ohio, would be reported on two separate reports as follows:

First Report

From			Destination		
City:	Erie	2640			
State:	PA	42	City:	PA/OH State line	9939
County:	Erie	C049	County:	Erie	C049

Second Report

From			Destination		
City:	OH/PA State Line	9942			
State:	OH	39	City:	Ashtabula	0330
County:	Ashtabula	C007	County:	Ashtabula	C007

Inspection reports should be numbered consecutively. They can then be associated with each other in a listing of inspection activity, and a clear picture of the location of the entire inspection will be available.

An inspection crossing an entire State will show State line identifiers at each end, and will be associated with adjoining inspection reports by use of consecutive report numbers. For example, report an inspection from Pittsburgh, Pennsylvania, through West Virginia, to Columbus, Ohio, as follows:

First Report

From			Destination		
City:	Pittsburgh	6600			
State:	PA	42	City:	PA/WV State Line	9954
County:	Allegheny	C003	County:	Allegheny	C003

Second Report

From			Destination		
City:	WV/PA State Line	9942			
State:	WV	54	City:	WV/OH State Line	9939
County:	Brooke	C009	County:	Brooke	C009

Third Report

From			Destination		
City:	OH/WV State Line	9954			
State:	OH	39	City:	Columbus	1800
County:	Jefferson	C081	County:	Franklin	C049

Use a county or nearest city code for inspections beginning or ending at international borders (e.g., Canada or Mexico).

Note: When an inspection occurs at one point only, for example an inspection within the confines of a yard in one municipality, it is not necessary to fill in the "destination" fields.

Defect Line Item F6180.96 Reports

Inspectors must upload their RISPC inspection reports on a weekly basis. If an error is discovered requiring correction of a report, then the corrected report must be issued to the railroad representative. Furthermore, as soon as possible, the corrected report must be uploaded to FRA's data contractor.

When making an unaccompanied inspection, the inspector will deliver a copy of the report to the railroad personnel having jurisdiction in the area covered by the report. However, when an inspection such as one from a train occurs and no defects are noted, it is not necessary to deliver a copy of the report.
In the Track discipline, do not mix defect-only line items and items checked yes in the "Violation Recommended" field on an F6180.96 form. In the case where an inspector discovers defect items and violation items during an inspection, these will require at a minimum two separate reports (one with defects only and another with violation items only). See below for line items with a recommendation for violation.

Violation Recommended Line Item F6180.96 Reports

Inspectors shall complete a separate F6180.96 report for any items identified for recommendation for violation. However, the above instructions pertaining to uploading and corrections also apply to reports containing items checked "yes" in the "Violation Recommended" field. In addition, carefully monitor the "Written Notification to FRA of Remedial Action Required" field to ensure railroads are complying with this requirement. Failure of the railroad to comply with the written notification requirement should be considered for a violation (Part 209, Section 405(a)).

Multiple violation line items on an F6180.96 report must be of the same Code of Federal Regulations (CFR) part, because all items from such a report will automatically populate into an F6180.111 violation narrative report (see below).

Violation Report Narrative - FRA F6180.111

General Instructions

It is always necessary to provide supplemental information to an F6180.96 by writing a narrative report (F6180.111) when recommending a violation. These written narratives will accompany the F6180.96.

In the RISPC system, use F6180.96 forms that contain items recommended for civil penalty to generate an F6180.111. Open the RISPC main menu and perform the following actions:

1. Select “Other Programs”
2. Select “New Violation Report”
3. At the blank violation screen, select “New Report”
4. From the Inspection Reports Wizard, select the appropriate violation form (Track 213), [1]
5. Highlight the report and line item number you want and click on “Select and Create Violation Report”
6. Inspectors are to enter their sequential violation number and click on “OK”

Note: When recommending a violation for a Roadway Workplace Safety item, select the Track-214 form.

For special instructions on the completion of each field in the F6180.111 report, refer to Appendix D–Instructions, F6180.111 Track Violation.

A narrative submitted with a track inspection report should contain sufficient detail to completely describe and support the inspection activity. Copies of all pertinent data, such as railroads’ plans, records, bulletins or orders; any pertinent photographs; the names and titles of railroad employees who were witnesses; the time of day when the inspection or investigation was conducted; and the location of any violation with reference to some fixed object should also be furnished to further support the inspection activity. GPS coordinates, if available, may also be used.

When filing a violation report, take great care to obtain adequate evidence to support each element of each violation recommended in the violation report. This should include evidence through personal observation and/or records indicating train operations over the track defect. Also, evidence that the railroad should have known (knowledge standard) that the defect existed must be included in accordance with § 213.5(a), which states that responsibility for compliance with the track regulations lies with the track owner “... who knows or has notice that the track does not comply with the requirements....” This is the “knowledge standard.”

If pertinent, include copies of previous FRA track reports or the railroad’s own records to document prior knowledge given to the railroad indicating the presence of the track defect. Establish knowledge of a defect by constructively showing that the defect is of such a nature that the railroad would have known of the defect from past track inspections. In this regard, it is helpful to note the date of the railroad’s last inspection (and include the railroad’s last inspection record) and explain why the condition must have been present at that time by stating that this type of condition takes a longer time to develop than the time between the railroad’s last inspection and FRA’s inspection. See Chapter 4 of this manual for additional instructions concerning the knowledge standard.

Inspectors should be careful to identify, in the narrative report, all circumstances or facts that the inspector did not witness by stating the source of such information. If necessary, accomplish this by attaching a report of an interview to the narrative report. Identify all copies of records by providing the name, title, and address of the custodian of original records.

If more than one count (or occurrence) is listed in a line item of an inspection report, the narrative of the violation report should clearly state whether all counts are being recommended as separate violations or as one violation for the entire line item, as the intent is not always clear. If separate violations are being requested for each count, the Transmittal of Violation Report cover sheet should list each violation as a separate line item and in Railroad Enforcement System (RES) as well (unless multiple days are being requested). This will ensure that FRA's Office of Chief Counsel (RCC) is aware of both the inspector's intent and the Region's approval of the number of counts requested. Note that entering the violations as multiple occurrences on FRA Form 6180.96 in RISPC automatically generates a footnote indicating that penalties have been assessed for 2 or more days on which the violation continued, which is not correct in many cases.

Submission of Photographs as Evidence

Photographs can be very strong evidence in support of a violation. When using photographs in the violation narrative package, explain what each photograph shows. Clearly identify what each photograph illustrates in support of the violation. In violations with multiple counts or line items, caption each photograph to link it to a specific violation item, e.g.JAS_001, Line Item 2

Photographs must be in digital format. It is acceptable to place descriptions or pointers using software to help the reader understand the nature of the violation. However, photographs must not be digitally manipulated in any manner to alter the appearance of any item or element in the photograph. Digital photographs shall be annotated to indicate that there are no electronic alterations.

Statements of Witness

Unless a violation is substantiated by an inspector's personal knowledge, the railroad's own records, or admissions of railroad officials contained in reports of interview, the violation report should be accompanied by one or more witness statements on the appropriate "Statement of Witness." (That form is designed for use by railroad employees; if a statement is being obtained from a nonemployee, consult the RCC about how to proceed.) The witness statement must clearly substantiate any elements of the violation not established by other evidence. As in any type of case where a violation report is based on information received from a complainant, neither the report nor any of its attachments should reveal that the case arose from a complaint or identify any person as a complainant. The whistleblower protections found at 49 U.S.C. § 20109(i)(1) prohibit FRA from revealing the identity of anyone who brings a safety complaint to FRA without that person's written consent. However, 49 U.S.C. § 20109(i)(2) states that the U.S. Department of Transportation will disclose to the Attorney General the name of an employee described in 49 U.S.C. § 20109(i)(1) if the matter is referred to the Attorney General for enforcement.

Each witness statement must contain the time, date, full name, title, and mailing address of the person who was interviewed. Note: Inspectors should reference the General Manual, Chapter 5, for witness statement guidance and an example of a witness statement form.

FRA Guidelines for Conducting Interviews

Inspectors should reference the General Manual, Chapter 5, for guidance in conducting interviews.

Copies of Railroad's Records

When necessary, the violation report must be accompanied by legible copies of the railroad's relevant records containing information that will provide RCC with substantiating documentation of the violation. The violation report should give a clear understanding of how the documents help demonstrate the violation of Federal safety regulations.

This information may be submitted in the form of duplicated copies of the railroad's records or through comprehensive, word-for-word extracts taken from the railroad's records.

Violation Report Package Arrangement

When the violation report and all supporting documents have been converted into a PDF format these documents will be combined into one master document.

Each violation is required to have a master file in PDF format. The filename must contain the following information: Region, Case Type, Inspector Initials, and Violation Number, for example R4-TS-CLD-49.pdf. The following table lists violation case types.

Violation Case Type List

Code	Type
AD	Alcohol and Drug Regulations
AR	Accident Reports Regulations
BW	Bridge Worker Safety Standards
EO	FRA Emergency Order
EP	Railroad Enforcement Procedures
EQ	Engineer Qualification Regulations
FCS	Freight Car Safety Standards
GC	Grade Crossing Signal Safety Regulations
GS	Safety Glazing Standards
HMT	Hazardous Materials Regulations
HS	Hours of Service Laws
HSR	Hours of Service Record Keeping Regulations
LI	Locomotive Safety Standards and Statutes
Code	Type
LIS	Steam Locomotive Safety Standards and Statutes
PEP	Passenger Train Emergency Preparedness Regulations
PEQ	Passenger Equipment Safety Standards
REM	Rear End Marking Device Regulations
ROP	Railroad Operating Practices
ROR	Railroad Operating Rules
RSP	Railroad Communications Regulations
RW	Roadway Worker Protection Regulations
SA	Safety Appliance Statutes and Regulations
SI	Signal Inspection Regulations and Statutes
TH	Train Horn/Quiet Zone
TS	Track Safety Standards

The violation report package should be arranged in the following order: Violation Report, List of Exhibit page, and exhibits in order or relevance. The requirements for these documents are detailed as follows:

1. **Violation Report - Form FRA F6180.111, including any continuation sheets:** Inspector must ensure all reports in the violation report package are signed using electronic signature.
2. **List of Exhibits:** A List of Exhibits page must be created and inserted immediately after the Form FRA F6180.111.
   1) The Exhibit List must be a separate document titled *"List of Exhibits" rather than "Attachment List".*
   2) The list must not be entered in the narrative of the Violation Report (field 34).
   3) All of exhibits must be listed in order of relevance, and will not be numbered 1,2, 3, or lettered A, B, C.
3. **Exhibits:** Exhibits include, but are not limit to, the following:
   1) Original Form FRA F6180.96 containing the recommendation for civil penalty
   2) Form FRA F6180.96 reports for the inspection that includes the defects not recommended as violations – railroad copy..
   3) Statements of Witness, if any.
   4) Copies of pertinent pages of the timetable and any other instructions that are in effect at the time of violation, such as a temporary speed restriction that amends the authorized speed.
   5) Photographs, as described above. Photographs should clearly illustrate the severity of the violation, any dynamic movement added to a measurement, or anything to further document why the defect is recommended for violation. Do not include photographs if they do not show something that is significant in supporting the violation.
   6) Copies of railroad records when they are available and are part of your determination to recommend a violation.
   7) Include any other items that may further substantiate that a violation is in order.

For identification purposes, each exhibit of the violation report package must be labeled with the inspector's initials and the violation report number, for example, JDP-55, which should be placed in the lower right corner of each sheet.

If an inspector feels that a violation needs special handling, the inspector must submit an additional cover memo (to be signed by the Regional Administrator) justifying the recommendation. Special handling includes a penalty above the amount shown in the penalty schedule (Appendix B to Part 213), up to or including the aggravated maximum penalty of $105,000, or when numerous counts of multiple days are recommended. Please ensure that the cover memo is included in the violation package. and that the memo provides the information and justification required by the "Improvements in Civil Penalty Enforcement" memo dated 6/18/09.

The entire violation package for transmittal contains:

1) TFR - F6180.72x (transmittal document)
2) Cover letter regarding extraordinary penalties (if applicable)
3) Violation report package

Note: One and two are separate files and do not require a digital signature by the inspector.

Supervisory Review

Upon receipt of a Track Inspection Report, or any other report submitted by an inspector, the Supervisory Track Specialist will make a thorough review to determine that:

- The report is complete.
- It has been prepared in accordance with outstanding instructions.
- The type and number of inspections are consistent with the goals of FRA.
- With respect to violation reports that the inspector has recommended for civil penalty, the inspector's recommendation for prosecution leaves no doubt as to the degree of seriousness of the violation and that, where a willful violation or an extraordinary penalty is sought, the report and/or Regional Administrator cover memo provides the additional justification to support a penalty beyond the ordinary level stated in the penalty schedule for the track safety standard violated.

Before uploading an F6180.111 form to the RISPC system and sending the electronic package to the regional headquarters, inspectors are to send a draft copy to their Supervisory Specialist for review. An electronic draft copy can be generated by "printing to PDF" and emailing it. The Specialist—after considering the hazard of the specific track violation, the railroad's record of accidents, and its overall compliance attitude—should indicate his or her concurrence or nonconcurrence with the inspector's estimate of the seriousness of the violation. The Supervisory Specialist may also indicate edits or corrections the inspector can incorporate into the final report package.

If the Specialist does not concur with the inspector's estimate of the seriousness of the violation, the Specialist should prepare a memo stating that fact and the reasons for his or her nonconcurrence. He or she should address the memo to the Regional Administrator, attached to the violation report and with a copy furnished to the inspector. The report should then be discussed with the inspector.

Violation Report Package Distribution

Upload the F6180.111 form narrative to the RISPC database within 30 days after the date of the inspection report. After the upload process, inspectors shall prepare an electronic master document of the entire violation package and send it to Supervisary Specialist. The violation report package will include a copy of the inspection report and supporting documentation bookmarked for easy reference.

After review by the Supervisory Specialist, the region will electronically submit the violation report package including the original report, exhibits and photographs to RCC. The region is required to retain a copy in regional files.

The inspector must number the violation narrative reports sequentially throughout his/her career without regard to the end of any calendar or fiscal year.

Special Notice for Repairs

General Guidelines

The Special Notice for Repairs Report (SNFR) is an effective instrument to handle certain circumstances in which a railroad does not take the proper remedial action to address defects. Use it in accordance with current FRA policy and in circumstances where noncomplying track conditions are repetitive or pose a safety risk. For example, if an inspector has determined that a segment of track does not comply with 49 CFR Part 213, is unsafe for continued service, or presents an imminent safety hazard to railroad employees or the general public, and if voluntary compliance has not been undertaken by the railroad, then inspectors should be prepared to issue a Special Notice for Repairs under the guidelines described in Chapter 4 of the Track Safety Standards Compliance Manual. Line items in the inspector’s F6180.96 that support the SNFR should have the line item box labeled “SNFR” checked.

Special Notice for Repairs F6180.8 Instructions

When the defects noted on the SNFR form are representative of general conditions identified on the track segment, the Track inspector should include a note on the Track Inspection Report form stating that the conditions reported are representative of the conditions on the identified track segment. Attach copies of the Form F6180.96 to the SNFR form (F6180.8).

Fill out the original and three copies of the SNFR form. Give the original to the appropriate carrier official and distribute the copies as follows:

1. The first copy–send to the Track Specialist.
2. The second copy–forward to the Associate Administrator for Railroad Safety/Chief Safety Officer, attention Track Division, RRS-15.
3. The third copy–keep in the inspector’s file.

Upon receipt of an SNFR, the railroad may appeal the decision of the inspector to the Regional Administrator. Such appeal must be in writing. The Regional Administrator will then assign an inspector, other than the inspector who originated this action, to reinspect the track. If the decision of the original inspector is sustained, the Regional Administrator will notify the railroad that the appeal is denied.

If found that it is safe to operate at the class deemed proper by the railroad, the Regional Administrator will immediately notify the railroad that the restriction is no longer in effect. In the case where doubt exists as to the seriousness of the conditions, the Regional Administrator can postpone the effective date of the slow order until a reinspection occurs. Only the Regional Administrator has this authority. Inspectors shall not make any statement that could be an indication of how FRA will resolve the appeal.

For instructions concerning the completion of Form F6180.8, in RISPC, see Appendix E–Instructions, F6180.8 Special Notice for Repairs.

Special Repair Remedial Action Report F6180.8a Instructions

An appropriate railroad official completes the Special Repair Remedial Action Report (SRRAR). It indicates remedial action taken by the railroad to correct the noncomplying conditions listed on the SNFR. The RISPC program will populate data from the SNFR to the SRRAR once the SNFR is completed. Inspectors will have the option of printing a hardcopy or saving the SRRAR in PDF. In addition, inspectors will also have the option of emailing the report to the appropriate railroad official. However, inspectors are encouraged to hand-deliver a hardcopy of the SRRAR, along with the SNFR, to the appropriate railroad official whenever possible and should always mail an original copy of each to the railroad.

For instructions concerning the completion of Form F6180.8, in RISPC, see Appendix F– Instructions, F6180.8a, Special Repair Remedial Action Report.

Reinspection

When assigned to reinspect track involved in an SNFR, the inspector shall commence that activity immediately. The inspector will conduct the reinspection in accordance with the provisions of Chapter 1 of this manual and it will be made over the entire limits covered by the SNFR. The inspector will determine if the defects present support the decision to issue an SNFR. The inspector must also submit to the Regional Administrator a thorough and complete written report that must include:

- A written description of the conditions found.
- Field measurements (where applicable).
- Photographs.
- A statement giving reasons for either denying or approving the appeal.

The reinspection will take into consideration all aspects of the TSS and shall not be limited to the defects listed on the SNFR.

It is the responsibility of the Track Specialist to keep the Regional Administrator advised of developments as they occur. If the carrier does not provide an F6180.8A to FRA in 30 days, then a followup inspection will be conducted. The purpose of this inspection is to determine if the carrier is complying with the provisions of the SNFR. If the carrier does not address the conditions noted in the SNFR, then refer to the section titled, “Violation of FRA Emergency Order or FRA SNFR” in Volume I, Chapter 4 of this manual.

Appendix A - Activity Codes

Multidiscipline Code Table of Definitions
(The table is based on the RISPC Database Revised January 17, 2012)

Activity	Discipline	Definition	Comments
174A	H, M	**General Requirements –** The purpose of this inspection is to determine compliance with §§174.3, 174.5, 174.9, 174.14, 174.16 and 174.50. This code is to be used for railroad facility inspections. Record one unit for the inspection of each car transporting hazardous materials.	
174B	H, O	**General Operating Requirements** – The purpose of this inspection is to review a train crew's documentation for each rail car containing hazardous material, including any changes in placement of the car. The inspection should include determining compliance with the basic hazardous materials shipping paper descriptions as required in § 174.26. Record one unit for each train consist inspected, and one subunit for each inspection of the basic shipping paper description of each car containing hazardous materials. **Note 1:** Inspectors must use Activity Code TPLH to record inspections associated with train placement requirements. **Note 2:** Inspectors must use this code instead of Code 172C when inspecting shipping papers specific to a particular train.	
209	ALL	**Remedial Action –** The purpose of this inspection is to report a railroad that has not complied with a requirement to provide a remedial action as noted in a previous inspection report. Record one unit for each remedial action not in compliance. (See General Manual for additional guidance).	
215D	H, O, S, T	**Freight Car Mechanical Inspection –** The purpose of this inspection is for any inspector **other than an MPE inspector** to determine compliance with Part 215, including Appendix D. The inspection includes those performed by an FRA inspector or when an FRA inspector observes railroad employees performing this inspection. MPE inspectors should reference Activity Code 215. Record one unit for each freight car inspected or observed inspected for compliance with § 215. For articulated cars, count each platform as one unit.	

Activity	Discipline	Definition	Comments
		Note 1: HM and OP inspectors should use the Activity Code HM for ALL of their Part 215 inspections. **Note 2:** Properly stenciled maintenance-of-way equipment is exempt from Part 215.305(b).	
217E	ALL	**Emergency Order –** The purpose of this inspection is to determine compliance with a current Emergency Order. Record each unit and subunit as directed by the unique instructions issued by FRA Headquarters regarding each specific Emergency Order. Inspectors must thoroughly explain the inspection in the inspection report's narrative.	
217O	ALL	**Other Operations Observations –** The purpose of this inspection is to observe railroad employees of any craft performing duties regarding railroad operating rules (ROR), and railroad safety rules(RSR). It will include all related RORs, RSRs, railroad bulletins, and any written railroad policy not otherwise covered in Federal regulations. Noncompliance will be recorded as a non-FRA defect under this activity code. Record one unit for an entire yard or equivalent facility monitored, and one subunit for each crewmember, yardmaster, contractor, track employee, mechanical employee, signal maintainer, etc., that the inspector continually observed a sufficient amount of time to determine compliance or noncompliance. **Note:** Unlike noncompliance with Federal regulations, it is FRA policy that inspectors provide information recorded under this activity code regarding noncompliance of an ROR/RSR, **without identifying the noncompliant employee by name**, in the Federal inspection report. See the General Manual for further explanation. **Example 1**: An FRA Track inspector observes a 20-person section gang working for approximately 45 minutes when the inspector observes a track employee sitting on the rail. The FRA inspector intervenes by addressing the employee's noncompliance with an RSR, and then discusses the noncompliance with the employee's supervisor. The inspection report will include the recording of one occurrence of a non-FRA defect for a track employee's failure to comply with the specific RSR that prohibits employees from sitting on a rail. The inspector will record the inspection as one unit and 20 subunits **Example 2:** An FRA MPE inspector observes four persons working on a railroad	

Activity	Discipline	Definition	Comments
		car with proper Blue Signal Protection for approximately 10 minutes when the inspector observes one of the workers perform a task while not wearing the required protective equipment. The FRA inspector intervenes by addressing the employee's noncompliance with an RSR by discussing it with the employee's supervisor. The inspection report will include the recording of a non-FRA defect for a car shop employee's failure to comply with the specific RSR that prohibits performing the task without the proper protective equipment. The inspector will record the inspection as one unit and four subunits.	
218C	O,S,T	**Camp Car Protection -** The purpose of this inspection is to determine compliance with camp car protection. Record one unit for each track inspected that requires camp car protection.	
218M	M, O	**Blue Signal Protection on Main or Other than Main Track** – The purpose of this inspection is to determine if the protection provided railroad employees requiring Blue Signal Protection in accordance with §§ 218.25, 218.27, and 218.30. Record one unit for each track that requires Blue Signal Protection. If the track requiring Blue Signal Protection has more than one train or cut of cars requiring protection record one unit for the entire track. Regarding inspecting compliance with Blue Signal regulations involving a remotely controlled switch, record one unit for all associated recordkeeping requirements at that location, and one subunit for each track associated with those records. **Note 1:** Except for stub tracks, both ends of the track must be inspected for compliance with the Blue Signal regulations. **Note 2:** There is a drop-down FRA observation code inspectors may use in lieu of writing a comment when there are not any exceptions noted.	
218O	ALL	**Part 218, Subpart F –** The purpose of this inspection is to determine a railroad's compliance with Part 218 Subpart F, including the requirement for a railroad to have complying railroad operating rules as indicated in the regulation. Record one unit for each day, or partial day, spent reviewing relevant railroad rules or for each yard or equivalent facility monitored. Record one subunit for each crewmember, yardmaster, contractor, track employee, mechanical employee, signal maintainer, etc, that the inspector continually observed a sufficient amount of time to determine compliance or noncompliance.	

Activity	Discipline	Definition	Comments
		Note: It is FRA policy that inspectors provide information regarding incidents recorded under this activity code as noncompliance of a Federal regulation. It will include **identifying the noncompliant individual by name** in the inspection report. See the General Manual for a further explanation. **Example 1**: An FRA Track inspector observes a 12-person section gang working for approximately 45 minutes when the inspector observes a track employee throwing a switch with equipment in the foul of the switch. The FRA inspector intervenes by addressing the employee's noncompliance with Part 218 Subpart F, and then discusses the noncompliance with the employee's supervisor. The inspection report will include the recording of the noncompliance for the track employee's failure to comply with Part 218, Subpart F, and the name of the employee in noncompliance. The inspector will record the inspection as one unit and 12 subunits. **Example 2:** An FRA MPE inspector observes six persons switching railcars in a car shop for approximately 10 minutes when the inspector observes one of the workers fail to properly protect a shoving movement. The FRA inspector intervenes by addressing the employee's noncompliance with Part 218 Subpart F, and then discusses the noncompliance with the employee's supervisor. The inspection report will include the recording of the noncompliance for the car shop employee's failure to comply with the Part 218 Subpart F, and the name of the employee in noncompliance. The inspector will record the inspection as one unit and six subunits. **Example 3**: An inspector reviews the railroad rules to determine if they are in compliance with the requirements setforth regarding railroad equipment in the foul and operating switches. The inspection report will include the recording of one unit for this inspection and will also reference the precise railroad rules, or lack thereof, in the inspection report's narrative.	
218S	M, O	**Blue Signal Protection Locomotive or Car Shops** – The purpose of this inspection is to determine compliance with regulations requiring Blue Signal Protection in a locomotive servicing track area, a car shop repair track area, or a track that has been designated as a repair track or expedite track. Record one unit for each area inspected. If § 218.29(c), *Alternative methods of protection,* applied in a car shop repair track	

Activity	Discipline	Definition	Comments
		area or a locomotive servicing track area, one unit is recorded for the entire area, regardless of the number of tracks in the area or the number of cars or locomotives on those tracks. **Note 1:** Except for stub tracks, both ends of the track, or each entrance to the area must be inspected for compliance with the regulation. Workers must be on, under, or between equipment, inspecting, testing repairing, or servicing before recording a unit for this activity. **Note 2:** There is a drop-down FRA observation code inspectors may use in lieu of writing a comment when there are not any exceptions noted.	
221	M, O	**Rear End Markers** – The purpose of this inspection is to monitor compliance with Part 221. This activity code **should not be used** when inspecting an End of Train (EOT) device under Part 232. Record one unit for each train, locomotive (includingdistributed power units DPU's) or caboose inspected for compliance. The inspection of each rear end marking device in rooms or locations where rear end marking devices are stored and/or recharged and maintained is one unit. Each rear end marker ID must be recorded in the line item along with the appropriate observation. Individual marking devices that are not attached to trains or in storage areas not subject to service are not recorded as a unit. **Note:** There is a drop-down FRA observation code inspectors may use in lieu of writing a comment when there are not any exceptions noted.	
227N	IH	**227N - Occupational Noise Exposure -** The purpose of this inspection is to determine compliance with Part 227 regarding occupational noise exposure in the **locomotive cab**. It will include audiometric test records, employee noise exposure monitoring plan and monitoring records, cab noise monitoring records, postings of monitoring results, training plans and records, or interviewing persons regarding noise exposure. Record one unit for each day or partial day of an inspection and one subunit for each Part 227 record reviewed. **Note:** This activity may only be claimed when accompanied by a member of the Industrial Hygiene staff.	
228	O, S	**Hours of Service Records Inspection –** The purpose of this inspection is to	

Activity	Discipline	Definition	Comments
		determine if Hours of Service (HOS) records are in compliance with Part 228. Record one unit for each day or partial day of inspection, and one subunit for each HOS record reviewed. This activity code includes any examination of HOS logs, HOS report forms, HOS documents, interviewing employees regarding HOS, and any other HOS records review activity. This activity code is not used to document an employee exceeding the HOS. **Note:** Reports ***taking exception to*** an employee exceeding the hours of service should **not** be recorded under this activity code, please reference the proper activity code associated with the employee's type of work or discipline. Example: Activity Code 228P, 211, or HSL.	
228C	O,S	**Construction of Employee Sleeping Quarters –** The purpose of this inspection is to determine compliance with Part 228 Subpart C. Record one unit for each day, or partial day, spent reviewing relevant facilities regarding Part 228, Subpart C.	
229X	H, O	**Locomotive Inspection in Operations –** The purpose of this inspection is for any inspector, other **than an MP&E inspector**, to determine a railroad's compliance with Part 229. Record one unit for any locomotive inspected. The inspection may include, but is not limited to, the locomotive daily inspection, any passageway tripping hazards, cab sanitation, cab lighting, speed indicator check, etc.	
232E	M, O	**End of Train Device** – The purpose of this inspection is to inspect an End of Train (EOT) device for compliance of § 232. The inspection must include verifying that the information on the calibration sticker is legible, and that it contains the date, name of person, and location of the last calibration. This activity also includes comparing the quantitative values between the front and rear unit, and the ability of the rear unit to effect an emergency application in response to an emergency application initiated from the front unit. Record one unit for each EOT inspected or observed for compliance. **Note:** This activity code will be used when citing defects on the Head End Device (HED) associated with the End of Train (EOT). device	
232O	H, O, S, T	**Freight Train Brake Test Observation –** The purpose of this inspection is for any inspector, **other than an MP&E inspector,** to determine compliance with Part 232 not covered in activity code 232E or 232X. It includes any airbrake test required by Part 232. Airbrake test inspections should include in the narrative of the inspection	

Activity	Discipline	Definition	Comments
		report if the inspector was observing or accompanying a railroad employee or contractor employee performing the airbrake test. Record one unit for each observation or inspection, and one subunit for each railcar involved.	
232X	M, O	**Securement of Locomotive and Cars** – The purpose of this inspection is to determine if railroad equipment is in compliance with § 232.103 (n). Record units as follows: 1. Record one unit for an inspection of unattended equipment that consists of a single locomotive or locomotive consist, either attached to cars or not. This inspection includes determining compliance with the requirements for throttle position, status of the reverse lever, position of the generator field switch, status of the independent brakes, position of the isolation switch, handbrake, and position of the automatic brake valve. 2. Record one unit for an inspection of unattended equipment **NOT** attached to locomotives that are required to be secured under this regulation. This unit includes inspections for bottled air. . **Note 1:** If a train is separated to avoid blocking any type of crossing it should have each section of the equipment recorded as a separate unit. **Note 2**: The inspection report that records a defect or recommended violation indentified should clearly state the number of handbrakes found to be applied, the number of handbrakes required to be applied, and the current operating rule in place that indicates the precise number of handbrakes required to be applied. **Note 3**: This inspection also includes an inspector reviewing railroad rules for compliance of this part. **Example:** If 30 unattended railcars are found on a track that is required to have seven hand brakes applied but the inspection reveals that only has one handbrake is applied, it will be recorded as one unit with one occurrence for the failure to have the other six handbrakes applied.	
238O	H,O, S, T	**Passenger Equipment Inspection (Partial)** – The purpose of this inspection is for any inspector, **other than an MP&E inspector,** to determine compliance with Part 238 that is not covered in activity codes 232X or 238T. Record one unit for each inspection and a subunit for each passenger car inspected.	

Activity	Discipline	Definition	Comments
238T	M, O	**Passenger Train Brake Test Observation –** The purpose of this inspection is to document an observation of a passenger train airbrake test, excluding tourist equipment. Record one unit for each entire brake test observed for compliance with Part 238, and one subunit for each railroad record associated with the Class I air brake test. **Note:** There is a drop-down FRA observation code inspectors may use in lieu of writing a comment when there are not any exceptions noted.	
238X	M, O	**Passenger Equipment Securement –** The purpose of this inspection is to determine if passenger or commuter equipment is properly secured (excluding tourist equipment). Record one unit for each train, whether or not a locomotive is attached.	
BPL	H, M	**Bulk Packages, (Applies to bulk packagings, including Intermodal Portable Tanks and Intermediate Bulk Containers, other than tank cars)** – One unit for each limited, ground level inspection of both sides of the bulk package and does not include a top level inspection. This activity code may only be used when assessing compliance with §§172.302, 172.304, 173.326, 172.502, 172.516, and 174.50. **Note 1:** Use TCL & TCT codes to record tank car inspections.	
BWS	S,T	**Bridge Worker Safety –** An inspection concerning Part 214, Subpart B, Bridge Worker Safety Standards. Record one unit for each bridge gang or work group, and one subunit for each member of the gang or work group.	
FCL	H, M	**Inspection of Freight Containers, General Handling and Loading Requirements –** The purpose of the inspection includes inspecting the exterior of freight containers for markings, placards, structural integrity, and securement to the railcar. Record one unit for each freight container inspected. **Note 1:** Use BPL & BPT codes to record intermodal tank inspections.	
NOIR	ALL	**Noise Test Records** – The purpose of this inspection is to document a review of a locomotive’s noise testing session, or a locomotive’s noise testing record. Record one unit for each locomotive’s noise testing session monitored and/or all noise	

Activity	Discipline	Definition	Comments
		testing records associated with that locomotive tested. **Example 1:** A shortline railroad has three records on file documenting a locomotive horn test performed on locomotive SP 1234. Record one unit for the examination of all three records. **Example 2:** A shortline railroad has three records on file documenting a locomotive horn test performed on locomotive SP 1234, and two records on SP 2345. Record two units for the inspection of the noise testing records for two locomotives. **Example 3:** An inspector monitors three noise testing sessions on SP 4567, and then reviews three noise testing records regarding that same locomotive. Record one unit for the locomotive and testing records involved. **Note 1:** This activity code should only be used by inspectors who have been trained to inspect locomotive horn testing records. **Note 2:** This activity code should not be used with Part 227 Occupational Noise Exposure inspections, (activity code 227N), or when performing a noise test (activity code NOIS).	
NOIS	ALL	**Noise Tests –** The purpose of this inspection is to perform a noise test in accordance with Federal regulations. This activity code should only be used by inspectors who have attended the FRA training course regarding the equipment used to conduct these inspections. Record one unit for each day or partial day of an inspection. This activity code should not be used with Part 227 Occupational Noise Exposure inspections, (activity code 227N), or when reviewing noise records (activity code NOIR).	
RADX	H, O, T	**Radar Speed Monitoring –** The purpose of this inspection is to monitor and/or accurately validate the speed of trains and railroad equipment for compliance with Federal regulations and/or railroad operating rules. Record one unit for each speed monitoring session and one subunit for each locomotive, train, or railroad equipment on the rail monitored. Noncompliance with railroad operating rules should be recorded under activity code 217O.	Revised 2-26/2011

Activity	Discipline	Definition	Comments
		Note 1: When entering this code, the inspector must indicate the initials and number of the lead locomotive, or a locomotive within the consist, in the Train # / Site field. This field permits the entry of 15 characters. Each train or piece of equipment monitored will require a new line item. **Note 2:** FRA and participating state employees must not perform radar monitoring sessions unless they received a certificate of qualification from an FRA employee who holds a current certificate as a stationary radar trainer. See Chapter 3 of the General Manual for a complete discussion of FRA policy.	
RMM	T, S	**Roadway Maintenance Machine & Hi-Rail –** The purpose of this inspection is to document an observation or inspection concerning Part 214 Subpart D, On-Track Roadway Maintenance Machines and Hi-Rail Vehicles. Record one unit for each roadway maintenance machine or hi-rail vehicle inspected. **Example:** If a large scale tie unit consisting of 20 roadway maintenance machines and one Hi-Rail vehicle is operating on the tracks, and only five of those machines are inspected, then record five units. **Note:** If a machine operator fails to comply with railroad rules not covered by Part 214 or any Federal regulation the inspector must note the non-compliance by recording it using a Non-FRA defect under activity code 217O, as provided in the guidelines of that activity code.	
RULE	ALL	**Rulebook Review -** The purpose of this inspection is to record an inspector's review or formal discussion with a railroad manager, regarding railroad rules that will determine if they accurately correlate with current FRA regulations. Record one unit for each day, or partial day, spent reviewing a railroad rule(s) for compliance with Federal regulations. Record a subunit for each CFR section involved. Only comments should be recorded under this activity code. Any defects should be recorded under the proper corresponding activity code. **Note:** Inspections regarding reviewing railroad rules to ensure compliance regarding § 232.103 (n) and Part 218 Subpart F, should not be recorded under this activity code. Inspectors should reference activity code 232X and 218O respectively for those railroad rule inspections. **Example 1:** An inspection of NEBR railroad's rulebook determined that railroad rules regarding signal systems (Part 234 and Part 236) comply with Federal	

Activity	Discipline	Definition	Comments
		regulations. Record one unit and two subunits. **Example 2:** An inspection that included discussions with railroad managers regarding NEBR railroad's rulebook and bulletins determined that the railroad's rules regarding Part 217 and Part 220, Subpart C, correlated with FRA regulations. Record one unit and two subunits.	
RWP	O, S, T	**Roadway Worker Protection** – The purpose of this inspection is to determine compliance with Part 214 Subpart C, Roadway Worker Protection (RWP). Record one unit for an individual worker or group of employees (with a roadway worker in charge) at a specific location. This will include attending a job briefing with a group of RWP employees. Record each train required to provide an audible warning signal as a separate unit, and each employee requiring RWP as a subunit. **Note:** When performing multi-point inspection work with the same employee (or group of employees), record only one unit for determining compliance, and one subunit for each employee of the workgroup per day. **Example 1:** When observing or inspecting a large production crew, record a separate unit for each different location where an employee (or group of employees) is monitored for compliance. E.g., large projects may have multiple teams or workgroups at various locations along the right of way, record each worker, team or workgroup at each different location as a separate unit. **Example 2:** You observe an RWP crew consisting of <u>one</u> Employee-In-Charge and <u>20</u> track employees together at a single location. Record one unit for the location and <u>21</u> subunits for the entire RWP work group.	
TCL	H, M	**Tank Car Inspection –** The purpose of this inspection includes inspecting for markings, placards, and structural integrity, and securement. Record one unit for each ground level inspection that did not include a top level inspection. This activity code may only be used when assessing compliance with §§172.302(a)(1), 172.304, 172.502(a)(1)(i), 172.516(c)(2) and (6), 174.50, 179, & 180.	
TPLH	H, M, O	**In-Train Placement of Placarded Rail Cars, Transport Vehicles, and Freight Containers -** The purpose of this activity is to determine compliance with positioning in-train of placarded cars, §§ 174.84 and 174.85. Record one unit for	

Activity	Discipline	Definition	Comments
		each train inspected.	

Bridge and Track Activity Code Table of Definitions
Revised March 9, 2012

Activity	Discipline	Definition	Comments
ATIP	T	**Automated Track Inspection Program Surveys (ATIP)** – The purpose of this activity code is to document an inspection onboard an FRA geometry car. Record one unit for monitoring and accessing each mile of track tested. **Note:** Not to be used by OP inspectors for ATIP on-board assignments. OP inspectors must use activity code 217R.	
BAI	T	**Bridge Accident Investigation** - The purpose of this activity code is to document accident investigations involving railroad bridges. Claim one unit for the investigation. Count each bridge observed as part of the accident investigation using Activity BOBS.	
BWI	T	**Bridge Waiver Investigation** - The purpose of this activity code is to document evaluation of Part 237 Bridge Safety Standards waiver applications. Claim one unit per waiver application.	
BCI	T	**Bridge Complaint Investigation** - The purpose of this activity code is to document bridge observations and evaluations relating to a complaint. Claim one unit per complaint. Count each bridge observed using Activity BOBS.	
BIR	T	**Bridge Inspection Record** - The purpose of this activity code is to document an inspection of a track owner's bridge inspection records. Claim one unit per inspection day and one subunit per record reviewed.	
BMP	T	**Bridge Management Program Review** - The purpose of this activity code is to document the review of a track owner's Bridge Management Program and other written policies for compliance with Part 237 requirements. Claim one unit per program review.	
BSSE	T	**Bridge Safety Standards Compliance Evaluation** - The purpose of this activity code is to document evaluation of a track owner's compliance with their adopted Bridge Management Program as well as compliance with Part 237 requirements falling outside of the BMP. Claim one unit per day of the compliance evaluation. Count each bridge inspection record evaluated for accuracy at the subject bridge	

Activity	Discipline	Definition	Comments
		using Activity BOBS.	
BOBS	T	**Bridge Observation** - The purpose of this activity code is to document railroad bridge structural observations. A unit may only be recorded when specifically observing or evaluating bridge structural components including ties on an open-deck bridge where the timbers are an integral structural load distribution element of the bridge. Claim one unit per bridge observed.	
BTNL	T	**Tunnel Observation** - The purpose of this activity code is to document railroad tunnel observations. Claim one unit per tunnel observed or for tunnels exceeding one mile in length, claim one unit per tunnel mile or fraction thereof.	
BMV	T	**Movable Bridge Observation** - The purpose of this activity code is to document movable bridge observations. Claim one unit per movable bridge observed.	
BMSC	T	**Miscellaneous Structure Observation** - The purpose of this activity code is to document observations and evaluations of retaining walls, station platforms, culverts, overhead bridges, and other miscellaneous structures not covered by Activity Codes BOBS, BTNL, or BMV. Claim one unit per structure observed.	
CWRP	T	**Review CWR Plans** - The purpose of this activity code is to document one CWRP unit whenever an inspector conducts a track inspection where there is any CWR observed.	
DER	T	**Derail** - The purpose of this activity code is to document a complete inspection of any derailing device used to divert free-rolling equipment off the track, to ensure the device functions as intended. Record one unit per derail inspected.	
GRMG	T	**Gage Restraint Measurement Vehicle–Government Owned** - The purpose of this activity code is to document an inspection onboard an FRA-owned gage restraint measurement vehicle used to determine compliance with § 213.110 (GRMS track). Record one unit for monitoring and accessing each mile of track tested.	

Activity	Discipline	Definition	Comments
GRMS	T	**Gage Restraint Measurement Vehicle–Other Than Government Owned -** The purpose of this activity code is to document an inspector's observations occurring on board a railroad owned gage restraint measurement vehicle. Record one unit for monitoring and accessing each mile of track tested.	
HGCT	T	**Highway-Rail Grade Crossing–Track -** The purpose of this activity code is to document a walking inspection to determine whether vegetation on railroad property interferes with motorist visibility of highway-rail grade crossing warning devices. See §§ 213.37(a)(2) and 213.321(a)(2). Record only one unit per highway-rail grade crossing installation.	
LRA	T	**Lift Rail Assembly -** The purpose of this activity code is to document a complete inspection of a railroad bridge lift-rail assembly and associated devices such as expansion joints. Record one unit per assembly or device. Each assembly on a bridge is considered a unit and each track on a moveable bridge should have four lift rails.	
LTT	T	**Life Tips Track** – The purpose of this activity code is to document and record one unit for interacting with/briefing railroad or contractor employees regarding Federal regulations or issues regarding railroad safety. Count each member of the work group as a subunit. When using this code, the inspector must write a brief description (two sentences or so) in the "Comments" section of the F6180.96 report. **Example 1:** You attend a safety meeting to discuss railroad safety issues (Part 214, Part 218 Subpart F, and etc.). This meeting consisted of one track supervisors and two inspection and repair foremen. Record this activity as one unit under LTT, and three subunits under LTT. **Example 2:** You have active involvement in a job safety briefing with a train crew, group of roadway workers, etc. Your involvement may include FRA regulations regarding personal or operational safety (Parts 214, 218, etc.) Record this activity as one unit under LTT, and record one subunit for each train crew member, work crew member, etc.	New activity code

Activity	Discipline	Definition	Comments
		Example 3: You have active involvement in a discussion with five railroad workers regarding an FRA Safety or Emergency Advisory. Record this activity as one unit and five subunits under LTT. **Note 1:** This activity code does not include an FRA inspector debriefing a railroad representative(s) in connection with an FRA inspection report (F6180.96). **Note 2:** This activity code does not include attending meetings with short line railroad operator, labor organizations, etc., regardless of whether the inspector discussed safety regulations.	
MSB	T	**Bridge Track Inspection** - The purpose of this activity code is to document an inspection of track located on a railroad bridge. Record only one unit per bridge. A unit may only be recorded when specifically inspecting bridge track components such as ties, rail, rail fastenings, joint bars, etc.	
MTH	T	**Main Track–Hi-Rail** - The purpose of this activity code is to document a main track inspection while on board a hi-rail or other on-track vehicle such as a motorcar. **Note 1:** Inspectors will monitor compliance with the **note** to the requirements of 213.233 Track inspections. **Note 2:** Hi-rail vehicles should be operated at a speed 5mph below the maximum speed recommended by the manufacturer for the safe operation of the hi-rail and apparatus during use on the rail, where practicable. Record one unit per mile of track inspected.	
MTW	T	**Main Track–Walking** - The purpose of this activity code is to document a main track inspection while walking. Record one unit per track mile walked. Example:	

Activity	Discipline	Definition	Comments
		if an inspector walked three curves at three different milepost locations each curve having about 528 feet per curve, only one unit should be documented. If the total accumulated footage is less than 5280 feet one unit is to be taken, if more than 5280 feet is inspected take a second unit.	
RII	T	**Rail Integrity Inspection** - The purpose of this activity code is to document an inspection of a non-destructive rail testing operation. Record one unit per operation.	
ROWP	T	**Review Subpart G Right of Way Plan -** The purpose of this activity code is to document the monitoring of a railroads high speed "right of way" plan by an inspector. Record one unit per plan monitored.	
RREC	T	**Review Railroads Rail Inspection Records** - The purpose of this activity code is to document an inspection of the carriers rail inspection records. Record one unit for records associated with one day of inspection by one test car, and one subunit if any supplemental records exist.	
RXM	T	**Rail Crossing–Main Track -** The purpose of this activity code is to document a walking inspection of a at grade rail-to-rail crossing (diamond) located in a main track. Record one unit per rail crossing.	
RXY	T	**Rail Crossing– Yard Track -** The purpose of this activity code is to document a walking inspection of a at-grade rail-to-rail crossing (diamond) located in other than main track. Record one unit per rail crossing.	
TGMS	T	**Inspection From a Track Geometry Measurement Vehicle (Other Than Government Owned)** - The purpose of this activity code is to document an inspector's observations occurring on board an other than government owned geometry measurement vehicle. Record one unit for monitoring and accessing each mile of track tested.	
TOM	T	**Inspect Main Track Turnout** - The purpose of this activity code is to document a walking inspection of a turnout located in a main track. Record one unit per turnout inspected. **Note:** A yard is a system of auxiliary tracks used exclusively for the classification	

Activity	Discipline	Definition	Comments
		of passenger or freight cars according to commodity or destination; assembling of cars for train movement; storage of cars; or repair of equipment. If a track doesn't fit this definition, inspectors must consider it a main track.	
TOY	T	**Inspect Yard Track Turnout** - The purpose of this activity code is to document a walking inspection of a turnout located in other than main track. Record one unit per turnout inspected. **Note:** A yard is a system of auxiliary tracks used exclusively for the classification of passenger or freight cars according to commodity or destination; assembling of cars for train movement; storage of cars; or repair of equipment. If a track doesn't fit this definition, inspectors must consider it a main track.	
TREC	T	**Review Railroad's Track Inspection Records** - The purpose of this activity code is to document an inspection of a carrier's track inspection records. Record one unit per subdivision and one subunit per record reviewed.	
TRM	T	**Inspection From a Train** - The purpose of this activity code is to document an observation or inspection of track/train interaction, right-of-way signage, signals obscured, etc. when on board a train. Under this activity code, § 213 defects are limited to items an inspector can clearly justify in an inspection report, such as vegetation. Record one unit per train and one subunit per track mile.	
VTI	T	**Inspection From a Vehicle/Track Interaction Car** - The purpose of this activity code is to document an observation occurring on board a VTI vehicle. Record one unit for monitoring and accessing each mile of track tested.	
WPI	T	**Inspect Welding Plant Facility** - Document an officially directed visit to a rail welding facility. Claim one unit per facility.	
YTH	T	**Inspect Yard Track–Hi-Rail** - The purpose of this activity code is to document an inspection of other than main track while onboard hi-rail or other on-track vehicle such as a motor car. Record one unit per mile of track hi-railed. Example: if an inspector hi-railed three yard tracks with about 528 feet per track, only one unit is to be documented. If the total accumulated footage is less than 5280 feet one unit is to be taken, if more than 5280 feet is inspected take a second unit.	

Activity	Discipline	Definition	Comments
		Note: Yard means a system of tracks, not including main tracks and sidings, used for classifying cars, making-up and inspecting trains, or storing cars and equipment. If a track doesn't fit this definition, inspectors must consider it a main track.	
YTW	T	**Inspect Yard Track–Walking** - The purpose of this activity code is to document an inspection of other than main while walking. Record one unit per mile of track walked. Example: if an inspector walked three yard tracks with about 528 feet per track, only one unit is to be documented. If the total accumulated footage is less than 5280 feet one unit is to be taken, if more than 5280 feet is inspected take a second unit. **Note:** Yard means a system of tracks, not including main tracks and sidings, used for classifying cars, making-up and inspecting trains, or storing cars and equipment. If a track doesn't fit this definition, inspectors must consider it a main track.	

Appendix B - Source Codes

Inspectors are advised to reference General Manual, Chapter 3, for a list of source codes.

Appendix C - Instructions, F6180.96 Track Inspection

F6180.96 Field	Format	Instructions/Special Features
Inspector's ID Number	Numeric	The RISPC automatically places the inspector's ID number in this field. An inspector using a hand-printed report must show the assigned five-digit identification number. This field is mandatory because RISPC rejects a report without the inspector's ID number.
Report Number	Numeric	A report number assigned to each inspection activity. Inspectors must number their reports consecutively beginning with number one (1) on the first inspection day of each calendar year. Care must be taken so that subsequent numbers are correct and not duplicated. This field is automatic with RISPC and will generate a mandatory report number, or you can enter a report number up to a maximum of 999. A maximum of three digits in each number is allowed.
Date (of an Inspection Activity)	Date	Inspectors must show the correct inspection date and enter the occurrence of the inspection activity. The field is mandatory and automatically entered by RISPC. Indicate by a two-digit number each the year, month, and day of the inspection. For example, enter June 19, 2001, as 06/19/01. Inspectors can make an entry postdated, but they cannot predate inspection reports.
Violations Recommended	Check Box (Y/N)	If a track inspector recommends a civil penalty (violation) against a track owner or other responsible party, a narrative report is generated (F6180.111) by RISPC. The narrative numbering sequence begins with the first report submitted by an FRA inspector and continues sequentially throughout their career without regard to the annual inspection numbering. The F6180.96 form that accompanies an inspector's violation report must have one or more line items with the "yes" field (recommended as violations to Chief Counsel). Where a variety of defects are discovered during an inspection (e.g., some of which meet the criteria to support a recommendation for civil penalty), two separate reports must be prepared: 1) a report listing defects only and 2) a report listing items recommended for civil penalty only. See instructions under "Violation Report Narrative - FRA F6180.111."
Railroad/Company Name and Address	Drop-down List/Text	Enter the name of the railroad/company responsible and the subject of the inspection. RISPC users default to the R/C field first, then enter in the RR/CO. code. This field generates a name and address based upon the railroad code input. In RISPC, click on the "table lookups" button to search for and select a code. Click the scroll bar arrows or drag the field in the scroll bar to look through the entries. You may also search through the entries, and enter division and subdivision.

F6180.96 Field	Format	Instructions/Special Features
R/C	Drop-down (R/C)	Enter either the code "R" if the report is for an inspection of a railroad defined in the general railroad system of transportation or a "C" for a company (facility) not a part of the general railroad system of transportation. This field is mandatory and is necessary for the proper classification of reports. Source code V should be associated with this type of activity (e.g., inspection conducted in a welding plant [Activity Code WPI] or rail plant [RMI] facility).
RR/CO. Code	Drop-down List/Text	Enter the code assigned by FRA for the railroad/company. This field is mandatory. If the required information is missing or invalid, RISPC will flag the report as incomplete pending inspectors' verification and correction. Indicate the name of the railroad responsible for the maintenance of the track, for which the report is prepared, and the correct alphabetical code for that railroad in the space provided on the form. In addition to the RISPC listing, the source of this code is published in Appendix A of the FRA Guide for Preparing Accident/Incident Reports, without periods, hyphens, or other additions (maximum of four characters).
Division	Text	RISPC allows division codes—an elective for regional inspector purposes. Division is the alphabetic code representing an operating division (or region–district) of a railroad. For railroads not divided into operating divisions show as "System."
Subdivision	Drop-down List/Text	Railroads can be organized into subdivisions (sometimes called branch lines, or other names), identified in timetables or other railroad special instructions. Using the RISPC drop-down list, enter the name of the subdivision at the location the inspections were made. If the RISPC system does not contain the subdivision name, use "system." In such a case, inform the regional track specialist to have the name added into RISPC. This field is mandatory.
RR/CO. Representative (Receipt Acknowledged)	Text	Print the name and title of the railroad official contacted or accompanied. Obtain a signature, acknowledging receipt by an accompanied railroad official and initialed on the continuation sheets, to signify receipt of their copy. RISPC allows you to input data, search, and recover representative record information. If an unaccompanied inspection becomes necessary, show the word "unaccompanied" in this field. If, on the day of inspection, the inspection report cannot be personally delivered, those defects and their locations must be given by phone at the end of the day to a responsible railroad official. Note the time, date, name and title of the person who receives this defect information on the track inspection report form. Mail the railroad's copy to the appropriate railroad official. When using the RISPC program rather than generating a printed copy, it is acceptable to e-mail a PDF copy to the railroad representative. A return email from the railroad representative is an acceptable alternative to a signature of receipt. This is only acceptable for F6180.96 reports that do not contain line items recommended for civil penalty.

F6180.96 Field	Format	Instructions/Special Features
From City/State/County	Drop-down List/Numeric	RISPC allows users to open State codes from a drop-down menu. Identify the city, State, and county name, as applicable, where the inspection activity began. In addition to an imbedded lookup in the RISPC program, all appropriate codes regarding the city, State, and county names are in the GSA Worldwide Geographic Location Guide books. Leave this field blank whenever an inspection did not take place in the boundaries of a city, town, etc. However, list State and county code identifiers, as they are mandatory. Precede county codes with the letter "C" to ensure that a listed city it is within the geographic boundaries of the county identified. If conducting an inspection between two points, enter in the appropriate field the name and code of the county the inspection began. Also, see "Special Instructions - Inspections From/to State Lines" above. This is a mandatory field.
Destination City and County	Drop-down List/Numeric	Complete this field if the inspection activity involves a destination other than a location identified in the "From City/State/County" field. It is not necessary to complete this field when inspections are contained within a single location, but follow instructions for "From City/State/County." Enter, in the field, the State and city codes of the inspection point as shown in the GSA. If the inspection point is not near a city, substitute the county name and code from the RISPC table lookup menu. When using the county code, the letter "C" will precede a three-digit number (e.g., C021 or C131 for counties, respectively). Do not record an inspection extending into more than one State on the same form. Use a separate report form to record an inspection for each State. In order to more fully describe inspected track that is limited by borders, a system has been devised to indicate that the inspection actually extended to a State line rather than having terminated at some point within the boundary county, as would be the case using simply a county code.
Milepost: From & To	Text	When conducting a track inspection or performing another inspection activity, i.e., all ATIP surveys, and train riding, it is mandatory to show a starting milepost identifier in this field. Record, in the "To" field, the milepost of the farthest point your inspection extended over the segment of track inspected. Record the numeric portion of the milepost in an NNNN.NN format. The computer can accommodate a maximum of 10 characters, but only two to the right of the decimal point. For example, 1234.56 and 12.15 are acceptable identifiers of a milepost location (maximum 10 characters). If the railroad uses an alphabetic identifier in conjunction with a milepost number, they should precede the numeric value and not exceed three characters in length. Acceptable

F6180.96 Field	Format	Instructions/Special Features
		field entries include SL12.25, R218.5, YL12.50, ABB146.55, and X12.45. If a portion of track cannot be inspected between “From” and “To” fields, then tracks inspected should also be indicated in the “Inspection Point” field or if necessary a separate line item “comment.” For example: If inspecting from milepost BF1 to BF22 and BF7 to BF9 was inaccessible, enter BF1 to BF7 and BF9 to BF22 in the “Inspection Point” field and only claim miles actually inspected. Capture only one set of milepost ranges on the database.
Inspection Point	Text	As an elective, enter the name of the site, branch or the milepost location limits of the track inspected (e.g., a repair facility, train yard, interlocking plant, single or double main track). The field has a maximum of 50 characters.
Activity Codes (1)	Drop-down List/Text	Pick activity code(s) from the RISPC lookup table. See Appendix A–Activity Codes.
Units	Drop-down List/Numeric	Each mile of track, turnout, record, crossing at-grade, and derail, as inspected, should be counted as a unit. The number of track miles inspected is limited to 125, per report. The number of railroad track records inspected is limited to 650, per report. For additional instructions concerning units see Appendix A–Activity Codes.
Source Code	Drop-down List/Text	Enter one of the available letter codes to identify the source of (why or purpose for) the inspection. Only one letter may appear on the inspection report. If the required information is missing or invalid, the report will be “incomplete,” pending inspectors’ verification and correction. See Appendix B–Source Codes.
File Number	Text	A file number is required for ATIP activities (source codes I & J), complaint investigations with assigned numbers (source code B) and waiver investigations (source code E). For an inspection without a file number or it is not a reinspection, leave this space blank. When conducting a reinspection, inspectors are to type in their ID and report numbers of the previous inspection.
Accompanied Inspectors	Numeric	Use this field when conducting a joint inspection (two or more track inspectors). Complete one F6180.96 inspection report. Insert the accompanying inspector ID number.
Item	Numeric	A track inspection is limited to not more than 999 line items (maximum three digits). Note: the following fields repeat for each line item.
Initials/Milepost	Text	Indicate the location of the defect to the nearest one hundredth of a mile (52.8-feet). In this field it is necessary to use the same milepost criteria as described in the “Milepost: From & To” field as shown above.
Equipment/Track #	Text	Indicate the track number where the defect exists. For a track with a name (no number), enter an abbreviation (maximum three digits or characters).

F6180.96 Field	Format	Instructions/Special Features
Type/Kind	Drop-down List/Text	Enter the appropriate type code listed at the bottom of the form (maximum one digit). "M"–defects located on controlled and non-controlled main tracks. However defects in turnouts, see "T" and "X" below. Use care in distinguishing the type of track distinctions among main and other than main trackage identified in § 213.233(c). "S"–defects located on controlled and non-controlled sidings identified in timetables or other pertinent information conveyed to allow opposing trains to pass (but, not where defects are located in the turnout). "Y"–defects located within yard classification tracks or other tracks designated to store or make-up trains. For tracks such as industrial spurs and auxiliary tracks designated other than main tracks use "I." "I"–defects located on industrial track (i.e., grain elevator tracks, spur and back tracks owned and maintained by the railroad). "T"–defects located within a turnout area, whether on the straight side or the turnout side. The turnout area extends from the point of a switch to the heel of the frog. "X"–defects located on a track that is between the two turnouts (heel of the frog to heel of the frog) of a crossover, independent of track centerline distance.
49 CFR/USC	Drop-down List/Text	Refers to the CFR parts pertaining to the TSS, under Part 213; Roadway Workplace Safety, under Part 214; etc.
Defect (Rule)	Drop-down List/Numeric	Refers to the defect codes explained and listed in Chapter 5 of this manual. The defect code or "Rule" refers specifically to the digits to the left of the decimal point.
Subrule (Defect Code)	Drop-down List/Text	Subrule refers specifically to the digits to the right of the decimal point. Some defect codes have fewer than six digits, therefore use zeros as fillers. For example, defect code 7.1 would be recorded as 0007 (Defect) and 01 (Subrule).
Speed	Text	Speed, in miles per hour, is for the track as authorized by the railroad. If freight and passenger speeds differ, show only the speed that establishes the highest track class under § 213.9(a). Do not attempt to show more than one speed.
Class	Numeric	Class of track for the speed designated is under the speed field above and in accordance with §§ 213.9(a) and 213.307(a) of the regulations that prescribe the maximum allowable operating speed for each track class. If the railroad has designated the track as excepted, insert "X."
Train #/Site	Text	This is an option to capture additional descriptions of defect locations.
SNFR	Dropdown (Y/N)	Use when issuing a Special Notice for Repairs (SNFR), FRA F6180.8.
RCL	Drop-down (Y/N)	This field will indicate whether the line item relates to remote control locomotives.

F6180.96 Field	Format	Instructions/Special Features
# of Occ. (Occurrences)	Numeric	**Special instructions.** Inspectors can record multiple defects of the same type in this field as long as the number of times the defects occur is on a specific unit of inspection. Defects captured in this field will be the number entered. For no entry, use a single defect count of one (1). Normally, inspectors look for noncompliance in a 528-ft (tenth of a mile) segment of track. Some subpart defects are divided into smaller areas (i.e., alinement 31, 62, 124 ft; crossties in 39 ft and curve limitations in a 155-ft segment). Other noncompliance items (i.e., missing track bolts) are recorded by a point-by-point basis and summarized. However, reference all defects to the one-tenth (528 ft) of mile segments. For example, nine recurrent crosstie defects (213.109.01) found in 351 ft. Those nine defects can be captured by completing a single defect item and recording “9" in the “# of Occ.” field, because the 39-ft (9×39=351) track segment (unit of inspection) does not exceed 528 ft. Another example would be if while inspecting a railroad’s track records, and there are 10 instances where the signatures (213.241.03) on the reports are missing. Similarly, show “10" in the “# of Occ.” field. Do not itemize the total number of loose or missing frog bolts because the unit of inspection is the body of the frog in a turnout. Likewise, missing cotter pins are a component of a switch (regardless of the number or location of cotter keys it would be one occurrence). It is often helpful to include a reference to the quantity in the narrative description such as, “5 missing cotter pins” but remember, the “# of Occ.” would be one in this field. Other multiple defective items that constitute one unit in a switch include, rail braces, bolts/nuts, guardrail bolts, and clamps/wedges. Each defective item that constitutes a separate occurrence in a switch includes switch rod, switch heel, switch point, frog, guardrail, switch stand, stock rail, switch clip, and switch stop. With respect to joint bars, a loose joint bar assembly is to be counted as one occurrence, whereas a joint with two broken or cracked joint bars would be two occurrences. Except as indicated below, when recording multiple occurrences such as loose joint bars, the precise location of each pair of loose bars must be included in the description. Each joint bar pair bar identified by location would be an occurrence. If a systemic condition (e.g., loose joint bars) is found over an area in addition to identification of specific identified defects/locations, inspectors may add a comment in the last noted defect and indicate that the above defects are “representative conditions.” In such a case, the specific limits and track number/name of the respective conditions should be noted. An occurrence would only be taken for each item identified. Only record an occurrence for each item specifically identified by location. An acceptable alternative method of identifying each

F6180.96 Field	Format	Instructions/Special Features
		occurrence would be where all items between two specific locations are defective. For example, all the joints between frog of two opposing switches are all loose, then it would be acceptable to indicate "all 10 joints are loose between the frog of switch A and the frog of switch B" (10 occurrences).
Activity Code (for each line item)	Text	Choose a code that matches the activity occurring when observing the defect. Must match one the activities listed in the activity code field in the form header.
Description (type)	Check Box	Choose: 1) Defect, 2) Non-FRA Defect or Observation, or 3) Comments to Railroad/Company. Non-FRA defects include items of concern that are not regulated by FRA, such as rough highway/rail grade crossing surfaces, items that are imminently close to becoming an FRA defect, etc. Observations include information such as noting an inspection with "no defect found."
Description	Text	Provide a description of the defect in this space. It must include actual field dimensions of the defect, when applicable, and a description of physical conditions associated with defects not involving numbers or dimensions. Confine any comments concerning the defect to the description field. If necessary, use more than one line to describe the nature and location of defects. Brevity is desirable, but it is essential that the railroad representative understand the defect and its precise location to take corrective action. Record dimensions or adequate description of the defect to evaluate the appropriateness of the railroads' reported followup action. For example, a joint tie defect is "located 10 joints south of under-grade bridge at milepost 110.19 on the west rail." Field expands from 250 to 1000 characters. See options.
Latitude/Longitude	Numeric	GPS coordinates, where applicable (e.g., ATIP program), may be used in addition to standard location descriptive in description field. General use is anticipated for the future.
Violation Recommended	Drop-Down (Y/N)	This is a required field. This field signifies whether or not a RR/Company is to receive a Federal violation.
Remedial Action	Drop-down (R/O/Blank)	Railroads, under § 213.5(a), must bring the track into compliance when any defective condition is discovered. In addition, railroads must inform FRA in writing of the remedial action taken to abate those track conditions identified as violations whenever the "Y" is selected in the "Violations Recommended" section of the header (as per § 209.405). All line entries must contain an "R"(Required), "O" (Optional) or blank check mark in the "Required" block field. It is optional, not mandatory, to return the report to you when the "N" is selected in the "Violations Recommended" section of the header.
Railroad Action Code & Date	Date/Text	When an inspection report indicates that an inspector recommends a violation, the codes on the reverse side of the form are for the railroad representative to record what remedial action was taken to correct the defect and the date it took place. The railroad should provide a brief

F6180.96 Field	Format	Instructions/Special Features
		description of corrective action according to the list of codes on the reverse side of the Form 96. Enter the comment regarding the corrective action opposite the item number; it does not have to be confined to one line. The railroad must correct the defects immediately and should report the corrective action taken within 30 days following the end of the month the inspection took place. A responsible railroad employee should sign and date the report in the space provided on the back before returning it to the inspector. Remember, the return of this form is mandatory when a violation ("Yes" box checked) is recommended with notations of railroad corrective action, which is strictly voluntary and no violation of law or regulation is incurred for the railroad's refusal to submit forms when defects are cited for correction ("No" box checked). However, railroads should be encouraged to return the form as requested. Two alternatives in the RISPC program exist: print the backside after printing the F6180.96 report or have a supply of copies of the back of the page of the first and continuation sheet available to print reports on.

Appendix D - Instructions, F6180.111 Track Violation

Field #	F9180.111 Field	Editable	Auto in 96	Format	Instructions/Special Features
1	Inspectors Name	No	Yes	Text	Mandatory field.
2	Inspector's Violation Number	Yes	No	Numeric	Inspector to type in the first number–subsequent sequential numbers generated automatically. Mandatory field.
3	Annual F6180.96 No.	No	Yes	Numeric	Mandatory field.
4	Inspection Date	No	Yes	Date	Mandatory field.
5	Violation Date	Yes	Yes	Drop-down Date	RISPC populates this field with the same date as field 4. However, this date-formatted field is editable to allow the inspector to place a date of the violation report if that date is not the same as the inspection. Mandatory field.
6	Violation Report Number	Yes	Yes	Drop-down Date	Same as field No. 5. Mandatory field.
7	RR/Co. Initial	No	Yes	Text	Mandatory field.
8	Railroad/Company Name	Yes	Yes	Text	RISPC populates this field with the full name of the company only, if available, otherwise type in for entities such as a contractor. Mandatory field.
9	Division	No	Yes	Text	Mandatory field.
10	Subdivision	No	Yes	Text	Mandatory field.
11	Inspection Point	No	Yes	Text	Mandatory field.
12	Track Type	No	Yes	Text	Mandatory field.
13	Track Number/Name	No	Yes	Text	Mandatory field.
14	Initials/Milepost	No	Yes	Text	Mandatory field.
15	Speed	No	Yes	Text	Mandatory field.
16	Track Class	No	Yes	Text	Mandatory field.
17	MGT (Million Gross Tons)	Yes	Yes	Text	Optional field (e.g., MGT may not be known at some locations such as a yard track or may be a track inspection record violation).
18	HazMat	Yes	No	Drop-down (Y/N)	Check box. Since an activity might be a record inspection, this is an optional field.

Field #	F9180.111 Field	Editable	Auto in 96	Format	Instructions/Special Features
19	Method of Operation	Yes	No	Drop-down List/Text	Drop down list: Manual Block; Traffic Control System; Automatic Block System (ABS); Yard/Restricted Limits; Automatic Block Signal with Manual Block; Interlocking Rules; and Other Than Main Track. Since an activity might be a record inspection, this is an optional field.
20	Line Item	No	Yes	Numeric	RISPC automatically populates in the F6180.96 line item number. Since an activity might be a record inspection, this is an optional field. Mandatory field.
21	Part No.	No	Yes	Text	RISPC automatically populates in “213.” Mandatory field.
22	Part Title	No	Yes	Text	RISPC automatically populates in “Track Safety Standards.” Mandatory field.
23	Section No.	No	Yes	Text	RISPC automatically populates “defect” No. from the F6180.96. Mandatory field.
24	Section Title	Yes	Yes	Text	RISPC automatically generate the title based on No. 23 above (e.g., 53 = gage, 109 = crossties, etc.). Mandatory field.
25	Paragraph Code	No	Yes	Numeric	RISPC automatically populates from the F6180.96 the subrule field. Mandatory field.
26	# of Occ.	No	Yes	Text	RISPC automatically populates the field from “# of Occ.” from the F6180.96. This is a numeric field allowing three characters. Mandatory field. Note, fields 12 through 26 will repeat as a block group in the F6180.111 for multiple line items on an F6180.96 recommended for civil penalty.
27	Text of Violated Paragraph	Yes	Yes	Text	RISPC populates in the entire subrule paragraph text corresponding to No. 25. If the paragraph includes a table, RIPC will not populate the table. Insert only the applicable table information from the TSS for the defect/tack class of the line item. Mandatory field.
28	Synopsis of Violation	Yes	No	Text	The synopsis is an opening paragraph that briefly describes what the report is about and includes: 1) who, what, where, when, the date of the inspection, 2) who was involved; railroad, contractor, FRA, and others, 3) what regulation was violated, and the actual violated condition (what did you find?), and 4) where found. Mandatory field.

Field #	F9180.111 Field	Editable	Auto in 96	Format	Instructions/Special Features
29	Geographic Condition/Location	Yes	No	Text	The intent of this field is for the reader to get a mental picture of the location and track leading to the violation. Include a statement, such as the accompanying railroad representative supplied all information regarding milepost locations, track names, switch numbers, or any other identifiable information of defect location. GPS identification, if available, would eliminate any conflict for a followup inspection. Conclude by introducing the F6180.96 that recommends violation as exhibit A. Mandatory field.
30	Seriousness/Reasons for Violation	Yes	No	Text	Use this field to establish the reason for recommending civil penalty. Begin with the type of inspection (hi-rail, walking), describe the conditions and introduce photographs of the defective condition, including your measurements as an exhibit. State how much the defective condition exceeds the TSS for class of track. Mandatory field.
31	Prior Constructive Knowledge	Yes	No	Text	Use this field to show how the railroad or company should have known of the defect prior to the FRA inspection. Review previous railroad inspection records for a reasonable time frame prior to your inspection for similar defects or failure to record defects. Consider the number and type of defects found during your inspection. Establish and state the inspection frequency for the track, and state only what is required. The text of the rule does not need to be included. Determine if this condition is something that could happen within a short time frame, or one that develops over time (that previous railroad inspections failed to note). Introduce FRA ATIP geometry data, if applicable, and railroad geometry/internal rail defect data, if applicable. Mandatory field.
32	Other Items Found During Inspection (not recommended for violation)	Yes	No	Text	List other defects in the noted during your inspection that are not recommended for civil penalty. List the defects found in association with your inspection. Enter the additional inspection report as an exhibit.

Field #	F9180.111 Field	Editable	Auto in 96	Format	Instructions/Special Features
33	Background /Special Circumstances	Yes	No	Text	Use this field to include other pertinent information, such as: 1) population of the area, 2) proximity to schools, airports, waterways, etc., 3) provide specific information about hazardous material movement, 4) are hazardous materials transported over this section of railroad? If so, list the type of materials observed, 5) recent compliance, and 6) previous violations. Mandatory field.
34	List of Exhibits	Yes	No	Text	Leave this field blank.
35	Inspector Signature	No	No	n/a	Blank field for signature (no database link).
36	Date Signed	Yes	Yes	Drop-down Date	Mandatory field.
37	FRA Inspector No. 2	Yes	Yes	Numeric	Import name from first ID number of accompanying inspector on F6180.96. Optional field.
38	Name (Railroad/Company Representative)	Yes	Yes	Text	RISPC populates with data from the F6180.96. Optional field.
39	Title (Railroad/Company Representative)	No	Yes	Text	RISPC populates with data from the F6180.96. Optional field.
40	Accompanied FRA During Inspection	Yes	No	Check Box (Yes/No)	Indicate if the railroad representative to whom No. 38 and 39 is referenced was the same person who was present during the inspection. Optional field.

Appendix E - Instructions, F6180.8 Special Notice for Repairs

Field #	F9180.8 Field	Editable	Auto in 96	Format	Instructions/Special Features
1	Name of Inspector	No	Yes	Text	Mandatory field.
2	ID Number	No	Yes	Numeric	Mandatory field.
3	SNFR Report Number	No	No	Numeric	RISPC populates the field based on the number assigned when the program is initially opened. SNFR reports are numbered sequentially for life.
4	Region	Yes	No	Numeric	Drop-down menu containing a predefined table identifying regions 1 through 8, then, click on the region desired to complete this field. Completion of this field is mandatory.
5	Inspection Report Number	No	Yes	Numeric	Mandatory field.
6	Operating Railroad	No	Yes	Text	Mandatory field.
7	RR Initials	No	Yes	Text	Mandatory field.
8	City	No	Yes	Text	Mandatory field.
9	State	No	Yes	Text	Mandatory field.
10	County	No	Yes	Text	Mandatory field.
11	Date	No	Yes	Text	Mandatory field.
12	Time	Yes	No	Time	Enter the time when the segment of track is reduced to a lower track class (eight-character limit). The time entered should be the time the appropriate railroad official notified of this action. Completion of this field is mandatory.
13	Railroad Official Name	Yes	Yes	Text	RISPC populates this field from the F6180.96 Inspection Report (30-character limit). However, make manual entries as necessary. Completion of this field is mandatory.
14	Railroad Official Title	Yes	Yes	Text	Same as No. 13.
15	Railroad Division	No	Yes	Text	Mandatory field.
16	Railroad Subdivision	No	Yes	Text	Mandatory field.
17	Equipment				MP&E use only.
18	Initial & No.				MP&E use only.
19	Track No. (or name)	Yes	No	Text	This field requires manual entry. Enter the appropriate track number or name (three-character limit). Completion of this field is optional.

Field #	F9180.8 Field	Editable	Auto in 96	Format	Instructions/Special Features
20	Track Class	Yes	No	Numeric	This field requires manual entry (one-character limit). Enter the appropriate track class. Completion of this field is optional.
21	MPH Passenger	Yes	No	Numeric	This field requires manual entry (three-character limit). Enter maximum authorized speed for passenger trains. Completion of this field is optional.
22	MPH Freight	Yes	No	Numeric	This field requires manual entry (three-character limit). Enter maximum authorized speed for freight trains. Completion of this field is optional.
23	Reference Measurement	Yes	No	Text	This field requires manual entry (20-character limit). The restricted limits indicated in both, “location from” and “location to” must be referenced to a known fixed point such as a mile post, road crossing, switch point, etc. Completion of this field is optional.
24	Track Description	Yes	No	Text	This field requires manual entry (20-character limit). Enter the name of the track, yard, branch or other designation that identifies the railroad location of the track to which the order applies.
25	Location from City, State, Mile Post	Yes	No	Text	This field requires manual entry (45-character limit). Enter city, State and milepost. Completion of this field is optional but required for Track.
26	Location to City, State, Mile Post:	Yes	No	Text	Same as No. 25.
27	Line Item Number	No	Yes	Text	A variable number of line item entries from the F6180.96 may be populated onto the SNFR, (e.g. 27a, 27b, 27b, etc.).
28	CFR, Rule, & Subrule	Yes	Yes	Text	Since not all defect codes used in RISPC correspond to the actual CFR section, be sure to cite the specific section in the CFR that corresponds to the defect(s) listed (10-character limit).
29	Defects	Yes	No	Text	This field is not populated by the RISPC and inspectors may type in a reference to the F6190.86 and its corresponding line item. Only SNFR items should exist on a corresponding F6180.96 or the line item numbers will not correspond. This field will support cut-and-paste functions from other programs, and there is a 350-character limit. It is acceptable to indicate how the defects repeat over large area. In such a case, include a description of the beginning and end limits of such a representative condition. Field 27, 28, and 29 repeat

Field #	F9180.8 Field	Editable	Auto in 96	Format	Instructions/Special Features
					as a group for multiple line items on an F6180.96 that have the "SNFR*" field checked yes.
30	Movement Restrictions				MP&E use only.
31	Regional Administrator Name and Address			Drop-down List	This field will feature a drop-down menu containing the name and address of the appropriate Regional Administrator. Click on the name desired to complete this field. Completion of this field is mandatory.

Appendix F - Instructions, F6180.8a Special Repair Remedial Action Report

Field #	F9180.8a Field	Editable	Auto in Part I	Format	Instructions/Special Features
1	Name of Inspector	No	Yes	Text	Mandatory field.
2	ID Number	No	Yes	Numeric	Mandatory field.
3	SNFR Report Number	No	No	Numeric	RISPC populates the field based on the number assigned when the program is initially opened. SNFR reports are numbered sequentially for life.
4	Region	Yes	No	Numeric	Drop-down menu containing a predefined table identifying regions 1 through 8. Click on the region desired to complete this field. Completion of this field is mandatory.
5	Inspection Report Number	No	Yes	Numeric	Mandatory field.
6	Operating Railroad	No	Yes	Text	Mandatory field.
7	RR Initials	No	Yes	Text	Mandatory field.
8	City	No	Yes	Text	Mandatory field.
9	State	No	Yes	Text	Mandatory field.
10	County	No	Yes	Text	Mandatory field.
11	Date	No	Yes	Text	Mandatory field.
12	Time	Yes	No	Time	Mandatory field.
13	Railroad Official Name	Yes	Yes	Text	RISPC populates this field from the F6180.96 (30-character limit). However, manual entries may also be made. Completion of this field is mandatory.
13	Locomotive or Freight/Passenger Car Initials and Number				MP&E use only.
14	Track Number Location, Description, Etc.	Yes	No	Text	Enter manually from the information provided by the railroad. Optional field because it may not be required in an MP&E report.

Field #	F9180.8a Field	Editable	Auto in Part I	Format	Instructions/Special Features
15	Location Repaired: City:	Yes	No	Text	Same as No. 14. This is information provided by the railroad on the SRRAP and sent to the Regional Administrator upon completion. The originating inspector will not be able to fill in this, or any of the following fields.
16	State	Yes	No	Numeric	Same as No. 14.
17	Date Repaired	Yes	No	Numeric	Select from a pop-up calendar according to the Remedial Action Date provided by the railroad. This is a mandatory field.
18	Time Repaired	Yes	No	Text	Same as No. 14.
19	Remedial Action Codes	Yes	No	Text	Enter information provided by the railroad. It will allow up to three remedial action codes. Select the codes from the pop-up table of remedial action codes used in RISPC, or the codes may be entered manually. Mandatory field.
20	Line Item No	No	Yes	Text	This will be repeated from the Form F6180.8 for each line item contained there. A variable number of entries may exist.
21	CFR, Rule, & Subrule	Yes	Yes	Text	Same as No. 20.
22	Defects	Yes	No	Text	Same as No. 20
23	Repair Details	Yes	No	Text	Enter information to these fields manually from the information provided by the railroad concerning actions to correct the problems. These data entry blocks appear on the same screens as the line item information for the Form F6180.8. Field 20, 21, and 22 repeat as a group for multiple line items on an F6180.8.

Federal Railroad Administration

Track and Rail and Infrastructure Integrity Compliance Manual

Volume I, Chapter 3
Automated Track Inspection Program (ATIP) Geometry Car Operation

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CHAPTER 3

Track Geometry Inspection Car Operation

Background

This chapter provides functional understanding of the Automated Track Inspection Program (ATIP) in terms of operation, policy, on-track safety requirements, geometry measurement technology, and national deployment of the FRA railbound inspection cars. Under the statutes mandated by Congress, ATIP cars conduct operational surveys of the U.S. rail transportation network for the singular safety function of determining railroad compliance with Federal Track Safety Standards (TSS). Since 1974, the operation of ATIP cars serves an important role in FRA's overall compliance programs. FRA's Office of Railroad Safety manages the program, and logistic support is provided under a contract.

ATIP Track Geometry Inspection Car Operation

All FRA Inspectors assigned to ATIP cars are to ensure applicable compliance with railroad operating rules, special instructions, and specific FRA policy and procedures by everyone on board when ATIP geometry cars are operated.

The seven ATIP cars are identified by Universal Machine Language Equipment Register (UMLER)[1] (listed as private equipment) and publicly recognized with the DOTX prefix on the car body above the truck. They are officially DOTX series 216, 217, 218, 219, 220, 221, and 223. All ATIP cars areoperated in tow mode although DOTX 217, 218, and 219 can be self-propelled. Self-propelled is a limited mode of operation. .

FRA policy defines the self-propelled ATIP cars as specialized maintenance equipment (SME) and they may not reliably shunt track signal circuits. As a result, certain operating restrictions apply. By policy, ATIP cars are not considered locomotives[2] (even though they have cab controls and couplers). Operating as an SME relieves ATIP contractors from maintaining locomotive engineer certification and hours of service regulations and other requirements. As an SME, self-propelled ATIP cars are not subject to Title 49 Code of Federal Regulations (CFR) Part 229, but are amenable and will act in accordance with the safety appliance section and other pertinent sections of the regulations.

ATIP cars operate safely in accordance with all railroad operating rules. ATIP self-propelled geometry car movement has one rule exclusion; following absolute block protection must be maintained and supersedes railroad operating rules or equivalent protection given to a train[3] or on-track equipment. ATIP cars in towmode will follow the railroads operating rules for dispatching and protection.

ATIP cars offer advances such as crashworthiness protection, high-speed trucks, satellite communication, and asset management—including innovations in ride-quality accelerometer measurement and the differential global positioning system (GPS) for precise location of track exceptions. FRA has developed a secure Web site accessible at http://atip.fra.dot.gov to

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[1] UMLER is a registered rail equipment reference, e.g., DOTX 217 is the same as T17, etc.
[2] 49 CFR Part 229, Subpart A – General, § 229.50(k), Definitions
[3] 49 CFR Part 236, Subpart G – Definitions § 236.832, Train

facilitate and improve communications. The site contains survey schedules and operational information.

Modes of Operation

1. **Manned Operation** (Normal Mode)- This is the mode where the FRA Track Inspector is on board the car.
2. **iTrack**- This mode the Track Inspector is on the car for a partial trip or not at all. A exception summary is emailed directly to the Track Inspector for evey 5 miles the Geometry Car travels. See Appendix B for frutehr details about iTrack.
3. **Amtrak Assesment**- This mode is when one of the Geometry cars is coupled into an Amtrak consist. This will produce two types of reports: Non Compliant Exception Report(NCER) and a Track Assesment Report(TAR).
4. **Remote Track Geometry Measurement System(RTGMS)**- This is when there are no personal on the Geometry car and the data is being edited near real time in a remote location. This mode will also create a NCER and TAR.

On-Track and Onboard Safety

ATIP cars are required to operate safely in accordance with railroad rules, Federal regulations, and FRA policy. Safe ATIP inspection surveys are the responsibility of everyone on board. Assigned FRA personnel are responsible for the authority, enforcement, and control of this policy. Inspectors must report any unsafe situation to FRA regional or headquarters managers.

ATIP contractor employees must conduct activities in accordance with the specific instructions conveyed in the *Safety Manual for FRA Survey Cars.* The Federal Track Inspector, in coordination with the Survey Director, will provide a job briefing on general geometry car safety, apparatus, and on-track protective procedures whenever anyone comes on board or leaves the ATIP car and fouls a track. The on-track safety job briefing will discuss, at a minimum, the following:

1. General communication methods and procedures during emergencies.
2. Location of geometry car safety apparatus (i.e., fire extinguishers, first-aid kits, breathing apparatus, and identifying individuals on board who are trained in CPR).
3. Procedures for egress through specific doorways and windows.
4. Applicable physical and operating hazards and procedures when fouling the track.

The FRA Track Inspector is responsible for ensuring that everyone on board the ATIP car is briefed and updated, as safety conditions or events change throughout the day. Before exiting the car and fouling the track occupied by the survey car, on-track safety is established by using the ATIP car's exclusive authority to move on controlled track (train coordination). All train movements are coordinated with the Survey Director.

Whenever the ATIP car stops to evaluate a track condition, conduct instrumentation checks, or carry out repairs, FRA Track inspectors will ensure the following:

1. A railroad Employee-In-Charge (EIC) ensures appropriate on-track safety requirements and a job briefing before fouling the track.

2. FRA Track inspectors, the railroad EIC, and ATIP car personnel are reminded that train coordination, as previously discussed, in coordination with the Survey Director, may afford on-track protection. Before fouling any other track protection such as train approach warning must be used.

If a railroad employee is unavailable to assume the in-charge role, the FRA Track inspector may afford on-track safety in accordance with FRA policy as follows:

1. Two FRA or State inspectors may work together and use train coordination as protection on the track occupied by the survey car and on non-controlled track with one acting as a watchman/lookout for the other, if they know the operating characteristics of the railroad at that inspection point, including train speeds.
2. An FRA or State inspector working alone is authorized to use train coordination on the track occupied by the survey car or individual train detection on non-controlled track. The individual inspector's responsibility is to obtain the information necessary to provide proper on-track safety.

FRA may invite guests on an ATIP car. However, guests are not authorized to occupy the track without the permission and protection afforded by either FRA or the railroad. The term "guests" does not include ATIP contractor personnel who are agents of the Government.

Operations

ATIP crewmembers usually consist of a Survey Director and three others whose responsibilities include safe operation of the car, calibration, and maintenance of the instrumentation, and collection of survey data. ATIP car survey operations generate a track geometry inspection report (TGIR), video charts and imagery (DOTX217 only) in electronic format.

A survey schedule is distributed regionally. FRA Track and OP Specialists review the schedule outline and provide route feedback. Upon regional acceptance, the schedule routes are applied to a monthly calendar format and accessible on the ATIP Web site at http://atip.fra.dot.gov.

As a contract requirement, an Office of Railroad Safety official notification letter and an operations plan are distributed to the respective railroads and applicable regions at least 3 months in advance of the survey. The content of the letter details FRA's authority, operations geography, contact personnel, and other pertinent information. A daily ATIP schedule identifies normal railroad crew change points that estimate travel time that the ATIP car should achieve in a 12-hour day.

Daily Deployment

An active survey contract workday averages 13 hours per day with 1½ hours consisting of pre- and post-survey work. Survey on-duty time should not extend beyond 12 hours. However, it is understood that certain justifiable operating delays might occur from a variety of causes; unforeseen railroad operation, ATIP car equipment failure, or an emergency occurrence. Conditions that explain the reason for excessive delays, beyond 12 hours, require documentation by the contractor, concurrence by the Track inspector, and preapproval by the regional and HQ managers, as necessary. Provable operational delays, which result in going beyond the average daily hours because of subjective decisions to reroute and give priority to other traffic, must be well-documented by the Inspector in charge. If unreasonable delays occur due to differential priority treatment, the railroad may be subject to forfeiture of reimbursable costs and fined under the law or regulations.

Occasionally, the ATIP schedule may be altered to correspond with minor changes effecting daily start and stop times or locations. The distribution and coordination of necessary schedule modifications to the respective railroads and FRA regions, by way of earliest means, is essential. There should be no substantive changes to the final schedule 2 weeks prior to the survey, unless an unforeseen circumstance occurs. Last-minute changes have an undesirable effect, are difficult to make, and affect the overall schedule in other regions and railroads.

ATIP priorities and risk-based route scheduling preference involve primarily:

1. Inspector observations, regarding deteriorating or noncomplying track geometry, associated with structural conditions, e.g., crossties, ballast, etc.
2. A railroad's compliance history, exception repeatability, degradation rate, and track quality.
3. Duration between last inspections (i.e., between 2- and 4-year cycles where tonnage is more or less than 50 million gross tons, respectively).
4. Passenger operation (i.e., Amtrak and applicable commuter/freight territories, such as Southeastern Pennsylvania Transportation Authority, Metropolitan Rail Corporation, Long Island Rail Road, Northeastern Illinois Regional Commuter Rail, etc.
5. Designated hazardous material and Strategic Rail Corridor Network (STRACNET) routes;
6. Railroad operating speeds greater than 20 mph.
7. Other special regional needs or activities (e.g., the 2002 Winter Olympics in Utah).

Regions located in the northern latitude are normally scheduled in late spring through early fall, and those in the southern latitudes can expect the ATIP car through the winter months.

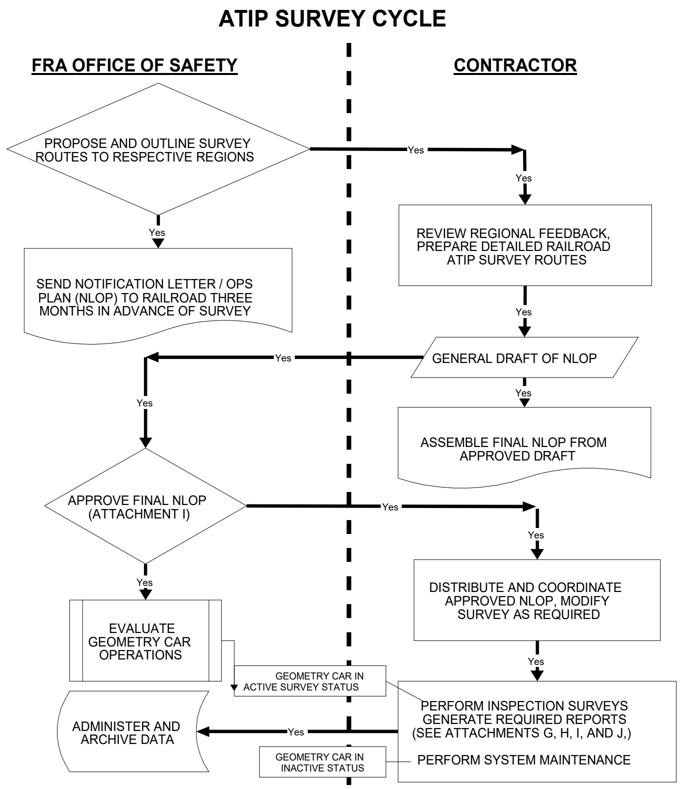


Figure 1

Track Geometry Measurement System (TGMS)

On board ATIP cars, TGMS instrumentation generates automated signals processed online by a computer, which produces a graphical record of detailed track geometry measurements. The measurements recorded are gage, left and right rail alignment and profile, crosslevel, superelevation, warp, harmonic rock, run-off, and limiting speeds. ATIP cars measure and record existing track geometry conditions and compare those measurements to ensure compliance with the 49 CFR Part 213, Subpart C for the lower speeds (Classes 1–5), as well as Subpart G (Classes 6–8) for high speed to determine compliance with:

1. Track gage in inches, measured ⅝ inch below top of rail.[4]
2. Profile (humps and dips) deviation from uniformity of a 31-, 62-, and 124-foot midchord offset (Class 6 and above) in inches.
3. Alignment deviation from uniformity of a 31-, 62-, and 124-foot midchord offset (Class 6 and above) in inches.
4. Crosslevel on tangent track in inches.
5. Crosslevel deviation from uniformity on spirals and curved track in inches.

[4] Excessive vertical and horizontal rail headwear loss or rail section design may produce errors, unless properly adjusted.

6. Curvature.
7. Warp using a variable base length up to 62 feet on tangent, spiral, and curved track, in inches, and a 31-foot section on spiral track;
8. Length of spiral portion of curved track and rate of elevation run-off or run-on.
9. Calculated unbalanced amount in inches.
10. Limiting speed (mph) in curves (based on amount of superelevation and degree of curvature).
11. Harmonic rock, as created by six pairs of low joints, each pair exceeds 1¼ inch.
12. Run-off in 31 feet *.
13. Twist 31 *.

*Denotes exceptions are advisory. Condition can occur if criteria is meet. Further investigation is needed.

TGMS Definitions

Alignment: Alignment is the projection of the track geometry of each rail or the track centerline onto the horizontal plane.

Crosslevel: The difference in elevation between the top surface of the two rails at any point of railroad track.

Curvature: The degree of curvature is defined as the central angle subtended by a chord of 100 feet. Theoretically, it shoul be by an arc of 100 feet. The chord is used for easy measurement in field. Since the degree of track curvature is usually small, there is little difference when using a chord or arc.

***Gage**:* The measurement between the heads of the rails at right angles to the rails in a plane five-eighths of an inch below the top of the rail head.

Profile: (Vertical surface) Profile relates to the elevation along the longitudinal axis, which is an adherence to an established grade and the incidence of dips and humps.

Run-Off: Elevation (ramp) difference of a line along the top of the rail is used for the projection.

Superelevation: A constant elevation of the outside rail over the inner rail maintained on curves, as well as a uniform rate of change on spirals, and measured in the same manner as crosslevel.

Twist: The difference in crosslevel between two points of a fixed distance.

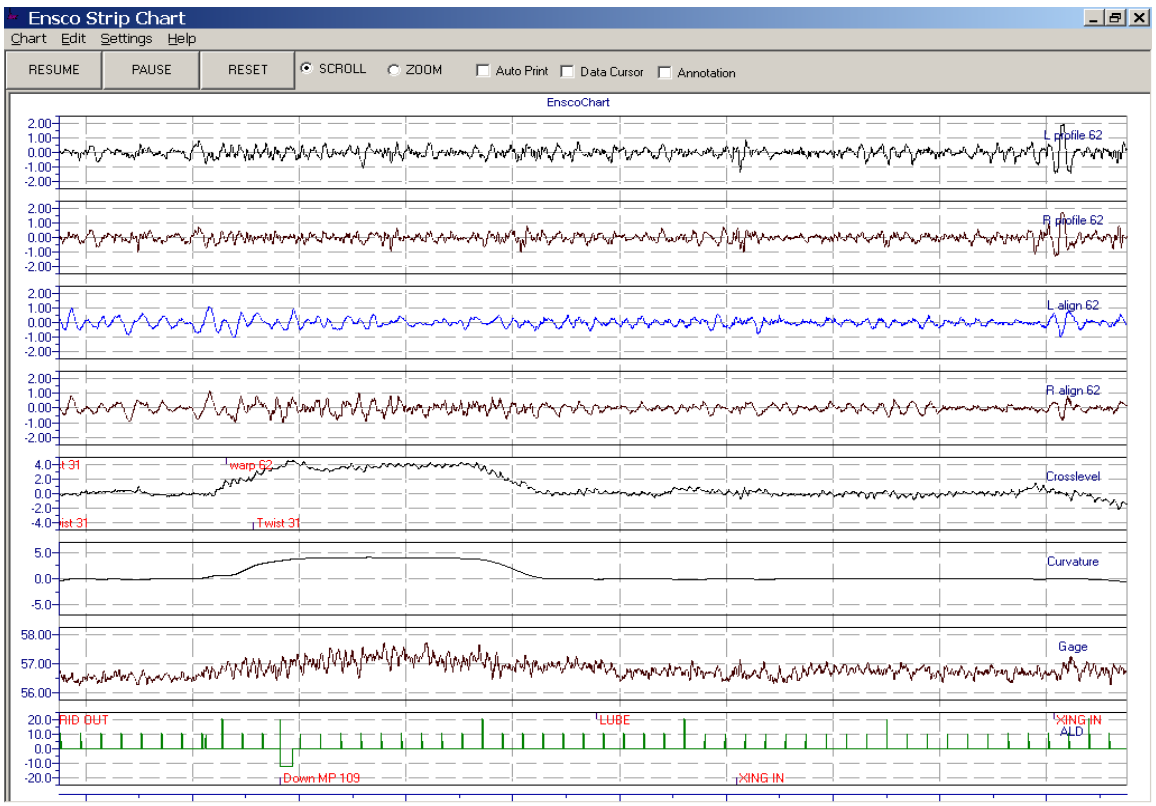
Warp: The difference in crosslevel between any two points within the specified chord length.

Exception Detection

The exception detection process compares the geometry data to the exception thresholds. When an exception is detected, the exception detection process provides the type of exception, the location (start of exception, end of exception, and peak location), and the value of the exception.

Stripchart

The multichannel video stripchart (illustrated in the following figure) continuously displays geometry values, i.e., left and right profile or run-off, left and right alignment, crosslevel or curve superelevation, degree of curvature, gage, and automated track event location detection (ALD) references.



When viewing the stripchart, the ATIP car direction is always from the left-hand margin toward the right-hand margin. Representative lines, drawn on the stripchart, infer statements of track quality. The dash lines represent the upper and lower class limits. The exception trace lines differentiating noncomplying conditions may indicate that operational and/or maintenance remedial action is necessary. Electronic and paper copies of the stripchart defects are provided on demand so that noncompliance with federal regulations receives immediate attention. In an effort to reduce paper consumption, inspectors can view ATIP geometry information electronically using GeoEdit software. The same information is viewable on the Track Data Management System ATIP Web site. The eight channels are selectable in any order in GeoEdit.

The profile channel combines left and right profiles and shows run-off. . The centerline is equal to zero; profile measurements above the centerline indicate a dip and profile measurements below the centerline indicate a hump.

The alignment channel displays left and right alignment. . On tangent track, the centerline is equal to zero; alignment exceptions above the centerline are considered outward from the track center, and measurements below the centerline are considered inward to the track center.

The crosslevel channel indicates crosslevel deviation, warp, rockoff hazard, and superelevation. A line plotting above of the centerline indicates the left rail is the high rail, and plotting to below the centerline indicates the right rail is the high rail.

The curvature channel displays degrees of curvature. Correct selection of curvature (5, 10, or 20 degrees) is dependent upon the physical layout of the track. Curvaure trace lines plotting to below the centerline are left-hand curves, and plotting above the centerline are right-hand curves, as viewed in the direction of travel (such as left to right).

The gage channel displays gage measurements. Nominal gage is 56½ inches. Measurements above and below the nominal gage are read directly as either wide or narrow gage, respectively.

The ALD channel is usually illustrated on the very bottom. Each milepost marking, track number, and current class of track tested is reported and assists in locating track exception. The curvature scaling with the file number (in the year, month, day, and file number format [yymmddxx] is posted on the right border. Location references consist of event message numbers that clearly indicate mileposts and other wayside features such as road crossings, bridges, and trackside detection devices (e.g., hot boxes and clearance devices) are detected and manually entered in the data stream by the contractor. Smaller and larger vertical lines indicate 100- and 1,000-foot track segment division, respectively.

Other features may be marked automatically on the chart when ALD equipment senses their presence magnetically (i.e., turnouts and wayside detection devices). This allows inspectors and host railroad representatives to easily locate exceptions from either the analog or video chart references at the time of occurrence.

Video Stripchart

A video stripchart outline begins with a header that contains the following information:

- Date
- Railroad name, division, subdivision, and line code segment
- Geometry car (i.e., DOTX 219)
- Survey number
- Track class
- Location from
- Location to
- Posted speed
- Milepost start/end
- Track

- Type (single, multiple, double main, etc.)
- Track direction (north, south, east, or west)
- Scan rate
- Video number

The information is arranged as a plot where each of the measurements, with the exception of the wayside features data, forms a continuous line moving to the left or right as the measurement changes. The stripchart is only printed on the car when an exception is found. The stripchart will have 1 mile worth of information on it with the exception being centered on the page. The entire stripchart can be requested and delivered in a PDF format for the entire run.

Track Geometry Inspection Report (TGIR)

The TGIR contains a list of all exceptions identified during a survey. The report header includes:

- Location and name of events, including speed and class of track changes
- Header information
- Exception
- Start location and footage
- End location and footage
- Length of exception
- Differential GPS locations
- Maximum value
- Maximum value location
- Exception limit
- Track
- Maximum train speed
- Posted class (timetable)
- Complying track class (differentiating one-class or more-than-one-class drop)
- Space for date corrected
- All other outputs from additional measuring devices (rail profile and corrugation)

Manual or automatic entry supplemental information is required to properly evaluate and locate track geometry exceptions. Therefore, provisions are incorporated to permit the Data Specialist to enter other exceptions, such as:

- Milepost number

- Track class (FRA TSS 1 through 8)
- Track type (passenger, freight, or both)
- Track number
- Track or wayside features

Class Plus One

Class plus one is a section of the TGIR report that will provide the FRA Inspector and the Railroad with exceptions for the next class up from the posted class by timetable and temporary slow orders.

Number of Channels

At least eight channels can be displayed that may be selected from all stored data from the TGMS or the Ride Quality Measurement System. All appropriate scales for each channel are marked on each chart. At a minimum, the following channels are displayed:

- Left profile
- Left alignment
- Right profile
- Right alignment
- Superelevation
- Curvature
- Gage
- Location
- Car body lateral acceleration (CBL)
- Car body vertical acceleration (CBV)
- Truck frame lateral acceleration (TL)

Standard Operating Procedures (SOP)

Test Speed Classification

ATIP cars always comply with the operational speed requirements. However, FRA policy does not necessarily recognize all “slow orders” in terms of track classification. Railroads place general orders (GO) or track bulletins (TB) for a variety of justifiable reasons, i.e., operational, structural, and geometry, which are substituted for the maximum authorized train speed. Railroads also may elect to reduce train speed to expedite train and ATIP car movement in advance of ATIP surveys by placing a temporary or provisional slow order (TSO), so-called “blanket slow orders,” over long segments of track. Subsequently, geometry data may be reprocessed to the maximum authorized train speed. The geometry car will operate at the temporary speed but testing will be done at the highest class while a blanket slow order is in place. .

For example, a timetable authorizes freight trains to operate at 40 mph, or Class 3 classification. However, a valid and verifiable TB reduces freight speed to 25 mph, a Class 2 classification, because of a crosstie condition. As a result, inspectors will allow ATIP cars to inspect and record exception to the Class 2 safety limits. In another example, on the day of the survey, a railroad issues a slow order reducing train speed from 70 mph (Class 5) to 60 mph (Class 4) for operational reasons, such as anticipating multiple slow orders. This lowered speed will be less disruptive to the dispatcher and actually increase cooperation with ATIP car movement. Inspectors will ensure thatthe lower classification operating speed will be followed but will allow the ATIP car to inspect to the posted higher classification in accordance with the timetable speeds.

Any ATIP exception location and value discovered may only be edited by the inspector (through the Survey Director) from the TGIR because of precision, accuracy, repeatability, and reproducibility (PARR) uncertainty. However, track geometry exceptions are only deleted from the TGIR and not exclusively removed from TGMS storage. Thus, exceptions are always available for subsequent review, analysis, and reprocessing.

The class plus 1 feature on the car will give the raoilroad and instant reprocessed report of the track at one class higher than posted. This feature will replace the need to reprocess the file to the next higher class. It is also a separate section of the TGIR.

Clearance Restrictions

Prior to the survey, FRA inspectors will coordinate with the Survey Director regarding current track numbers, current authorized operating train speeds, and track charts (curvature) input information for the survey. For TGMS to correctly plot the degree of curvature on video or stripchart, FRA inspectors will advise the Survey Director in advance on where curvature varies or differs from those established on a track chart in groups of 5, 10, or 15 degrees.

ATIP geometry cars comply with Association of American Railroads interchange rules, however track curvature greater than 13 degrees presents certain clearance issues and may govern or restrict car operation when towed by a locomotive. Operation of cars on curves greater than 20 degrees is prohibited. Clearance diagrams and restrictions of all ATIP cars are provided on the ATIP Web site (https://www.fra.dot.gov/Page/P0648).

Track Designation

For the purpose of ATIP surveys, the TGIR designates Tracks 1 through 4 as standard notations for double- or multiple-controlled track configuration, unless otherwise numbered by the railroad (alphanumeric [ABCD.1234] format). For example, a track may be designated as YL10.45. A single main track is designated as Track 5. A controlled siding is designated Track 6, and Track 7 notations represent all “other than main” noncontrolled tracks and includes excepted track.

Operational Delays/Surveys Beyond 12 Hours

FRA inspectors are to report excessive delays greater than one-half hour and cumulative delays resulting in time exceeding 12 hours on-duty. For example, on-duty time begins when the ATIP car conducts its brake test. Inspectors will ensure the Survey Director reports recurring or prolonged operational and repair delays, and determine the reason for the delays and/or operating constraints that are placed by the railroad (e.g., dispatching and crew delays or personnel hours of service restrictions). Inspectors are to notify regional and HQ managers if any unusual occurrence significantly affects ATIP daily schedules. The use of the onboard telephones to communicate with railroad officials to expedite movement and advise regional and HQ managers is authorized.

Although normal survey hours are expected to be conducted during daylight, operations may require surveying before sunrise and after sundown. Inspectors should address any safety concerns in a safety briefing. Personnel on board ATIP cars must know their individual limit for physical fatigue beyond 12 hours of on-duty time. Any time an unsafe circumstance exists that does not conform to railroad or ATIP procedures and instructions, the situation will be immediately addressed, resolved, and reported to FRA regional or HQ managers.

Regardless time of the day, the TGMS will always record the track conditions and produce a TGIR, unless TGMS equipment malfunctions, as specified below.

Measurement Equipment Malfunction

In collaboration with the Survey Director, inspectors will monitor the stripchart exceptions and verify that all channels are within scale and reading properly. Inspectors will convey this information to railroad maintenance-of-way representatives, ensuring a complete understanding of the data presented. A single-point failure, or combination, that exhibits questionable value or information of any exception, is justification to stop the survey at that location until it is repaired. A survey will not continue until the conditions are resolved. If repairs cannot be made to the geometry measurement system, ATIP surveys are not to be continued. The track segment affected will be declared as an invalid survey. Track segments identified as invalid will be rescheduled for an ATIP inspection at a later date.

Certain conditions are known to produce small variations in measured track geometry during automated surveys. These differences affect geometry measurement and are mainly caused by:

1. TGMS calibration tolerance.
2. Transition in the applied track load between survey run dates caused by speed, acceleration, or weather conditions.
3. Difference of 1-foot data sample locations.
4. Changes in track position caused by:
    - Prevailing rail traffic.
    - Rail temperature variations.
    - Physical conditions: rail and wheel.
    - Certain types of guardrails.
    - Flangeway obstructions

Under the rail profile system, specific rail sections (headfree rail) and special track work may affect where the ⅝ point on the gage side of the rail is measured automatically. Extreme vertical headwear loss (greater than 40 percent) also presents problems associated with proper measurement. This rail condition may influence the accuracy of the TGMS and is identified on the TGIR. Under International Organization for Standards (ISO) certification, the conditions are minimized and controlled. Significant lengths of this type of rail condition may warrant an adjustment to the gage sensor by the Survey Director, but these adjustments must be authorized by FRA HQ. Where a significant amount of headwear loss is prevalent, FRA inspectors are to advise and discuss the rail condition with the railroad. Headwear loss values can be viewed with the Rail Profile System and on GeoEdit.

Valid and Invalid Surveys

ATIP cars inspect and produce a TGIR of all applicable mainline tracks, controlled sidings, and “other than main track” when scheduled, warranted, or the opportunity is practicable. For example, occupying a main track and directed to occupy a siding to meet another train would present an inspection opportunity on the siding track. Unplanned inspection of main or yard track, including “excepted track” designations is discretionary; however, care must be taken to prevent possible ATIP car damage from a variety of sources. Producing a TGIR is mandatory for a valid survey and will not be produced for invalid surveys or certain track segments thereof.

For ISO quality reasons, ATIP cars record geometry data when moving above a certain speed, except where conditions exist to cause damage or as designated by FRA HQ. Anywhere the ATIP car operates, the TGMS instrumentation on board will record applicable track geometry measurements. An authorized or valid survey operation occurs on condition that the following prerequisites are in place:

1. The railroad is officially notified by FRA in writing.
2. A qualified railroad locomotive engineer or pilot is on board (self-propelled or towed).
3. Authorized track speed is greater than 5 mph.
4. TGMS is online, functional, and can produce a TGIR.

An unauthorized or invalid survey (segment thereof) operation is declared if the following circumstances occur:

1. TGMS failure resulting in instrument inaccuracy.
2. TGMS instrument impairment due to snow, vegetation, high ballast levels or excessive debris, mud, and grease/oil causal factors.
3. The geometry car is “deadheading” in a train, and TGMS is offline.
4. Performing PARR testing, undergoing scheduled or unscheduled maintenance.

Producing a TGIR is mandatory for all valid surveys. A TGIR will not be produced for invalid surveys. When valid TGIRs are produced, they will be provided to the host railroad. Those locations where certain track segments were deemed to be invalid, the inspector will <u>not</u> provide geometry data to the host railroad.

Exception Location

There are two basic methods of locating exceptions using the TGIR:

1. Download or enter GPS data (latitude and longitude) into a handheld GPS device. Follow GPS directions to the exception. GPS exception coordinates are listed in the TGIR. (A gps file is available upon request from the Survey Director to use on other devices)
2. Inspectors may use the stripchart and the TGIR to find the track number and footage beyond a milepost reference to locate exceptions. Use the stripchart information to also reference exceptions to other geographical features (turnouts, grade crossings, curves, etc.).

Sometimes detection problems are encountered for reasons such as erroneous manual entry from the ATIP car, missing mileposts, and “short” miles, which means a mile may not measure exactly 5,280 feet in length. The rule is the exception distance is referenced in the direction of travel regardless of increasing or decreasing mileposts. The TGMS counts the number of feet from the last entered milepost. According to the TGIR, if the mileposts are increasing (e.g., 9, 10, 11, etc.), the footage from a milepost is added and directly read, i.e., an exception located at Milepost 10+1,584 feet would be interpreted as 1,584 feet from Milepost 10 (decimally Milepost 10.30) in the direction of travel.

If the mileposts are decreasing (e.g., 11, 10, 9, etc.), the footage on the report from a milepost is subtracted from the milepost. For example, an exception located at Milepost 10+1,320 feet (specifically between Milepost 10 and Milepost 9), would be interpreted as 1,320 feet from Milepost 10 or located at Milepost 9+3,960 feet (decimally Milepost 9.75) in the opposite direction of travel. Appendix A - Conversion Feet to Decimals of a Mile is available on board and at the end of this chapter to assist inspectors. Dependent upon geometry car speed, a delay reaction time (translating to a distance of up to 400 feet) exists regarding exceptions.

Geometry exceptions, associated with a length (i.e., gage, warp, and harmonic rock), are measured from an exception reference point in the direction of travel. For example, a warp length of 56 feet is located at Milepost 9+3,960 feet, upon computer calculation; the other end to the warp is located at Milepost 9+3,904 feet (56 feet from the exception reference point, but in the opposite direction of travel). Handheld GPS receiver accuracy is usually within 30 feet of the exception location ‘tagged’ with the geometry car GPS coordinates.

Exception Verification

ATIP’s TGMS (instruments, algorithms, and SOPs) are certified by ISO 17025 standards and meets the quality procedures set by those standards for all ATIP cars. As part of ISO A2LA certifications, instrument verifications (IV) are made a minimum of three times per day on days with more than 100 scheduled miles and two times on days scheduled less than 100 miles and stripcharts are continuously monitored to ensure that TGMS is within allowable tolerances. Track gage conditions deemed as unsafe (in excess of 58½ inches) must be field verified. FRA inspectors must stop the ATIP car when encountering an unsafe level condition and verify geometry car measurements. All other on-track verifications will be at the sole discretion of the inspector. ATIP also conducts specialized random quality assurance field validations.

Railroads may question the accuracy of a reported exception. In those cases, the FRA inspector may stop the car and substantiate the exception by conducting additional instrument verifications and/or direct track measurements, as long as the activity is supervised under proper on-track safety procedures. If track structure, geometry, and operating circumstances warrant, inspectors may assess and consider a violation citation, in accordance with Volume I, Chapter 4.

ATIP satisfies 49 CFR § 213. 13 requirements to measure track under load. ATIP cars normally apply a lateral and vertical dynamic load and correspondingly, TGMS calculates the geometry compliance. Speed and impact factors determine the level of rail movement under load. Measurement under load (dynamic) must always be considered—the only exceptions are narrow gage, and guard face and check gages. Car wheels forcing a narrow gage or guard check and face gage condition outward are not measurement-appropriate under load (49 CFR § 213. 13).

It is important for the inspector to verify (reinspect) geometry measurements following an ATIP survey (see Source Code J). Inspectors should be confident geometry measurements are correct and accurate, and they should be ready to disprove any contentions that the measurements aren't accurate. Also keep in mind that static measurements will almost never exactly equal that of a dynamic (100-ton car) measurement.

Exception Remediation

Providing the ISO quality standards are met, inspectors will recognize exceptions discovered by ATIP cars as abiding to FRA's constructive knowledge standard in accordance with 49 CFR § 213. 5A responsibility and FRA policy. It is the railroad's responsibility to decide the remedial action when notice is given (ATIP survey), stating that their track does not comply with the safety standard requirements. Proper exception remedial action must be taken at the time of discovery by railroad representatives. Inspectors may not impose remedial action en route, except when stopping and verifying validity or in response to railroad remedial action. Inspectors shouldconsider citing violations when conducting an on-the-ground reinspection of an unsafe track condition (see Source Code J).

After an ATIP survey, reinspections determine if appropriate remedial actions have been taken and are at the sole discretion of the inspector. Proper source codes for this are located in this section under "Reports." Prior knowledge is met when the railroad is given a TGIR and enforcement action should be considered when remedial action has not been taken.

Reverse Movement

To accomplish on-the-ground track exception verifications or for other purposes, ATIP car movement in the reverse direction will be conducted in accordance with railroad operating rules. Conductorswill position themselves to oversee the reverse movement and communicate with the Engineer in accordance with railroad operating rules. Reverse movements are limited by:

1. Operations through an interlocking.
2. Operations over multiple highway-rail grade crossings.
3. Operations of a significant distance (usually 2 miles or more).

Speed Limitation on Curves

The V_{max} formula considers the average variable of actual elevation and curvature, and the amount of unbalanced elevation or cant deficiency in determining the maximum curving speed allowed. Curving forces become more critical if variations in track, equipment characteristics, or improper train handling conditions have not been abated. For guidance on speed limitation on curves, see 213.57 in Volume II Chapter 1 of this manual.

Geometry Car Security

Track inspectors are responsible for proper security of the ATIP car and must use good judgment and discretion in the application and placement of protective devices and train control signs (e.g., red or blue flags), as circumstances warrant. To prevent undesired access when the geometry car is unoccupied, FRA inspectors will ensure contractor personnel always provide protective measures. FRA inspectors will notify both regional and HQ staff if conditions exist that do not allow protective devices to be applied.

Highway-Rail Grade Crossings

All ATIP geometry cars are operated in a towed manner with a lead locomotive. If a geometry car is operated self-propelled, all occupants in the controlling compartment of the geometry car are responsible for ensuring the way is clear when approaching highway-rail grade crossings equipped with either passive or automatic warning signal system devices as detailed below:

1. The rate of deceleration on self-propelled geometry cars must be controlled to speeds deemed appropriate, based on the local conditions (e.g., gradient, visibility, individual rail surface stopping conditions) and approach a highway-rail grade crossing at reduced speed, be prepared to stop, if necessary, until it is known that automatic warning devices actuate.
2. If signal system failures disrupt the proper function of the warning devices, the occupants must be able to respond immediately.
3. The railroad representative reports warning system malfunctions to the dispatcher according to 49 CFR Part 234.
4. Take precautions not to interfere with the normal function of the automatic warning signal system devices. The exception to this is on condition that proper flag protection against highway vehicles is provided by railroad or contractor personnel when automatic warning devices fail to fully activate or when the host railroad's rules require an exception, Part VI of the FRA Manual on Uniform Traffic Control Devices provisions, or FRA regulations.

Reports

Document and Data Control

To ensure ATIP reports are delivered to those persons FRA authorizes, the Survey Director only delivers the TGIR reports to FRA Track inspectors. It is the responsibility of the FRA Track Inspector to authorize distribution of a sufficient quantity of reports (paper or electronic) to the railroad representative on board. Additionally, the Survey Director enters into the survey log the name, contact information, and the number of reports the railroad representative receives. The survey log is retained and kept on file with the daily survey documentation. If a FRA inspector is not on board, the Survey Director will provide a report to the accompanying railroad representative.

FRA Track Inspection Report

Inspectors are to prepare an FRA Track Inspection Report (Form F6180.96) for each ATIP survey, with appropriate source codes and the survey number. See Volume I, Chapter 2 of this manual for instructions on preparing Form F6180.96. Inspection surveys may involve multiple reports on a given day. Inspectors may complete multiple .96 report forms and assign among themselves different railroads surveyed during the day and reinspection activities. To avoid duplication and distorting the FRA database, only one .96 report form will be completed for each survey segment or railroad, even though more than one Inspector may be on board.

Source Code

I ATIP ACTIVE AND INACTIVE SURVEYS

Use Source Code I, with the reporting marks of the railroad, followed by an Office of Railroad Safety-assigned ATIP survey file number, e.g., XXXX_0123. Source code I will be used when inspecting track in conjunction with ATIP active surveys. The report header on the .96 report form is to be filled out during this inspection activity, and exceptions listed by the geometry car are to be appended and recorded on the .96 report form line items. Enter all units of inspection in the activity code box. Ensure that the survey miles accurately correspond (verified by the Survey Director) with the daily number of miles operated by the geometry car. When conducting an inactive survey, use Source Code I, but list only the mileage operated by the geometry car.

J ATIP FOLLOWUP REINSPECTION

Use the ATIP number corresponding to the original survey files number (e.g., alpha-numeric XXXX_0123) assigned by the Office of Railroad Safety. Followup inspections should be conducted within 30 days. Also, if the ATIP car is stopped for verification during an active survey and noncompliance conditions are cited, the Inspector must initiate a Source Code J report separate from the Source Code I report mentioned above.

When conducting ATIP followup inspections (Source Code J), if track exceptions— other than those reported by the geometry car—are discovered, another .96 report form with the appropriate source code must be completed. Do not combine ATIP exceptions with other exceptions on one 96 report form.

N ATIP INSPECTION OF THE STRATEGIC RAIL CORRIDOR NETWORK (STRACNET)

STRACNET is a network of military routes important to national defense. Paper and electronic State maps are available to help identify these important routes.

Appendix A: Conversion Feet to Decimals of a Mile

Milepost Increasing up in feet	Decimal Mile	Fractional Mile	Poles	Fractional Mile	Down Feet	Milepost Decreasing Decimal Mile
0	0.000	0	0	1	0	0.000
132	0.025		1		-132	0.975
264	0.050		2		-264	0.950
396	0.075		3		-396	0.925
528	0.100		4		-528	0.900
660	0.125	⅛	5	⅞	-660	0.875
792	0.150		6		-792	0.850
924	0.175		7		-924	0.825
1056	0.200		8		-1056	0.800
1188	0.225		9		-1188	0.775
1320	0.250	¼	10	¾	-1320	0.750
1452	0.275		11		-1452	0.725
1584	0.300		12		-1584	0.700
1716	0.325		13		-1716	0.675
1848	0.350		14		-1848	0.650
1980	0.375	⅜	15	⅝	-1980	0.625
2112	0.400		16		-2112	0.600
2244	0.425		17		-2244	0.575
2376	0.450		18		-2376	0.550
2508	0.475		19		-2508	0.525
2640	0.500	½	20	½	-2640	0.500
2772	0.525		21		-2772	0.475
2904	0.550		22		-2904	0.450
3036	0.575		23		-3036	0.425
3168	0.600		24		-3168	0.400
3300	0.625	⅝	25	⅜	-3300	0.375
3432	0.650		26		-3432	0.350
3564	0.675		27		-3564	0.325
3696	0.700		28		-3696	0.300
3828	0.725		29		-3828	0.275
3960	0.750	¾	30	¼	-3960	0.250
4092	0.775		31		-4092	0.225

Milepost Increasing up in feet	Decimal Mile	Fractional Mile	Poles	Fractional Mile	Down Feet	Milepost Decreasing Decimal Mile
4224	0.800		32		-4224	0.200
4356	0.825		33		-4356	0.175
4488	0.850		34		-4488	0.150
4620	0.875	⅞	35	⅛	-4620	0.125
4752	0.900		36		-4752	0.100
4884	0.925		37		-4884	0.075
5016	0.950		38		-5016	0.050
5148	0.975		39		-5148	0.025
5280	1.000	1	40	0	-5280	0.000

Legend for Railroad Delays	
PS	Passenger Stop (Boarding or Detraining Personnel
RB	Red Block (Priority Dispatching other Trains in CTC Territory: Signal Malfunction)
MD	Mandatory Directives Dispatching Territory (TWC, DTC, Form D, Traffic, etc.)
P1...Px	(Unqualified, Unassigned Crew Call or Late Reporting, etc.)
TS Ev	Track Structure (Unsafe Geometry, Special Trackwork; Clearance; Excessive Vegetation, Ballast, etc., or Obstruction)
GX	Grade Crossing, Signal, or other Shunting Failures
Legend for ENSCO Delays	
G1	Primary Gage System
G2	Secondary Gage System
C1	LVDT
C2	RVDT
C3	CAS Package
P1	Profile Accelerometer Left
P2	Profile Accelerometer Right
RQ1	Ride Quality Car Body Vertical
RQ2	Ride Quality Car Body Lateral
RQ3	Ride Quality Truck Lateral
PT	Paint
CN	Computer or Printer Network
P (E,F,R)	Onboard Personnel Induce (ENSCO, FRA, or Non-Operating Railroad)
T	Tachometer Failure
E1	Engine One Generated Failure
E2	Engine Two Generated Failure
Environmental Delay Legend	
W	Weather-Related: (Any Material {Water Over Top of Rail, Blowing Snow, Leaves, Etc.}

Appendix B: iTrack Procedures for the Region

iTrack Operating Procedures

iTrack is the utilization of new technologies developed by the ATIP team to better allow the regions to manage their man power in regards to geometry car operations. The region may opt for either managing their territories in the traditional manner of performing inspections from the Geometry Cars or deploying a number of methods to follow the progress of the car through their territory while not being onboard. This technology allows for the inspector to receive exceptions in a real time manner by providing them with the exception, location, GPS, and a link to Google maps to show surrounding terrain.

To initiate iTrack, the Region would notify ATIP of its decision to utilize the iTrack operation and not have an inspector accompany the ATIP survey. Notification should be 90 days before the scheduled survey, or as soon as possible.

ATIP Program will modify the standard notification letter to senior railroad engineering officials that:

- FRA inspectors may or may not be present on the ATIP during the identified survey,
- FRA will notify the local railroad personnel when FRA inspectors will not be present,
- Railroad personnel are encouraged to accompany the ATIP during the survey even without FRA presence on board
- ATIP cars during the survey will not stop to verify any geometry locations when there is no FRA inspector present

Regional involvement is still required & crucial as in a normal survey, including

- Designating a regional point of contact for each day of operation
- POC will notify the local railroad personnel the day of the survey that:
    - a FRA inspector will not be accompanying the car that day,
    - ensure the railroad knows about the procedures,
    - and to let them know that the Survey Director will be in charge of the car's movement.
- Responsible for ensuring the railroad locomotive and crew are in place for each day's survey
- Ensure that the tie up point at the end of the survey day is identified and appropriate.

Survey will be conducted and data distributed as follows:

- Identify and enter email addresses recipients entered into the email list onboard the Geometry Car
- All geometry exceptions will be immediately noted and sent by email list. No Advisory exceptions will be sent by this method.
- Survey will not be stopped to verify any geometry locations

- A TGIR will be prepared, printed, and presented to the railroad person accompanying the car at the conclusion of the survey by the Survey Director.
- A TGIR will be prepared and electronically sent following the current ATIP procedures.

Federal Railroad Administration

Track and Rail and Infrastructure Integrity Compliance Manual

Volume I General

Chapter 4 Exceptions to the Standards

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CHAPTER 4 Exceptions to the Standards

Introduction

Title 49 Code of Federal Regulations (CFR) Part 213 Track Safety Standards (TSS), contains the minimum requirements for safe track and roadbed. Railroads must comply with many separate requirements contained in the TSS. If a railroad deviates from these requirements and train operations continue without appropriate remedial action, consider enforcement action.

Each situation contains a multitude of factors. As such, each inspector must exercise professional judgment, guided by the enforcement discretion criteria set forth in 49 CFR Part 209, Appendix A (Statement of Agency Policy Concerning Enforcement of the Federal Railroad Safety Laws), when deciding whether to recommend legal action for noncompliance with the TSS. Among those criteria are “the inherent seriousness of the condition or action,” the “kind and degree of potential safety hazard the condition or action poses in light of the immediate factual situation,” “the general level of current compliance,” and the “recent history of compliance.” This chapter will assist the inspector in making enforcement determinations by providing guidelines for assessing the seriousness of any defect in the specific context of the TSS and the conditions observed during a particular inspection. This promotes FRA’s policy of focused enforcement (i.e., the use of FRA’s limited enforcement resources to attack the most serious and persistent compliance problems).

FRA’s primary purpose is to carry out the intent of Congress as stated in the Federal Railroad Safety Act of 1970: “to promote safety in every area of railroad operations and reduce railroad-related accidents and incidents.” Improved safety performance, achieved by adherence to prescribed standards, accomplishes this objective. Therefore, obtaining compliance with the TSS satisfies the purpose of the act. It may be necessary to improve compliance to reduce the risk of accidents in a particular situation; this should be a primary factor in determining enforcement action, such as the imposition of civil penalties.

An inspector can initiate enforcement action of various types (used individually or in combination). The enforcement tools available (in order of increasing severity) are:

1. Defect report (F6180.96).
2. Violation report recommending a civil penalty (F6180.111).
3. Special Notice for Repairs (slow order).
4. Compliance order recommendation.
5. Notice of track conditions (emergency order).

Each inspector should remember that the purpose of the safety laws, the TSS, and enforcement activity is to reduce train accidents, casualties, and property damage resulting from defective conditions in tracks and roadbed. Whereas adherence to each requirement of the TSS will help lessen the risk of track-caused accidents, the inspector must be able to distinguish the varying levels of safety risk presented by violations of different standards. Each condition identified in the TSS has a different effect on the performance of the track structure and, accordingly, different conditions have widely varying effects on the immediate hazard to train operations. For example, in most cases, a broken rail presents a greater immediate hazard to trains than vegetation adjacent to the roadbed.

When determining which of the five enforcement actions to pursue, an inspector must consider the risk of an accident presented by the defect itself. In addition, the inspector must consider the possible consequences of an accident caused by the condition, if the railroad representative knew the defective condition existed, previous track-caused accident performance on the particular rail line, and the railroad's track standards compliance program. Train speed at the particular location, type of traffic handled on the line (hazardous materials, passengers), population proximity, and terrain all can influence the consequences of an accident.

Defect Reports

All enforcement activity begins with an inspection, during which the inspector will record all defects on an F6180.96. (See Chapter 2 of this manual for instructions.) Defect reporting constitutes the most frequently used enforcement action and may lay the groundwork for more severe enforcement action, if necessary. Exercise care to conduct a thorough inspection, recording the location, type, and size of each defect discovered. Whereas defect reporting is usually sufficient to bring about compliance, the inspector must remember that every defect report may become part of a violation report if defects remain. It is imperative that these reports are legible, accurate, and complete. The description and location of each defect should be concise enough that persons not present during the inspection could locate the defects. Sound performance during inspections and reporting ensures sound legal action in the future, if needed.

Violation Reports

In the 1970s and 1980s, the railroad industry experienced a significant reduction in track-caused accidents. In recent years, the trend has leveled off, but the number of rail and rail joint-type track-caused accidents is increasing. Therefore, it is important that inspectors use all the enforcement tools, including the track violation, to help ensure compliance. It is the responsibility of each Regional Supervisory Track Safety Specialist to ensure effective violation report usage.

A defect is a condition not in compliance with the TSS. Defects noted on inspection reports serve as notification to the railroad of FRA's awareness of the defect's existence. Defects may also serve as evidence of the railroad's knowledge of the defect (see the discussion below of the knowledge standard). An FRA inspector may choose to also recommend a civil penalty (violation) for a defect, and so note the decision on the inspection form. A violation serves two purposes: 1) It notifies the railroad that FRA has concluded that a condition does not comply with the TSS, and 2) it notifies the railroad that the inspector has reviewed the circumstances associated with the conditions of noncompliance and is recommending a civil penalty.

In many cases, documenting conditions of noncompliance is sufficient to achieve compliance with the TSS. However, there are many instances in which a condition warrants a violation. When recommending a violation, the inspector must prepare a well-documented narrative report describing the seriousness of the condition.

Once the inspector has determined that a civil penalty should be recommended, all facets of the conditions and circumstances must be carefully considered to make a judgment as to the degree of the violation. Any person (see 49 CFR § 213.15(a) for definition of a person) who violates, or causes the violation of, any requirement of Part 213 is subject to a civil penalty of at least $650, and up to $25,000-ordinary maximum (maximum penalty for any ordinary violation under federal railroad safety laws), per violation. A penalty, not to exceed the amount specified in 49 CRF 218.6 ($105,000 as of December 2013) - aggravated maximum (for violations of railroad safety laws "when a grossly negligent violation or a pattern of repeated violations has caused an imminent hazard of death or injury to individuals or has caused death or injury) may be assessed under conditions described in § 213.15(a). Therefore, the inspector must present the facts of the situation in the narrative report and a recommendation for prosecution should leave no doubt as to the degree of seriousness of the violation.

The inspector should be familiar with the penalty amount normally assessed for a particular violation under the penalty schedule for Part 213 (see Volume II, Chapter 2, Appendix B – Defect Codes). If the circumstances seem to warrant a higher penalty and/or the assessment of penalties for multiple days that a violation continued, the inspector should discuss these factors with the Regional Specialist. If both agree that the extraordinary penalties are appropriate, they should prepare a cover memorandum for a Regional Manager to send to FRA's Office of Chief Counsel. The memorandum should explain the factors that warrant higher-than-normal penalties and/or an assessment for multiple days, note what the amount of the recommended assessment would be, and explain why such an extraordinary assessment is needed in this situation.

Knowledge Standard

Section 213.5 requires that any track owner who "knows or has notice that the track does not comply" with the TSS must bring the track into compliance or halt operations over that track. This knowledge standard has been in the TSS since its creation, and FRA decided to retain the standard when revising the TSS in 1998. The standard holds a track owner liable for violations of which it has actual knowledge or of which it would have known if the owner had exercised reasonable care (e.g., violations of which it has constructive knowledge). The standard is thoroughly discussed in the preamble to the 1998 final rule, found at 63 Federal Register 33992, 33995–33996 (1998).

In submitting a violation report recommending the issuance of a civil penalty, the inspector must fully support the conclusion that the track owner had actual or constructive knowledge of the defect at a time when operations occurred over the track. One way to establish actual knowledge is for the inspector to record and notify the track owner when the defect is found, then reinspect later to see if the track owner has taken appropriate remedial action. If the track owner has not taken appropriate action, the inspector should cite the track owner for a violation of the TSS. Another method to demonstrate actual knowledge is to show that the defect has been noted in the track owner's inspection records, including records of automated inspections. In demonstrating actual knowledge, the violation report should clearly trace each defect to a specific item in an FRA inspection report and/or railroad inspection records. Additionally, a citizen complaint or concern directed to a railroad would fulfill the knowledge standard.

In some situations, the defect has not been noted on a previous FRA inspection report or the railroad's own inspection records. Citing such a defect as a violation requires that the inspector demonstrate the track owner's constructive knowledge. Establishing constructive knowledge of a defect requires proof that the track owner would have known of the defect if the owner had conducted its previous inspection with reasonable care. A track owner cannot simply wait for FRA to provide notice of defects that the track owner should find. The track owner's duty to inspect its track gives it notice of any defect that such a required inspection would reveal, whether or not the railroad detected it. With demonstrated constructive knowledge and a civil penalty recommended, the inspector should attach a copy of the railroad's last required report of inspection. The inspector should explain why the defect is of such a nature that it would have had to exist at the time of the last inspection. For example, crossties generally deteriorate slowly over time, so a crosstie condition found by an FRA or State inspector probably was defective when the track owner last inspected the track. Similarly, rust on the surface of a component that would be exposed to moisture only when it is in noncomplying condition (e.g., on the broken surface of a joint bar) may demonstrate that the defect must have existed at the time of the last inspection.

Criteria Affecting the Seriousness of a Noncomplying Condition

A noncomplying condition under one set of circumstances may warrant a defect, while the same condition under a different set of circumstances may warrant a violation. The enforcement discretion considerations in Part 209, Appendix A, require the inspector to consider the inherent seriousness of the condition. For example, in the TSS context, is the defect among the leading causes of track-caused accidents nationwide? Does the nature of this particular defect (e.g., wide gage of a particular dimension) substantially increase the risk of an accident? Application of these criteria requires that the inspector be generally familiar with the leading causes of accidents in his or her discipline. Consult the FRA Office of Railroad Safety's accident/incident database for more detailed information about accidents on a particular railroad.

In addition to the inherent hazard posed by the defect, the enforcement discretion considerations also require the inspector to consider factors present in the immediate factual situation that may exacerbate or lessen the risk of serious consequences should an accident occur due to the inherent hazard posed by the defect. The inspector must also consider the track owner's compliance history at this location; repeated noncompliance is generally more deserving of enforcement action than is a rare noncomplying condition. Some examples of criteria for consideration when making a decision whether or not to recommend civil penalty include:

- Passenger trains.
- Hazardous materials.
- Population density (urban or residential areas).
- Speed.
- Tonnage.
- Involvement of a bridge or bridge approach.
- Proximity to schools and highway-rail grade crossings.
- Compliance history.
- Accident history.
- Potential for negative environmental impact.
- Strategic Rail Corridor Network (STRACNET) Route.

A violation report should stress the importance of the violation in light of the immediate circumstances, as well as the inherent hazard posed by the condition.

As discussed above, each inspector must exercise good professional judgment and weigh the enforcement discretion criteria when deciding whether to recommend a violation. However, the inspector must exercise discretion on behalf of the Agency, not his or her personal discretion. Accordingly, the inspector's exercising of discretion is subject to supervisory review. Moreover, as an Agency, FRA has the duty to guide the exercising of that discretion and, when necessary, the authority to exercise that discretion above the level of the individual inspector to ensure properly focused enforcement on important compliance problems.

In determining which instances of noncompliance merit penalty recommendations, the inspector considers (49 CFR Part 209, Appendix A):

1. The inherent seriousness of the condition or action.
2. The kind and degree of potential safety hazard the condition or action poses in light of the immediate factual situation.
3. Any actual harm to persons or property already caused by the condition or action.
4. The offending person's (i.e., a railroad or an individual) general level of current compliance as revealed by the inspection as a whole.
5. The person's recent history of compliance with the relevant set of regulations, especially at the specific location or division of the railroad involved.
6. Whether a remedy other than a civil penalty (ranging from a warning on up to an emergency order) is more appropriate under all of the facts.
7. Other factors that the immediate circumstances make relevant.

Certain circumstances concerning the TSS most likely warrant recommendation for civil penalty. These criteria (listed below) are a general application of the enforcement discretion applied to common factual patterns involving defects known to be leading causes of track-caused accidents, extremely persistent noncompliance, and/or willful noncompliance. Although it is not possible to list all circumstances that most likely warrant a civil penalty, these conditions should result in a violation unless the Track inspector determines that special circumstances are present that indicate otherwise. Such special circumstances may include immediate and comprehensive remedial action or factors that lessen the severity of the defects (e.g., dramatic reductions in traffic volume or changes in the railroad's management). Unless the inspector and Regional Specialist agree that circumstances dictate otherwise, civil penalty is recommended for the following situations:

- When followup inspections disclose that unsatisfactory remedial action (or no action) was taken for conditions of noncompliance previously noted by Track inspectors for FRA or the track owner. This includes ATIP reinspections.
- Systemic defects (should have been known to the track owner) are part of a pattern of repeated, similar substandard conditions on the same line, same subdivision, same yard, or within the same supervisor's territory. For example, a center-cracked or broken joint bar that the railroad knew, or should have known, existed (as shown by specific evidence) and is part of a track segment that has an excessive number of center-cracked or broken joint bars. For such situations, it may be appropriate to use a Special Notice for Repairs Report (SNFR).

- Multiple defective conditions occurring at the same location (e.g., joint tie defect with a center-cracked bar, a geometry defect with defective ties, etc.). In such cases, inspectors shall confer with their Specialist to determine the civil penalty or penalties to be cited.
- A rail documented as defective by the railroad's continuous rail flaw inspection with the absence of required remedial action.
- A "breakout in rail head" (§ 213.113) that has obviously existed since the last required railroad inspection.
- A track defect caused by improper repairs (deliberate installation of a joint bar that is not of a structurally sound design and dimension for the rail on which it is applied, or failure to drill holes in rail ends not complying with TSS).
- Defective turnout ties or poor support causing a spring rail frog to have excessive clearance between the hold-down housing and the horn(s). (Note: include a description of gouging or contact by the outside of the wheels against the gage side of the wing rail).
- Excessively chipped or worn switch points that are so chipped or worn as to present a significant derailment hazard.
- Any track geometry defect that clearly existed since at least the last required railroad inspection. Therefore, when these types of defects do not comply with the designated class of track and are found by an inspector, it is obvious the railroad was not following due diligence in inspecting the track (i.e., constructive knowledge).
- A switch stand or derail that can be thrown with the lock or hasp in place.
- The noncompliance of requirements under excepted track. For example, the track at a highway-rail grade crossing does not meet Class 1 requirements when the railroad is moving hazardous material placarded cars in trains over the track.

The list above does not in any manner constitute an all-inclusive list of items that should result in a violation. However, if inspectors consistently address these situations through enforcement action, we will effectively focus enforcement where it counts the most. This will be an important catalyst in helping the industry make significant reductions in track-caused accidents. If no civil penalty recommendation occurs for any situation described above, discuss the special circumstances with the Track Specialist. This review is necessary to achieve a reasonably uniform and consistent enforcement policy. Refer to Chapter 2 of this manual for instructions on preparing a violation report (F6180.111).

A regular cycle of inspection, notification by Form F6180.96, and reinspection is the best and most desirable means of promoting compliance and acquiring evidence of deliberate noncompliance. Make sure to cite the same defects in the original report and the report recommending a civil penalty. The original report should be included as background information supporting the material forwarded for legal action. In addition, individually reference each item number in the original report.

Complaint and Accident Investigations

If allegations of noncompliance with FRA's TSS are substantiated during a complaint investigation, and if consideration of the criteria discussed above indicates that it is the appropriate course, a violation report should be submitted.

During an accident investigation in which a track condition not in compliance with FRA's TSS is determined to be a causal factor and the knowledge standard can be satisfied, a violation report must be submitted. In such a situation, explain the causal relationship in detail, and a cover memorandum noting the causal relationship and recommended aggravated penalties should be submitted to the Office of Chief Counsel with the violation report.

Special Notice for Repairs–Track Class

Section 216.15 of 49 CFR deals with written notification issued to the railroad when track does not comply with the requirements for the class at which the track is being operated as defined in the TSS. The notice will describe the conditions requiring the track to be lowered in class, specify the exact location of the affected track segment and state the highest class and corresponding maximum speeds at which trains may operate over that track. This slow order will remain in effect until repairs are completed. Consider an SNFR, Form F6180.8, for a lack of voluntary compliance by the railroad.

Section 213.5 holds a track owner liable for violations of which it has actual knowledge or of would have known had it exercised reasonable care (e.g., violations of where it had constructive knowledge.) When other circumstances warranting issuance of a SNFR may exist, Track inspectors are advised to be judicious in their decisionmaking and to seek counsel with their respective Regional Specialist prior to or immediately after issuing a SNFR, when practicable.

If, during an inspection, a Track inspector determines that the track does not comply with the requirements of the TSS, make every attempt to encourage the carrier to take the proper remedial action to correct the existing defects. A Track inspector should consider issuing an SNFR when:

- The carrier refuses to take appropriate remedial action for the defective conditions found by the Track inspector.
- Finding defective conditions and determining that a pattern of noncompliance exists over an extended period of time.
- Observing evidence of repeated violations, which demonstrates a disregard of comprehensive inspections and taking appropriate remedial action.

The inspector should evaluate the seriousness of the defects. If it is determined that the existing defects presents a threat to safety, the inspector may issue an SNFR, requiring the carrier to reduce the maximum authorized operating speed over the affected track.

If issuing an SNFR to the carrier, compile complete documentation. This will include field measurements, photographs, location of defects in relation to known fixed points, and a written narrative. The narrative will give details concerning the track structure, the amount and type of rail traffic, and what type of condition is found. In addition, note conditions or defects throughout

the inspection area. Furthermore, note the reaction and response of the railroad and any other information that may affect the SNFR.
Complete the SNFR in the field. The track description must indicate track number or another designation that will specify the track to which the order applies. The location of the defects must be indicated and referenced to a known, fixed point (e.g., a milepost, road crossing, switch, etc.).

The SNFR must be in writing and personally presented to the appropriate carrier official. This will eliminate the possibility of a misinterpretation of the information being received by someone who does not have the authority or ability to carry out the provisions of the notice.

If encountering a delay in this action, a telephone warning can be used to advise the railroad that an SNFR is to be issued. The Track Specialist and/or the Regional Administrator will be notified by phone as soon as possible. Less serious conditions that do not meet the requirements of the TSS may not warrant issuing an SNFR. Consider this when determining the seriousness of the condition.

Make a thorough description of each defect on the SNFR form using the language of the TSS and measurements made in the field. It must be exact and contain sufficient detail to describe each defect. Make reference to the completed F6180.96 at the time of inspection. Section 213.5 holds a track owner liable for violations that it had actual knowledge of or would have known had it exercised reasonable care (e.g., violations that it had constructive knowledge.)

Compliance Orders and Compliance Agreements

General Instructions

Under 49 U.S.C. 20111, FRA has the authority to issue compliance orders when the agency has reason to believe that the respondent is engaging in a continuing pattern of conduct that involves violations of the TSS. Procedures for issuing a compliance order are found in 49 CFR Part 209, Subpart C.

A compliance order normally will require remedial actions necessary to assure compliance with the regulations, and may impose restrictions until compliance is achieved. A compliance order involving the TSS may include a requirement that the track owner make specified repairs by a specific deadline. The compliance order does not necessarily remove tracks from service. If the railroad does not comply with the terms of the order, FRA may seek penalties for violation of the order or seek enforcement of the order in Federal court.

Procedures

If, during an inspection, a Track inspector determines that a railroad is engaging in a continuing pattern of conduct that involves repeated violations of the TSS, the Regional Administrator, through the Track Specialist, should be notified. General guidelines for determining this continuing conduct or pattern are as follows:

- A number of inspections have been made.
- These inspections continue to reveal defects and repeated noncompliance.
- The carrier refuses to bring the track into compliance with the standards.

- The inspector has made every attempt to have the carrier take remedial action through actions such as:
  - Repeated inspections.
  - Submission of violation reports.
  - Meetings with carrier officials explaining the seriousness of the existing conditions.
  - Slow order through the use of an SNFR.

If it is determined by the Regional Administrator, with technical guidance from the Track Specialist, that there is a pattern of repeated noncompliance and conditions present a threat to safety, consideration should be given to recommending the issuance of a compliance order. The Track Division Chief (RRS-15) in the Office of Safety Assurance and Compliance and the Assistant Chief Counsel for Safety (RCC-10) should be notified and consulted at this time. The recommendation containing the information noted below under "documentation" must be forwarded to both of those offices.

Documentation

Complete documentation of the entire area must be developed and included with the Regional Administrator's recommendation. This documentation will include the following:

- Location of all defects including measurements, where required. This is to be recorded on Track Inspection Report Form F6180.96.
- Copies of Track Inspection Report Form F6180.96 for relevant previous inspections at this location.
- Copies of all relevant violation reports concerning the area in question.
- List of all track-caused accidents, reportable and nonreportable, that occurred during the previous 12 months.
- Copies of carrier inspection reports for the previous 6 months.
- A written narrative should be prepared detailing, but not limited to, the following:
  - Amount and type of rail traffic.
  - Proximity of tracks to homes, schools, stores, etc.
  - The carrier's inspection and maintenance programs and procedures.
  - The seriousness of the defects.
  - The basis for the determination that a pattern of noncompliance exists.
  - Details of each meeting held with carrier officials including dates, names and titles of those in attendance and items discussed.

Based on the information submitted, the Office of Railroad Safety and the Office of Chief Counsel will decide whether to recommend to the Administrator that a compliance order proceeding be initiated. With the Administrator's approval, the Office of Chief Counsel would then issue a notice of investigation based on the documentation submitted. If the railroad requests a hearing, FRA's hearing officer would preside over a trial-type hearing where FRA would have the burden of proving its factual allegations and the reasonableness of the remedial action sought. The hearing officer's decision could be appealed to the Administrator, and the Administrator's decision could be challenged in court. At any time during this process, FRA and the railroad could agree to a consent order and present it to the Administrator for signature. A consent order would impose requirements on the railroad and preclude further litigation of the issues.

In recent years, FRA has developed a simpler way of using the compliance order authority. Under a compliance agreement, the railroad agrees to take certain remedial actions; should those actions not occur to FRA's satisfaction, the railroad agrees not to oppose issuance of a compliance order or an emergency order imposing those conditions. Whereas the preparatory work necessary for a compliance agreement is substantially the same as for a compliance order (outlined above), the agreement presents FRA and the railroad with certain advantages. FRA can obtain remedial action quickly and informally, and if the terms of the agreement are not met, FRA can issue a compliance order or an emergency order without the time, expense, and litigation risk of a formal proceeding. Therefore, the railroad achieves improved compliance without being subject to an actual order unless it fails to meet its obligations under the agreement. In some agreements, FRA waives its right to pursue civil penalties for specified violations if the railroad meets all conditions of the agreement. In other agreements, the railroad will pay civil penalties on certain extremely serious violations that FRA may find while the agreement is in effect. If a compliance problem appears to be an appropriate situation for such an agreement, Regional Managers should contact RRS-15 and RCC-10.

Emergency Orders

Under 49 U.S.C. 20104, FRA has authority to take special remedial action to handle emergency situations. If, through testing, inspection, investigation, or research, FRA decides that "an unsafe condition or practice, or a combination of unsafe conditions and practices, causes an emergency situation involving a hazard of death or personal injury," FRA may immediately issue an emergency order. The order may impose restrictions or prohibitions necessary to bring about the abatement of the emergency situation. The authority to issue such an order rests with the FRA Administrator.

Unlike a compliance order, FRA may issue an emergency order without first providing the opportunity for a hearing. Accordingly, FRA has used the authority sparingly, and issued only 22 orders from 1970 through 2000. Although the statute does not define the emergency situation that must be present for FRA to issue such an order, FRA believes it refers to conditions and/or practices that present an imminent hazard of death or injury. The authority can be used to address conditions that are not in compliance with FRA's rules and conditions that are not addressed by those rules.

General Procedures

FRA has issued procedures for issuance of track-related emergency orders (49 CFR Part 216, Subpart C). Those procedures require that an inspector who detects an apparent emergency situation begin by issuing a notice of track conditions. The Regional Administrator then decides, based on that notice, whether to recommend that the FRA Administrator issue an emergency order removing the track from service. Those procedures (§ 216.27) also note that the Administrator can issue an emergency order without following this process. Ordinarily, in a true emergency, a cumbersome process is unacceptable. Therefore, we leave it to the discretion of the region to determine the degree of urgency, and for more urgent situations, dispense with the process set forth in Part 216.

An inspector who discovers or is informed of conditions that may constitute an emergency situation shall immediately contact the regional office. During an inspection, if an apparent emergency situation is brought to the inspector's attention, the inspector shall immediately inspect the alleged condition or practice to determine whether an emergency situation exists. If, during an inspection, the inspector discovers an emergency situation or determines after inspecting that an emergency does or may exist, the inspector must immediately follow the procedures outlined in this chapter. If the inspector has any doubt as to whether a condition or practice constitutes an emergency, the inspector must consult the Track Specialist.

- The Track Specialist shall immediately ascertain if there is a reasonable basis for the allegation and alert the Regional Administrator and FRA Headquarters (HQ) to the situation. The Regional Administrator will keep HQ advised.
- The Track Specialist shall make a preliminary determination as to whether further inspection is necessary.
- If the allegation of an emergency situation appears to have merit, the Track Specialist shall contact the track owner immediately, ascertain as many pertinent details as possible concerning the situation, and attempt to obtain immediate voluntary abatement prior to the inspection. The Track Specialist should ascertain and evaluate the steps, if any, that the track owner indicates should be used to abate the danger. An investigation shall then be conducted in accordance with the procedures outlined in this chapter.

Technical Considerations

After the determination to investigate has been made, the inspection should be thoroughly planned to the extent time permits. The Track Specialist and inspector should review the known facts and decide what technical equipment and personnel may be necessary to conduct the inspection.

Scheduling

Any allegation of an emergency situation received by a regional office, whether written or oral, must be handled as a high priority. Other commitments, weekends, holidays, leave, and other considerations must not interfere with the expeditious and thorough handling of these cases.

If it is determined that an inspection should be made, it will be scheduled and conducted at the earliest possible time. Except in extraordinary circumstances, the inspection should be conducted within 24 hours of the receipt and preliminary evaluation of the alleged emergency situation.

Inspection

In an inspection conducted because of an allegation of an emergency situation, the alleged situation shall be inspected first.

Any additional inspection activity should take place only after resolution of the emergency situation. After the emergency situation has been resolved, a complete inspection of the facility may be conducted.

Voluntary Corrective Action

As soon as it is concluded that conditions exist that constitute an emergency situation, the inspector shall attempt to have the situation immediately corrected through voluntary corrective action by the carrier. The track owner or a representative of the owner should be promptly advised that such a situation exists.

The track owner is ultimately responsible for determining the manner in which they will correct the dangerous condition. Before leaving the premises, FRA or State personnel must determine that the emergency situation has been resolved and will not recur.

The track owner shall be deemed to have resolved an emergency situation if they eliminate exposure to the situation, or eliminate the condition or practice that resulted in the situation.

If corrective action is taken voluntarily, the inspector shall make the appropriate notation on the FRA Track Inspection Report.

Refusal to Correct

If conditions that are of a serious nature are not corrected, the inspector shall immediately notify the regional office. Depending on the degree of urgency, the Regional Administrator will decide whether to proceed directly to recommend to HQ that an emergency order be issued, or to have the inspector issue a notice of track conditions to the appropriate railroad official, thus informing the carrier that the track does not comply with the requirements of the TSS. Whichever route is chosen, the inspector will issue a Track Inspection Report.

The inspector has no authority to order the closing down of an operation or to direct employees to leave an area in the case of imminent danger. His or her only authority is to inform the Regional Administrator of the conditions observed and provide the basis on which the Regional Administrator can make a recommendation to the FRA Administrator through the Associate Administrator for Railroad Safety/Chief Safety Officer.

The Notice of Track Conditions

Where the region decides to use the notice of track conditions process set forth in Part 216, the following procedures must be followed:

- The notice shall set out and describe in detail the conditions found, and specify the location, track number, and any other information necessary to properly describe the defects and the track involved.
- A copy of the notice of track conditions given to the carrier, along with a written narrative, must be provided to the Regional Administrator within 3 calendar days of the issuance of the notice. A copy of this notice will also be sent to the Office of the Associate Administrator for Railroad Safety/Chief Safety Officer, attention RRS-15, as soon as possible.
- The written narrative with complete documentation will include:

  - Field measurements.
  - Photographs.
  - Location of defects referenced to a known fixed point.
  - Details concerning the track structure.
  - The amount and type of rail traffic, not only at the location of the emergency order but also throughout the entire inspection area.
  - The reaction and response of the railroad.
  - Other information that may affect the order.
- Copies of Notice of Track Conditions shall be distributed as follows:
  - Original and first copy–mail promptly to the Track Specialist.
  - Second copy–retained by the inspector.
  - Last copy–issue to the carrier representative.

The Track Specialist will review the report, retain the first copy for regional records, and forward the original to the Office of Safety Assurance and Compliance, RRS-15.

Information Needed to Support Issuance of an Emergency Order

The Regional Administrator considers the inspector's report, input from the Track Specialist, and any material submitted by the railroad in developing a recommendation to the FRA Administrator. If the Regional Administrator decides that emergency action is necessary, the recommendation should be supported by ample documentation of the imminent safety hazard and previous attempts to address related safety issues on the particular railroad. Time permitting, the supporting documentation should include all of the following information.

General information required:

- Track Inspection Report Form F6180.96 for the entire segment recommended for the emergency order, showing each defect found during the inspection. (Repetitive entries may be summarized if a significant number of specific conditions are itemized and portray an accurate view of overall conditions.)
- Previous inspection reports served on the carrier for the particular line segment, including returned reports showing corrective action.
- Relevant violation reports filed with Chief Counsel (by report number and date of transmittal; FRA case number if known) and waiver investigation reports, if any.
- Description of method of operation.
- Operating speeds, temporary and permanent (copies of timetable, special instructions, slow orders).

Facts demonstrating that the defect poses an imminent hazard of death or injury to persons:

- ATIP data (including summary) if available.

- Narrative report of discussions with carrier representatives in chronological sequence, providing dates, locations, names, and titles.
- Number of trains (passenger through freight, local, by category) and annual tonnage.
- Motive power employed on line, maximum train lengths, carrier-imposed limitations on axle loads or particular equipment.

Hazardous materials information:

- Volume of hazmat traffic over the line, based on review of waybills or consists for a period of 2 to 4 weeks prior to the date of the investigation.
- Type of hazmat traffic (illustrative listing of recent hazmat data identifying number of cars carrying explosives, poison gas, flammable gas, chlorine, anhydrous ammonia, etc.).
- Hazmat violation history on line as related to derailment risks (train placement, etc.).

Demographic information:

- Towns and cities along the line by name, referenced by railroad milepost and approximate population.
- Illustrative description of the area (including homes, schools, businesses, hospitals, etc.), indicating proximity to rights-of-way, railroad mileposts, and estimated number of persons affected. Include major highway-rail grade crossings and railroad bridges over public streets. Provide photographs showing track in foreground and areas potentially at risk in background and street maps, if readily available.

Topographic information:

- General description of curves and grades. (Provide track charts, if available).
- Railroad bridges and sharp dropoffs adjacent to rights-of-way. (Photographs, as appropriate).
- Clearances with reference to other active track and structures along rights-of-way. (Photographs, as appropriate).

Accident history:

- Rail equipment accident/incident reports for the past 6 months, regardless of carrier-identified cause (affected line only).
- FRA accident investigation reports, if any (affected line only).
- Carrier internal reports of accidents not reported to FRA.

Special factors:

- Abandonment plans and status, if applicable.
- State agency interest in rail service continuation, if applicable.
- Planned rehabilitation efforts, if any.
- Involvement of State in inspections and investigations, if any.

- Press reports, complaints from public officials and/or union officers, etc.
- Economic impact of proposed order (only readily available information).
- List of major industries on line (with indication of hazmat traffic, if known), obtained from the railroad, and the likely effect that order will have on their business.

Railroad response:
Current information on planned remedial action, adequacy of response, projected completion dates, resources actually committed, progress of work to date of recommendation.

FRA actions needed to support issuance of an emergency order:

- Inspector serves Notice of Track Conditions to railroad representative. (Note: the Regional Administrator can choose to bypass this step and instead simply inform the railroad that he or she intends to recommend issuance of an emergency order based on the inspection results).
- Regional Administrator makes assignments of responsibilities to complete field investigation.
- Track Specialist alerts Track Division (RRS-15) requesting assistance, as needed. Track Division alerts Assistant Chief Counsel for Safety.
- Track Division (RRS-15) assists in the development of accident history information.
- Office of Chief Counsel and Office of Safety Assurance and Compliance, Track Division, work together to draft emergency order.
- Administrator issues order.

Wherever an emergency order has been issued by FRA, the Track Specialist shall arrange to immediately make a followup investigation to determine if the track owner is complying with the terms of the order. The Regional Administrator arranges followup inspections, as requested by railroad, to determine whether conditions for lifting the order have been fully met on all, or a portion, of the line affected.

Where followup inspections indicate that relief from the order is fully or partially warranted, the Regional Administrator notifies RRS-15 and RCC-10. Those offices draft Federal Register notices necessary to grant relief from the order.

These procedures are intended to provide general guidance. Additional information may be required in some instances. If there is any delay in the development of any elements pertaining to an emergency order, such as typing field reports, the Office of Safety Assurance and Compliance, Track Division, RRS-15, should be consulted.

Violation of FRA Emergency Order or FRA SNFR

When an inspector’s investigation, inspection, or surveillance activity discloses that a carrier has violated a provision of an FRA emergency order or SNFR, the inspector will immediately report the circumstances of the violation to the Regional Administrator. The Regional Administrator will promptly transmit this information to the Associate Administrator for Railroad Safety/Chief

Safety Officer and Office of Chief Counsel for advice as to what action should be taken and what information will be required to support that action.

An emergency order or SNFR violation report shall be made in memorandum form. The subject at the heading of the memorandum should read, "Violation Report Concerning Emergency Order No. (fill in number of order) Issued Against (fill in name of railroad)" or "Violation Report Concerning Special Notice for Repairs (fill in number of notice) Issued Against (fill in name of railroad or other track owner)." The first paragraph of the memorandum report should refer to the order or notice involved, and provide a brief summary relative to the circumstances and evidence to support the violation report in accordance with the advice and instructions provided by the Office of Chief Counsel.

Enforcement of the Safety Laws and Regulations Against Individuals

For further discussion of individual liability, in addition to this Chapter, inspectors should also reference the General Manual, Chapter 3, for guidance.

Under 49 U.S.C. 21311, substantial criminal penalties may apply to individuals or companies who "knowingly and willfully" falsify records or reports required to be kept or submitted under the railroad safety laws. The TSS contains specific recordkeeping requirements (e.g., § 213.241) and a specific reference to the criminal provision (§ 213.15(b)). The "knowingly and willfully" standard essentially requires that the Government be able to demonstrate that the person knew what they were doing was wrong and did it anyway with criminal intent. The Government would need to be able to prove all elements of its case beyond a reasonable doubt. Because of the high standard for knowledge and difficult burden of proof in such cases, these are not easy to prosecute. Moreover, failure to record track defects on a railroad's inspection records is most often the result of incompetence, negligence, or haste, rather than willful conduct. Nevertheless, if an inspector has reason to believe that a railroad might purposely be falsifying its inspection records, the inspector should contact regional staff, who should notify the HQ Office of Railroad Safety and the Office of Chief Counsel. Where appropriate, those offices will make the necessary referrals to request a criminal investigation.

Federal Railroad Administration

Track and Rail and Infrastructure Integrity Compliance Manual

Volume II Track Safety Standards
Chapter 1 Track Safety Standards
Classes 1 through 5

January 2014

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Text in italic font of this manual is regulatory language, whereas indented paragraphs provide field guidance for FRA inspectors. Indented paragraphs are not to be construed as regulatory language in any manner.

CHAPTER 1

Track Safety Standards Classes 1 Through 5

Introduction

This chapter provides the necessary information for FRA inspectors to properly apply the Track Safety Standards (TSS) during inspection activities (the term “FRA inspector” also includes State inspectors that are participants in the Federal program). This manual is not to be construed as a modification, alteration, or revision of the published TSS.

Any legal proceeding instituted against a railroad must be based on the regulations found in 49 CFR Part 213. Inspectors should refer to this manual as often as necessary to understand the intent of any particular rules, thereby assuring to the extent practicable the nationally uniform application of these rules as intended by Congress in the Federal Railroad Safety Act of 1970.

Inspectors will not, under any circumstances, adjust, correct, or repair track or appurtenances, nor will they authorize, suggest, or recommend any movements over any track. Full responsibility for these matters rests with the railroad. The inspector will immediately inform the railroad of any track condition not in compliance with the TSS.

This manual is based on the TSS published on October 1, 2012 and the Electronic Code Of Federal Regulations (http://www.ecfr.gov) which is current as of Juanry, 2014.

Inspectors are encouraged to provide suggestions for enhancement of future editions of this manual.

Appendix B contains the defect codes for each subsection of the regulation. Defect codes are important analytical tools for FRA’s data collection. If an inspector cannot find a defect code corresponding to a violation of the TSS, the inspector may still submit the violation.

This chapter addresses Track Classes 1 through 5. Volume II, Chapter 2 of this manual addresses Classes 6 through 9.

Subpart A – General

§ 213.1 Scope of part

1(a) This part prescribes minimum safety requirements for railroad track that is part of the general railroad system of transportation. In general, the requirements prescribed in this part apply to specific track conditions existing in isolation. Therefore, a combination of track conditions, none of which individually amounts to a deviation from the requirements in this part, may require remedial action to provide for safe operations over that track. This part does not restrict a railroad from adopting and enforcing additional or more stringent requirements not inconsistent with this part.

Guidance: It is important to note that the TSS are minimum safety requirements and are not appropriate for track maintenance purposes.

The VTI Final Rule (78 FR 16100, Mar. 13, 2013) added the phrase "In general" to provide a certain degree of flexibility, to encompass track conditions not necessarily "existing in isolation." In particular, it refers to ''combined'' track alinement and surface deviations contained in § 213.65.

While the TSS address specific track conditions that exist in isolation in general, there can sometimes be a combination of track conditions (none of which individually amounts to a deviation of the TSS) that require remedial action to provide for safe operations over that track. Section § 213.65 specifically addresses a combination of track conditions for curves with operations resulting in more than 5 inches cant deficiency. If an inspector encounters such a condition which is not encompassed in Section § 213.65, the inspector should also immediately bring the condition to the attention of the accompanying railroad official, explain the hazard of such a condition, and encourage its rapid removal. Where the inspector is not able to convince the railroad to initiate some action, the inspector should refer to the regional track specialist for assistance.

1(b) Subparts A through F apply to track Classes 1 through 5. Subpart G and §§ 213.2, 213.3, and 213.15 apply to track over which trains are operated at speeds in excess of those permitted over Class 5 track.

Guidance: With the introduction of high-speed passenger train operations in the Nation, the TSS was revised in 1998 to provide two sets of requirements low speed/Classes 1 through 5 (Subpart A through to F), and high-speed/Classes 6 through 9 (Subpart G). The VTI Final Rule (78 FR 16100, Mar. 13, 2013) further revised the Part 213, but mainly Subpart G. The high-speed standards include specific requirements for such operations, which also prescribe a number of track-vehicle interaction tests., 213.3 (Application), and 213.15 (Penalties) apply to both high and low-speed track.

§ 213.3 Application

3(a) Except as provided in paragraph (b) of this section, this part applies to all standard gage track in the general railroad system of transportation.

Guidance: Paragraph 3(a) specifically excludes from Part 213, track located inside an installation that is not part of the general railroad system of transportation. Additional language regarding plant trackage can also be found in 49 CFR Part 209, Appendix A, which explains that the track owner of any plant railroad trackage over which a general system railroad operates is responsible for the condition of track used by the general system railroad. Part 209, Appendix A, is not meant to imply that all of the requirements of the TSS, including inspection frequencies and recordkeeping, become applicable to a plant railroad once a general system railroad enters the property. Rather, it is a statement meant to convey FRA's intent that plant railroads should maintain, in a safe condition, that portion of their trackage used by a general system railroad.

3(b) This part does not apply to track –

1) Located inside an installation which is not part of the general railroad system of transportation; or

2) Used exclusively for rapid transit operations in an urban area that are not connected with the general railroad system of transportation.

Guidance: FRA does not have the manpower or resources to regularly inspect trackage within industrial installations. However, since the enactment of the *Federal Railroad Safety Act of 1970*, FRA has statutory authority to issue emergency orders to repair or discontinue use of industrial or plant trackage should FRA find that track conditions pose a death or injury hazard, (see 49 U.S.C. 20901). In other words, if FRA learns that a particular plant railroad is in such disrepair so as to pose a safety hazard of death or injury to a plant railroad employee, a railroad employee, or the public at large, FRA has the option of exercising its authority. FRA may issue an emergency order directing the plant railroad to discontinue using the track until specified repairs are made. It is FRA's opinion that this emergency order is sufficient power to ensure track safety within plant railroads. If conditions or events in the future tend to demonstrate that track safety within plants or installations should be regulated, FRA will seek to change the track safety regulations accordingly.

Because it is a policy statement, Appendix A to Part 209 cannot override the text of the TSS, which clearly excludes plant railroads from the reach of the Part 213 track safety regulations. Therefore, while the requirements of the TSS do not apply within plant railroads, those operations should use them as a guide to ensure that their tracks are capable of carrying rail traffic safely.

As a practical application of this policy, FRA expects that the trackage in a plant railroad, at a minimum, meet Class 1 standards on the segments where the general system trains operate in the facility. FRA expects that Subpart C and D (geometry and structure) requirements are met and does not expect that a plant railroad comply with inspection frequency requirements with its intended track class.

The TSS also excludes urban area rapid transit systems that are not a part of the general railroad system. The regulations are not intended to make the TSS applicable to certain rapid transit systems whose only connection to the general system is a switch permitting receipt of shipments of non-revenue materials from the general system. Any questions concerning the applicability of the TSS must be referred to the regional track specialist who will consult with the Office of Safety Assurance and Compliance and the Office of Chief Counsel for guidance concerning the particular entity.

§ 213.4 Excepted track

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

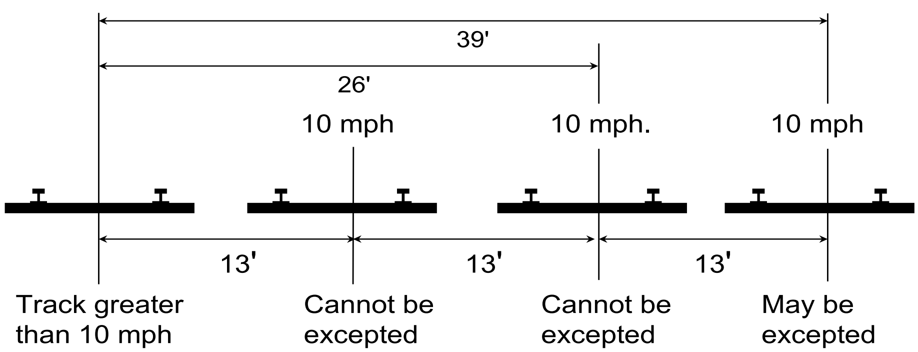
4(a) The segment is identified in the timetable, special instructions, general order, or other appropriate records which are available for inspection during regular business hours;

Guidance: The intent of this section is to permit portions of certain low density main tracks and associated yard tracks and sidings to be allowed excepted status and not comply with Subparts B, C, D, and E of the TSS unless otherwise expressly stated. However, by designating a track as excepted, the owner must meet the requirements specified in paragraphs 4(b) through to 4(f).

4(b) The identified segment is not located within 30-feet of an adjacent track which can be subjected to simultaneous use at speeds in excess of 10 miles per hour;;

Guidance: This paragraph prohibits excepted track designation of any track located within a 30-foot envelope of a track that can be subjected to simultaneous use at speeds in excess of 10 mph. As shown in the following figure, the 30-foot dimension is measured between track centerlines and applies to all tracks within that envelope (e.g., tracks converging at turnouts and rail crossings). In this example, since the far left track operate at greater than 10 m.p.h., only the far right track may be excepted. Simultaneous use means movement of cars or locomotives on both tracks at the same time.

Note: "adjacent track" means any track in proximity to the track in question



Operation on any track located within 30 feet of excepted track may be restricted to 10 mph by the physical layout of the tracks, or by definite restrictions placed by the track owner by rule, timetable, special instruction, or other positive instruction or order. These criteria provide the positive protection of trains on higher speed track against a collision with fouling equipment from a potential derailment on the excepted track.

The term "train" is defined in 49 CFR § 236.832 as, "A locomotive or more than one locomotive coupled, with or without cars". That definition applies to this rule.

A designation of excepted track need only be recorded by the track owner and implemented by issuance of appropriate instructions to all affected employees. The designation need not be filed with FRA. The TSS do not specify which employees the railroad or track owner must notify of excepted track designations; however, in order to ensure maximum safety and compliance with the requirements of this part, FRA recommends that railroad or track owner notify all employees who are involved with the operation of trains or with engineering functions on excepted track.

4(c) The identified segment is inspected in accordance with 213.233(c) and 213.235 at the frequency specified for Class 1 track;

Guidance: § 213.5(b) provides that a railroad may continue train operations on track segments designated as excepted track without complying with Subparts B, C, D, and E of Part 213. However, a railroad must still comply with the inspection requirements contained in Subpart F for track segments designated as excepted track. Railroads must inspect excepted track in accordance with §§ 213.233(c) and 213.235 at the frequency specified for Class 1 track. Failure to comply will result in a violation and loss of the excepted track privilege until inspection requireemenrts specified inthis paragraph are met.

4(d) The identified segment of track is not located on a bridge including the track approaching the bridge for 100 feet on either side, or located on a public street or highway, if railroad cars containing commodities required to be placarded by the Hazardous Materials Regulations (49 CFR Part 172), are moved over the track; and

Guidance: In the application of this paragraph, a public street or highway is defined as a roadway that is open to the public and is owned and maintained by a public entity. This paragraph includes both crossings of public roadways at grade and longitudinal running of the track for extended distances in a public roadway (street trackage).

Under § 214.7, a railroad bridge is defined as follows: 1) a railroad bridge is any structure supporting one or more railroad tracks with a span length of 12 feet or more measured along the track centerline; and 2) the term "bridge" shall apply to the entire structure between the faces of the backwalls of abutments or equivalent components, regardless of the number of spans. The term shall include all structures, whether of timber, stone, concrete, metal, or any combination thereof.

4(e) The railroad conducts operations on the identified segment under the following conditions:

(1) No train shall be operated at speeds in excess of 10 miles per hour;

(2) No occupied passenger train shall be operated;

(3) No freight train shall be operated that contains more than five cars required to be placarded by the Hazardous Materials Regulations (49 CFR Part 172); and

(4) The gage on excepted track shall not be more than 4 feet 10¼ inches. (This paragraph (e)(4) is applicable September 21, 1999.)

Guidance: In reference to (e)(1) through (4), a well-documented pattern of repeated or widespread deviations from these requirements by a track owner, including train operations in excess of 10 mph, will effectively terminate the privilege afforded by this section. The affected track would then become subject to all requirements of the TSS.

The word "occupied" in (e)(2) refers to paying and non-paying passengers. It does not include train crew members, track maintenance crews, and other railroad employees who must travel over the track to attend to their work duties.

The gage requirement only applies to the actual measurement itself under load, and does not extend to the evaluation of crossties and fasteners that provide the gage restraint. In the case of noncompliance with the gage requirement in excepted track, the railroad may invoke § 213.9(b) as remedial action. [See § 213.9(b) for restrictions.]

4(f) A track owner shall advise the appropriate FRA Regional Office at least 10 days prior to removal of a segment of track from excepted status.

Guidance: The railroad or track owner is required to notify the appropriate FRA Regional Office 10 days before removing trackage from excepted status. A railroad may not move the track from excepted to non-excepted status to operate an occupied passenger train or a train containing more than five cars placarded in accordance with 49 CFR Part 172, unless proper notification procedures are followed.

Inspectors will continue to inspect excepted track and report these inspections on the F6180.96 form. If serious deficiencies are discovered, they will be shown on the inspection form, noting that the track is in excepted status. The railroad or track owner would not be legally obligated by the TSS to correct the deficiencies noted, except for gage deviations in excess of 4 feet 10¼ inches (213 defect code 0053B5). However, if the condition of the track continues to constitute a hazard to life and limb and the track owner fails to alleviate the hazard, the inspector should notify the regional track specialist immediately. Issuance of an emergency order would be appropriate to address any serious defects that would pose an immediate safety threat to railroad employees or the public.

This notification provision is intended to prevent the practice FRA has witnessed in the past by some railroads. Specifically, those who remove trackage from excepted status only long enough to move a passenger excursion train or a train with more than five cars containing hazardous materials.

The following examples are provided to inspectors to determine compliance with the provision of excepted track.

<u>Example One</u>. On January 15, 2014, a railroad designates a 2-mile segment of its yard track Number 1, which is Class 1 track, as excepted track. The excepted track segment is located within 25 feet of an adjacent track over which simultaneous operations at speeds up to 20 mph are authorized. On January 25, 2014, an inspector discovers five locations in that segment at which Class 1 gage requirements are not being met.

Result: The segment of yard track Number 1 involved is ineligible for designation as excepted track because it violates § 213.4(b) simultaneous use restriction. Therefore, the segment remains subject to provisions of the TSS for Class 1 track. FRA may cite for correction or violation any deviation from the TSS discovered in the segment, such as the five gage defects. The railroad may also be cited, at the FRA inspector's discretion, for a violation of § 213.4(b) and will include the substantive defects (e.g., gage, alinement, crossties). As remedial action the railroad may authorize trains operations not to exceed 10mph speed restriction to include all tracks within 30-feet and adjacent to an excepted track, in effect removing the simultaneous use provision.

<u>Example Two</u>. A railroad designates yard track number 6, which is classified as Class 1 track, as excepted track on November 30, 2013. The railroad does not conduct any inspections over the track during December.

Result: Yard track number 6 loses its eligibility for designation as excepted track on January 1, 2014, and remains ineligible thereafter until the inspections required by § 213.4(c) begins. Starting January 1, 2014, the track becomes subject to all provisions of the TSS and remains subject to those requirements until such time as the inspections begin. Violation citations arising from inadvertent violations of the inspection requirement ordinarily should be issued only where safety was impaired or there is evidence of continued noncompliance.

In contrast to violations of the definitional (§ 213.4(a) to (d)) requirements, the unit of violation for noncompliance with the operational limitations is the train. We refer here to occasional and inadvertent noncompliance with operational limitations. A persistent and well-documented pattern of noncompliance with respect to a particular segment may cause the railroad to lose its privilege of designating the segment as excepted track (i.e., the track would no longer qualify for such designation), or force FRA to use more drastic enforcement remedies such as emergency orders. The following examples illustrate this concept.

<u>Example Three</u>. A railroad properly designates a track segment as excepted track, 10 days later it operates a freight train containing 10 placarded tank cars over the track segment.

Result: One violation of § 213.4(e)(3) by the railroad has occurred, not five, because the unit of violation is the train rather than each of the placarded cars exceeding the five car limit. The segment continues to be excepted track because a violation of an operational limitation does not render the track ineligible for excepted track status.

<u>Example Four</u>. Railroad A properly designates one of its track segments as excepted track. Railroad B's freight train 2425, using the segment pursuant to a trackage rights agreement with Railroad A, operates over the segment at a speed of 20 mph.

Result: One violation has occurred of § 213.4(e)(2) by Railroad A. The track owner is the responsible party for illegal operations over the excepted track. The segment continues to be excepted track.

§ 213.5 Responsibility for compliance

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

(1) Bring the track into compliance;

(2) Halt operations over that track; or

(3) Operate under authority of a person designated under § 213.7(a), who has at least one year of supervisory experience in railroad track maintenance, subject to conditions set forth in this part.

Guidance: This paragraph describes the action that must be taken by a railroad or track owner once they know or have notice (knowledge standard) that the track is not in compliance with the TSS. The track owner must:

(1) Bring the track into compliance by either repairing the defects or imposing an appropriate speed restriction.
(2) Remove the track from service, that is disallowing train operations.

(3) Operate under authority of a qualified person designated under § 213.7(a) in accordance with one the following provisions:

- § 213.9(b) Class of track – 30-day provision.
- § 213.11 Restoration or renewal of track under traffic conditions.
- § 213.113 Rail defects.

For additional information concerning the required corrective action for defects, see the guidance under § 213.9 (Classes of track; operating speed limit).

5(b) If an owner of track to which this part applies designates a segment of track as ″excepted track" under the provisions of § 213.4, operations may continue over that track without complying with the provisions of Subparts B, C, D, and E, unless otherwise expressly stated.

Guidance: The owner may designate the track ″excepted" provided it meets the requirements of § 213.4.

5(c) If an owner of track to which this part applies assigns responsibility for the track to another person (by lease or otherwise), written notification of the assignment shall be provided to the appropriate FRA Regional Office at least 30 days in advance of the assignment. The notification may be made by any party to that assignment, but shall be in writing and include the following —

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

(2) The name and address of the person to whom responsibility is assigned (assignee);

(3) A statement of the exact relationship between the track owner and the assignee;

(4) A precise identification of the track;

(5) A statement as to the competence and ability of the assignee to carry out the duties of the track owner under this part; and

(6) A statement signed by the assignee acknowledging the assignment to him of responsibility for purposes of compliance with this part.

Guidance: Paragraph 5(c) requires a track owner to notify FRA, through the appropriate regional office, when the responsibility for compliance with this part is assigned to another. Notification must contain the specific information required in this paragraph and shall be made 30 days before the assignment of the responsibility.

5(d) The Administrator may hold the track owner or the assignee or both responsible for compliance with this part and subject to penalties under 213.15.

Guidance: Where the track is not owned by the operating railroad through an arrangement such as a lease agreement,typically the operating railroad will be cited for violations. However, it may be appropriate to recommend civil penalties against the operating railroad and the owner when both parties contributed to the deficiency. Inspectors must determine the responsible party when recommending civil penalties for noncompliance and alert FRA's Chief Counsel when violation reports involve parties other than the track owner.

This paragraph also provides that the party responsible for compliance can be other than the actual owner of the track through assignment of responsibility or if the Surface Transportation

Board (formerly Interstate Commerce Commission) has issued a directed service order. FRA may hold responsible any party contracted by the track owner to ensure compliance with this part. FRA may hold the track owner, the assignee, or both responsible.

5(e) A common carrier by railroad which is directed by the Surface Transportation Board to provide service over the track of another railroad under 49 U.S.C. 11123 is considered the owner of that track for the purposes of the application of this part during the period the directed service order remains in effect.

Guidance: On rare occasions, such as a cessation of service by a railroad, the Surface Transportation Board directs a railroad, other than the track owner, to provide service, the designated operator shall be considered as the owner for the purposes of compliance of the TSS.

5(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.

Guidance: Both employees of railroads and track owners, and contractors to railroads, are subject to the requirements of the TSS when they perform functions required by the TSS.

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

7(a) Each track owner to which this part applies shall designate qualified persons to supervise restorations and renewals of track under traffic conditions. Each person designated shall have—

(1) At least —
(i) 1 year of supervisory experience in railroad track maintenance; or
(ii) A combination of supervisory experience in track maintenance and training from a course in track maintenance or from a college level educational program related to track maintenance;

(2) Demonstrated to the owner that he or she—
(i) Knows and understands the requirements of this part that apply to the restoration and renewal of the track for which he or she is responsible;
(ii) Can detect deviations from those requirements; and
(iii)Can prescribe appropriate remedial action to correct or safely compensate for those deviations; and

(3) Written authorization from the track owner to prescribe remedial actions to correct or safely compensate for deviations from the requirements in this part.

7(b) Each track owner to which this part applies shall designate qualified persons to inspect track for defects. Each person designated shall have—

(1) At least—
(i) 1 year of experience in railroad track inspection; or
(ii) A combination of experience in track inspection and training from a course in track inspection or from a college level educational program related to track inspection;

(2) Demonstrated to the owner that he or she—
(i) Knows and understands the requirements of this part that apply to the inspection of the track for which he or she is responsible;
(ii) Can detect deviations from those requirements; and

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

(3) Written authorization from the track owner to prescribe remedial actions to correct or safely compensate for deviations from the requirements of this part, pending review by a qualified person designated under paragraph (a) of this section.

Guidance: Inspectors may request verification of the experience and qualifications of the supervisory and track inspection personnel from a track owner. The submission of a seniority roster or job awarding bulletin is not to be considered as satisfactory identification of qualified employees or as a basis for their designation. The owner should make specific names of individuals and their qualifications available in writing. If the inspector is in doubt as to the qualifications of the owner's supervisory or inspection personnel, the inspector should examine the owner's inspection records. The TSS require the retention of track inspection reports for 1 year. Should the records consistently fail to reflect the actual track conditions, questions can be raised as to the competence and/or qualifications of the persons included in the list.

Paragraphs (a)(2)(i) and (b)(2)(i) clarify that the requirements for a person to be qualified under this section concern the portions of Part 213 necessary for the person to perform his/her duties. The person is not required to know or understand specific requirements of this part not necessary to fulfill his or her duties. For example, track foremen and inspectors may not be required to know or understand vehicle qualification and testing requirements for high cant deficiency operations in track Classes 1 to 5 in fulfilling their duties.

When in doubt as to the qualifications of an owner's supervisors or inspectors, the inspector should discuss the matter with the railroad.

7(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 specifically developed for the application of written CWR procedures issued by the track owner;

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

(i) Knows and understands the requirements of those written CWR procedures;

(ii) Can detect deviations from those requirements; and

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

(4) Written authorization from the track owner to prescribe remedial actions to correct or safely compensate for deviations from the requirements in those procedures and successfully completed a recorded examination on those procedures as part of the qualification process.

Guidance: As CWR track has characteristics inherently different than those of traditional jointed rail, track owners are required to designate which individuals are specifically qualified to inspect or supervise the installation, adjustment, and maintenance of CWR. In addition to the qualifications that an individual must have under either paragraph (a) or (b), an individual designated under paragraph (c) must have completed a CWR training course and be well-versed in the maintenance of CWR track as detailed in the track owner's CWR plan. The comprehensive nature of the training course is more important than its duration; therefore, the railroad employee must successfully complete an indepth initial training course of the track owner's written CWR procedures and continue subsequent periodic re-training thereafter, pursuant to the training program required by § 213.343(g). In addition, all individuals qualified on CWR for train operations must successfully complete a recorded examination on the track owner's CWR procedures. This recorded examination may be, for example, a traditional written examination, an electronic file of a computerized interactive training course that concludes with an examination, or a record of a supervisor's oral testing of the employee's knowledge through practical field application. Due to the language of the regulation, track owners have flexibility to test an individual's knowledge to one of the previously stated methods. However, it should be noted that the results of the examination must be recorded so that FRA may inspect the basis for the qualification of an individual under paragraph (c).

7(d) Persons not fully qualified to supervise certain renewals and inspect track as required in paragraphs (a) through (c) of this section, but with at least one year of maintenance-of-way or signal experience, may pass trains over broken rails and pull aparts provided that—

(1) The track owner determines the person to be qualified and, as part of doing so, trains, examines, and re-examines the person periodically within two years after each prior examination on the following topics as they relate to the safe passage of trains over broken rails or pull aparts: rail defect identification, crosstie condition, track surface and alinement, gage restraint, rail end mismatch, joint bars, and maximum distance between rail ends over which trains may be allowed to pass. The sole purpose of the examination is to ascertain the person's ability to effectively apply these requirements and the examination may not be used to disqualify the person from other duties. A minimum of four hours training is required for initial training;

(2) The person deems it safe and train speeds are limited to a maximum of 10 m.p.h. over the broken rail or pull apart;

(3) The person shall watch all movements over the broken rail or pull apart and be prepared to stop the train if necessary; and

(4) Person(s) fully qualified under § 213.7 are notified and dispatched to the location promptly for the purpose of authorizing movements and effecting temporary or permanent repairs.

Guidance: Paragraph (d) allows employees to be qualified for the specific purpose of authorizing train movements over broken rails or pull-aparts. This section requires the employees to have at least 1 year of maintenance-of-way or signal experience and a minimum of 4 hours of training, plus an examination (and periodic re-examination within 2 years of each examination) on requirements related to the safe passage of trains over broken rails and pull-aparts. The purpose of the examination is to ascertain the person's ability to effectively apply these requirements. A railroad may use the examination to determine whether a person should be allowed to authorize train movements over broken rails or pull-aparts.

The maximum speed over broken rails and pull-aparts shall not exceed 10 mph. However, movement authorized by a person qualified under this subsection may further restrict speed, if warranted by the particular circumstances. The person qualified under this paragraph must be present at the site and able to instantly communicate with the train crew so that the movement can be stopped immediately, if necessary.

Fully qualified persons under § 213.7 must be notified and dispatched to the location promptly to assume responsibility for authorizing train movements and effecting repairs. The word "promptly" is meant to provide the railroad with flexibility to pass trains over the condition prior to the time the fully qualified person would report to the scene. Railroads may permit persons qualified under § 213.7(d) to authorize multiple train movements over such conditions, but the person qualified under § 213.7(d) must examine the broken rail or pull-apart area initially, and before each subsequent movement, to ensure the location is safe for the passage of the next train.

7(e) With respect to designations under paragraphs (a) through (d) of this section, each track owner shall maintain written records of—

(1) Each designation in effect;

(2) The basis for each designation; and

(3) Track inspections made by each designated qualified person as required by § 213.241. These records shall be kept available for inspection or copying by the Federal Railroad Administration during regular business hours.

Guidance: Failure of the owner to have and maintain written records designating employees and the basis for each designation is a deviation from the TSS. Incomplete qualification records would also constitute a deviation from the standards. Designated employees include supervisors, inspectors, and those partially qualified to pass trains over broken rails and pull-aparts. Inspectors are also instructed to note that incomplete qualification records may not reflect the actual qualification of an individual. As such, a record deficiency shall not be the sole basis for a defect or civil penalty recommendation for not having a qualified designated person performing these functions. If there are questions about the qualifications of an individual, it will be necessary for the inspector to interview railroad or contractor employees.

§ 213.9 Classes of track: operating speed limits

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

[In miles per hour]

Over track that meets all of the requirements prescribed in this part for	***The maximum allowable speed for freight trains is***	***The maximum allowable speed for passenger trains is***
Excepted	*10*	*N/A*
Class 1 track	*10*	*15*
Class 2 track	*25*	*30*
Class 3 track	*40*	*60*

Over track that meets all of the requirements prescribed in this part for	***The maximum allowable speed for freight trains is***	***The maximum allowable speed for passenger trains is***
Class 4 track	*60*	*80*
Class 5 track	*80*	*90*

Guidance: The TSS classifies track solely on the basis of authorized speeds for freight and passenger trains. Tolerances are specified in the TSS for each class of track. A deviation beyond the limiting tolerances for Classes 1 through 5 requires repair, or reduction of speeds to the appropriate class. The only structural or geometry defect that is applicable on excepted track is gage exceeding 4 feet 10¼ inches.

The initial speed of any track is based on the design characteristics of the track. FRA does not set the speed, and railroads are required to keep track in compliance with the requirements of Part 213. In addition to track design characteristics, speeds may be set by other factors such as the type of signal apparatus. Maximum speeds are also limited if a signal system is not in place on a track (refer to 49 CFR § 236 for further information).

If a deviation exceeds Class 1 standards, operations may continue for not more than 30 days over the deviation, not exceeding Class 1 speeds. This is only permitted after a person designated and qualified in the provisions of § 213.7(a), determines that operations may safely continue and specifies limiting conditions, if any. The designated person must have personally seen and evaluated the deviation. This section may also govern a deviation exceeding allowable gage on excepted track.

As described in paragraph (a), the maximum allowable operating speed for each class of track is shown in the table. However, the maximum allowable operating speed on a curve is also limited by the geometry parameters contained in § 213.57(b) [Unbalance] and § 213.59(a) [Superelevation]. For example, a speed for a passenger train based on the elevation at a curve may be only 18 mph, even though the track may otherwise comply with a higher track class.

The rule is to provide a railroad or track owncer additional flexibility in resolving defective conditions while continuing rail service over the track. One loose frog bolt, out of several, would seldom constitute an immediate hazard, provided that the frog was otherwise secure. On the other hand, a missing cotter pin in a critical location such as in a connecting rod could have serious consequences.

One or two loose braces are usually not considered to be an immediate hazard, provided that the other braces are in acceptable functional condition to support the stock rail. On the other hand, several consecutively loose braces, especially in the higher track classes, could be much more serious.

Intermittent patches of vegetation that brush the sides of rolling stock may not be an immediate hazard, but more severe vegetation might have the potential of contributing to the injury of an employee who is riding on the side of a car or looking out locomotive cab windows. The specific description for this type of defect is “vegetation brushing sides of rolling stock that prevents employees from visually inspecting moving equipment from their normal duty stations" (213 defect code 0037E3).

As the above examples illustrate, non-class-specific defects (not associated with a particular track classification) must be considered in the context of the specific circumstances involved. The existence of a non-class-specific defect under one set of circumstances may not be serious, while the identical condition under other circumstances may constitute a serious safety concern.

Although some non-class-specific defects may not present an immediate hazard, these conditions will only degrade under train traffic. Therefore, it is important for the railroad or track owner and FRA inspectors to record these defects for remedial or corrective action. In summary:

1. Record all noncomplying conditions, including non-class-specific defects such as loose or missing frog bolts or switch braces. Care must be taken to conduct a thorough inspection, recording the location, type, and size of each defect discovered.
2. Evaluate the remedial action taken by the carrier. If an inspector becomes aware that the remedial action, or lack thereof, for a non-class-specific defect is not sufficient based on the circumstances, the inspector should seek a more appropriate action from the carrier. For a non-class-specific defect that is an imminent hazard, such as a missing nut on a connecting rod, the inspector should immediately inquire as to the remedial action planned by the carrier.
3. If the railroad does not initiate an appropriate remedial action, the inspector should consider recommending a violation. If the railroad has been advised that a violation has been recommended and has not initiated appropriate remedial action, the inspector should be prepared to issue a Special Notice for Repairs, under the guidelines described in Chapter 4 of this manual.
4. In the case of a non-class-specific defect that did not pose an immediate hazard when the defect was recorded and the inspector discovers that no action was taken within a reasonable time frame after the carrier had knowledge of the defect, the inspector should consider the enforcement options described in item 3 above. In any case, if no appropriate action was taken within a 30-day period, the inspector should consider the enforcement tools outlined above.

When a railroad inspector discovers a non-class-specific defect (as with all defects) the railroad inspector must initiate immediate action in accordance with § 213.233(d). The remedial action taken by the railroad inspector must be recorded in accordance with § 213.241(b). For non-class-specific defects, the record must show a reasonable explanation of the action taken. For example, "repaired before next train" would be appropriate for serious conditions. On the other hand, a notation for a defect such as vegetation that indicates it is scheduled for cutting by a weed mower by a specific date within 30-days may be appropriate.

When a railroad representative places a slow order on a segment of track for a defect for immediate corrective action, any other items within the same slow order segment would be "protected". For example, an FRA inspector finds a defect at Milepost (MP) 5.5 and railroad immediately places a slow order from MP 5.0 to MP 6.0. During the same inspection, the FRA inspector also finds a condition at MP 5.8 that would be a defect without the speed restriction. While the defect at MP 5.8 is under the slow order just imposed, it was obviously a defect prior to the placement of the temporary restriction. The FRA inspector can record a defect at MP 5.8.

A non-class-specific defect may not pose an immediate hazard for one train movement, but the condition may deteriorate to become a hazard to following trains. It is reasonable to expect that conditions such as loose or missing frog bolts or braces be repaired as quickly as possible. However, a qualified railroad representative under § 213.7 may determine that the condition is not an immediate hazard and decide to call for assistance to make the repairs, or the representative may decide to end the inspection, retrieve the necessary repair materials, and return later to make the repairs. In some cases, the representative may determine that a speed restriction is appropriate.

When non-class-specific defects are scheduled for repair, railroad inspectors shall continue to report the defect on their inspection reports until it is corrected. However, the 30-day limit for any given defective condition cannot be exceeded.

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

Guidance: A track segment must meet all the requirements for its designated class. Where a track segment does not meet all the requirements, railroads can reclassify the segment for the next lowest class for which it complies. For example, on a Class 3 Track, where the alinement mid-chord offset from a 62-foot chord on a tangent track measured 2-inches, the railroad can elect to reduce the speed equivalent to Class 2 track.

Trains may continue to operate over a noncomplying condition under § 213.9(b). However, the 30-day limit for any given condition cannot be exceeded. The 30-day period commences when:

- An FRA inspector notifies the carrier or issues notice with a F6180.96 form.
- A person designated under § 213.7 records the defect on a track owner's record of inspection.
- Notices of substandard conditions are received from third parties.
- The track owner is deemed to have constructive knowledge if the defects were discoverable through properly performed track inspections required by the TSS, even if the defects are not reported on the owner's record of inspection.

Several other points concerning § 213.9(b) should be noted:

- FRA inspectors should not attempt to predict an exact date on which a sub-Class 1 defect first existed. In most cases, a reasoned approximation (with accompanying explanation of the basis for the inspector's conclusions) will be sufficient to show that § 213.9(b) is not available to the track owner. Because of the serious enforcement problems presented by application of the constructive knowledge test, inspectors should use this authority judiciously.

- Once a determination has been made that operations may safely continue over a segment, the 30-day period applies to all sub-Class 1 defects present in the segment at that time. The 30-day period is an appropriate remedial action for sub-Class 1 defects and the 30-day period can only be applied one time. At the expiration of the 30-day period, the defects must be repaired, track placed into excepted track status, or the track must be removed from service.
- The limiting conditions, if any, placed on operations must be in a form generally used by the track owner to communicate operating restrictions to its personnel and to any other railroads authorized to use the track involved. If a train operating over the track fails to comply with any such condition, one violation of § 213.9(b) by the track owner has occurred, regardless of the identity of the operator of the train.
- Section 213.9(b) does not apply where defective rails are involved. Section 213.113 exclusively governs further operations over defective rails.

The following table shows examples of those sections in the TSS that are “class specific,” “speed defined” and “non-class-specific.” This table is not all-inclusive and is only a reference instrument. Inspectors should refer to the specific guidance under each section for further details and instructions on each item listed in the table.

Section	Topic	Class specific	Speed defined	Non-class-specific [1]
213.33	Drainage			X
213.37	Vegetation			X
213.57(b)	Curves; elevation and speed limitations (V-Max)		X	
213.103	Ballast; general			X
213.109(b)	Crossties not effectively distributed			X
213.110	Gage Restraint Measurement Systems	X		
213.113	Defective rails		X	
213.119	Continuous welded rail; general			X
213.121 (a)	Each rail joint, insulated joint, and compromise joint shall be of a structurally sound design and dimensions for the rail on which it is applied			X
213.121 (c)	If a joint bar is cracked or broken between the middle two bolt holes it shall be replaced	X[3]		
213.121 (d)	In the case of conventional jointed track, each rail shall be bolted…, and with at least one bolt on Class 1 track	X		
213.121 (e)	In the case of continuous welded rail track, each rail shall be bolted with at least two bolts at each joint	X[3]		

Section	Topic	Class specific	Speed defined	Non-class-specific [1]
213.121 (f)	Each joint bar shall be held in position by track bolts tightened to allow the joint bar to firmly support the abutting rail ends…..			X
213.127	Rail fastenings			X
213.133 (a)	Turnouts and track crossings generally			X [2]
213.133(b)	Classes 3 through 5 … shall be equipped with anchors on each side of track crossings and turnouts…	X		
213.133(c)	Each flangeway at turnouts and track crossings shall be at least 1½ inches wide	X		
213.135(a)	Each stock rail must be securely seated in switch plates…			X
213.135(b)	Each switch point shall fit its stock rail		X	X
213.135(c)	Each switch shall be maintained so that the outer edge of the wheel tread cannot contact the gage side of the stock rail.			X[2]
213.135(d)	The heel of each switch rail shall be secure….			X
213.135(e)	Each switch stand and connecting rod shall be securely fastened….			X
213.135(f)	Each throw lever shall be maintained so that it cannot be operated with the lock or keeper in place.			X [2]
213.135(g)	Switch position indicator			X
213.135(h)	Unusually worn or chipped switch points…			X [2]
213.135(i)	Tongue and plain mate switches…	X		
213.137(b)	If a frog point is chipped, broken, or worn more than ⅝ inch down and 6 inches back, operating speed over that frog may not be more than 10 mph		X	
213.137(c)	If the tread portion of a frog casting is worn down more than ⅜ inch below the original contour, operating speed over that frog may not be more than 10 mph …		X	
213.139(a)	The outer edge of a wheel shall not contact the gage side of a spring wing rail.			X [2]
213.139(b)	The toe of each wing rail shall be solidly tamped…			X
213.139(c)	Each frog with a bolt hole defect or head-web separation shall be replaced.	X		
213.139(d)	Each spring shall have compression…			X

Section	Topic	Class specific	Speed defined	Non-class-specific [1]
213.139(e)	The clearance between the holddown housing and horn…			X
213.141	Self-guarded frogs	X		
213.205	Derails			X

[1] Non-class-specific defects found during an inspection by a qualified railroad inspector and not immediately repaired must be noted on the track inspection form. If not immediately repaired, remedial action shall be taken by an individual qualified under § 213.7 (a). The 30-day period represents the maximum duration that FRA permits any non-class-specific defect(s) to remain in the track. Furthermore, it is not intended to create a 30-day timeline for all types of defects as immediate repair or a more restrictive appropriate action may be required at the time of the defect(s) discovery.

[2] While Part 213 does not require the railroad to take the track out of service, due to the severity of these defects, FRA recommends that railroads take the track out of service. At a minimum, however, the railroad should invoke § 213.9(b).

[3] This class specific defect requires remedial action § 213.9(b).

§ 213.11 Restoration or renewal of track under traffic conditions

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

Guidance: This section specifies that a person designated under § 213.7(a) must provide continuous supervision during work periods when track with conditions not complying with the designated class is under traffic conditions. The section is specific in that each phase of the restoration or renewal need not be under the visual supervision of that person, but the person must be present at the job site in direct control of the work and have direct knowledge of the condition of the track over which they permit a train or trains to pass.

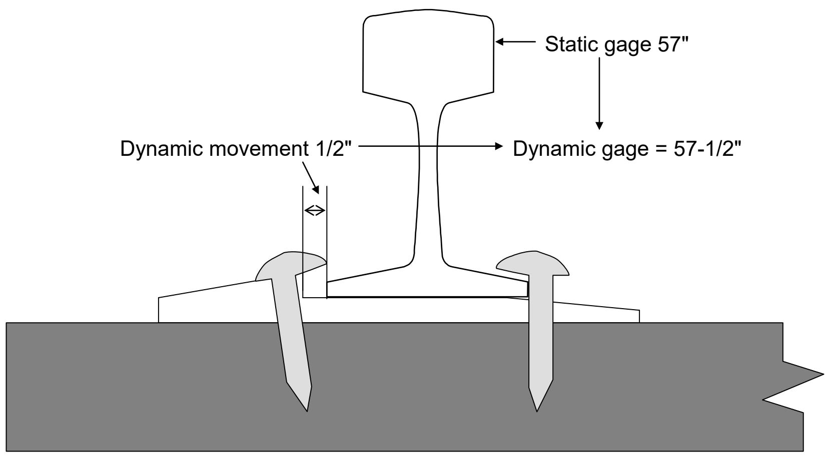
The qualified person at a work site may determine that it is safe to permit a train to pass through the work area at any speed up to the permanent speed on the track. For example, during a crosstie and resurfacing project, the qualified person may analyze the conditions present and authorize a speed higher than 10 mph through the limits of the work when temporary crosslevel conditions exceed the limits in § 213.63 for Class 1 track. Similarly, a welder may permit a train to pass over a frog when the welding and grinding process temporarily removes the point more than 6 inches back and ⅝-inch down. At the end of the work period, when the designated person leaves the work site, the track must be in compliance with the TSS. It is acceptable for the designated person to determine that the track is safe for operation at Class 1 speeds and use § 213.9(b) as a remedial action.

Continuous supervision may be met if the work is broken into a number of segments over a large area. Inspectors must use judgment and experience in applying this limitation to the general rule. The essential questions are whether the specific circumstances of a given project actually permit effective supervision by the designated person, and whether such supervision is being properly exercised. An example of an acceptable application of this paragraph would be a large tie and surfacing unit that has cleared a track for a short period to allow the passage of a train based on the qualified person determining that the track is safe for operation. On the other hand, if a switch gang is working separately from the tie and surfacing crew in the same general vicinity, a qualified person must be with that work unit.

§ 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.

Guidance: In addition to the static (unloaded) geometry measurements taken, the amount of visually detectable dynamic (loaded) deflection that occurs under train movement must be considered. This includes the amount of vertical or lateral rail deflection occurring between a rail base and Each deflection under the running rails must be measured and properly considered when computing the collective deviations under load. It is very important that consideration be given to both rails when measuring these deflections.



Vertical and lateral deflections may be found at locations such as rail joints and turnout locations with poor wooden crossties and conventional cut-spike fastening conditions or at bridge abutments and over culverts where the subgrade has settled.

§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.

Guidance: The section defines what is meant by curved track for the purpose of application of application of requirements for 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. This definition is intended to apply in all sections where limits for curved track are specified, unless otherwise provided.

Please note that, by implication of this section, track measurement systems required for compliance with part 213 must be able to detect curves with this minimum specified degree of curvature.

§ 213.15 Penalties

15(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 $500 and not more than $11,000 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 $22,000 per violation may be assessed. "Person" means an entity of any type covered under 1 U.S.C. 1, including but not limited to the following: a railroad; a manager, supervisor, official, or other employee or agent of a railroad; any owner, manufacturer, lessor, or lessee of railroad equipment, track, or facilities; any independent contractor providing goods or services to a railroad; any employee of such owner, manufacturer, lessor, lessee, or independent contractor; and anyone held by the Federal Railroad Administrator to be responsible under §213.5(d) or §213.303(c). Each day a violation continues shall constitute a separate offense. See Appendix B to this part for a statement of agency civil penalty policy.

15(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.

Guidance: This section covers all subparts of Part 213, including a schedule of civil penalties found under Appendix B to Part 213 – Schedule for civil Penalties..

§ 213.17 Waivers

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

Guidance: Inspectors have no authority under the TSS to grant waivers.

17(b) Each petition for a waiver under this section must be filed in the manner and contain the information required by Part 211 of this chapter.

Guidance: Per 49 CFR 211.7(b) and 211.45(f), any petition for waiver must be filed by the owner or designated operator with the Docket Clerk, Office of Chief Counsel, in Washington, D.C. The petition can also be filed by a trade association, such as Association of American Railroads (AAR), on behalf of its members. In addition to this chapter, inspectors should also reference the FRA Office of Railroad Safety's General Manual, Chapter 5 Complaint and Waiver Investigations, for guidance and information regarding waiver procedures.

General Manual, Chapter 5 (page 153) indicates that waiver petitions may also be addressed to a FRA manager or specialist. In the past, most petitions have been addressed to the chairperson of the FRA Railroad Safety Board as most waivers are decided by the board.

17(c) If the Administrator finds that a waiver is in the public interest and is consistent with railroad safety, the Administrator may grant the exemption subject to any conditions the Administrator *deems necessary. Where a waiver is granted, the Administrator publishes a notice containing the reasons for granting the waiver.*

Guidance:Typically, waivers bear the signature of AA/Chief Safety Officer, or his/her delegate. Inspectors should keep updated with any waivers in effect in their assigned territory which are relevant to their job activities.

§213.19 Information collection

19(a) The information collection requirements of this part were reviewed by the Office of Management and Budget pursuant to the Paperwork Reduction Act of 1980 (44 U.S.C. 3501 et seq.) and are assigned OMB control number 2130-0010.

19(b) The information collection requirements are found in the following sections: §§213.4, 213.5, 213.7, 213.17, 213.57, 213.119, 213.122, 213.233, 213.237, 213.241, 213.303, 213.305, 213.317,213.329, 213.333, 213.339, 213.341, 213.343, 213.345, 213.353, 213.361, 213.369.

Subpart B – Roadbed

§ 213.31 Scope

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

§ 213.33 Drainage

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

Guidance: One of the most essential elements of track maintenance is a comprehensive drainage system. Drainage facilities (bridges, trestles, or culverts) should be given careful detailed consideration during inspections. Openings under the track are used to channel and divert water from one side of the roadbed to the other.

The rule specifies that each drainage structure shall be maintained and the inspector should note conditions that would affect the integrity of the structure, such as culvert pull-aparts or separations, crushing or uneven settlement due to failure of or lack of head walls (in conjunction with frost action), too steep a gradient, and insufficient support.

Drainage openings must also be inspected and notice given where debris has accumulated to such an extent that expected water flow cannot be accommodated.

Most railroad drainage structures have existed for many years and, if properly maintained and kept free of debris, they are considered adequately designed to accommodate expected water flow, even though recent high-water marks may be slightly above the inlet opening.

Culverts designed with submerged inlets are common. Where questions are raised concerning the adequacy of drainage structures, the regional track specialist should be consulted.

Inspectors must take note of the conditions of:
- Right-of-way ditches.
- Culverts, trestles, and bridge inlets.
- Water carrying structures or passageways.
- Outlets or tail ditches.
- Berm ditches.
- Scouring of embankments, piling or piers in channels or at abutments.
- Filling in of passageways from silting, sand wash, or debris.

Inspectors must notify the track owner of any drainage condition deemed hazardous, or potentially hazardous, to the safety of train operations over the track.

§ 213.37 Vegetation

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

37(a) Become a fire hazard to track-carrying structures;

Guidance: Inspectors must be aware that live and dead growth, drift, tumbleweeds, debris, etc., can constitute fire hazards to timber bridges, trestles, wooden box culverts, and other track carrying structures.

37(b) Obstruct visibility of railroad signs and signals;

(1) along the right-of-way, and

(2) at highway-rail crossings; (This paragraph (b)(2) is applicable September 21, 1999.)

Guidance: This paragraph includes a requirement to clear vegetation from signs and signals along railroad rights-of-way and at highway-rail grade crossings. Because the scope of Part 213 limits vegetation requirements to railroad property, this is not intended to be an attempt to dictate standards for surrounding landowners. This paragraph also requires signs and signals on railroad property at highway-rail grade crossings be kept clear of vegetation and is intended to provide adequate visibility of these devices for the traveling public. It is not intended to preempt State or local requirements for the clearing of vegetation on railroad rights-of-way at highway-rail grade crossings.

Obstruction of the visibility of railroad signs and signals by vegetation is a deviation from the TSS. Although all signals are important, the visibility of certain signals must be closely observed [i.e., block signals, interlocking signals, speed signs (or other signs affecting the movement of trains), close clearance signs, whistle posts, and mileposts].

37(c) Interfere with railroad employees performing normal trackside duties;

Guidance: Judgment must be exercised by the inspector in determining whether trackside vegetation will interfere with the railroad employees' performance of normal trackside duties. Weeds covering the track that hinder the ability of an inspector to see track structure components is not necessarily a noncomplying condition.

37(d) Prevent proper functioning of signal and communication lines; or

Guidance: Before citing the railroad for vegetation interfering with signal or communication lines, the inspector must confirm that the line is active. Occasionally, inspectors may observe vegetation in lines that they are unsure if they are functional. Communication between the Track inspector and the FRA Signal and Train Control inspector is necessary if the railroad representative cannot confirm the status of a signal or communication line. When interfering with active lines, vegetation may cause false signal indications and/or disrupt communications that are vital to safe train operations. When there are questions regarding vegetation and the signal lines, joint inspections by track and signal personnel are encouraged. The Track inspector will issue violation reports, if necessary, with concurrence of the Signal inspector.

37(e) Prevent railroad employees from visually inspecting moving equipment from their normal duty stations.

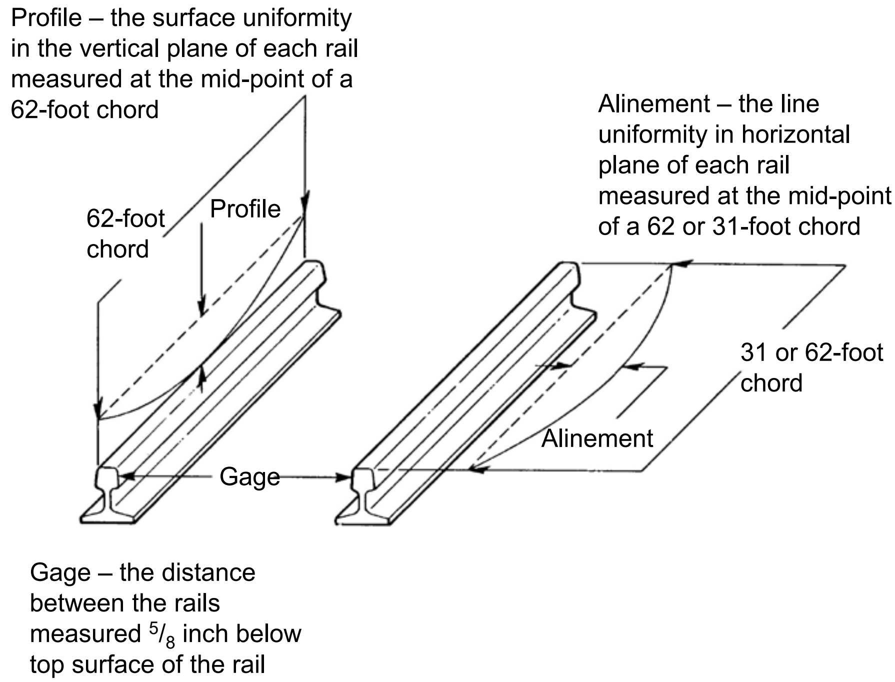
Guidance: There are several ways in which vegetation can prevent railroad employees from visually inspecting moving equipment. For example, if vegetation is striking the window of the locomotive cab, that can interfere with a train crew's ability to observe rolling stock. Or, if vegetation is striking trains, that can interfere with ground employees' ability to observe the rolling stock during switching operations.

Subpart C – Track Geometry

§ 213.51 Scope

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

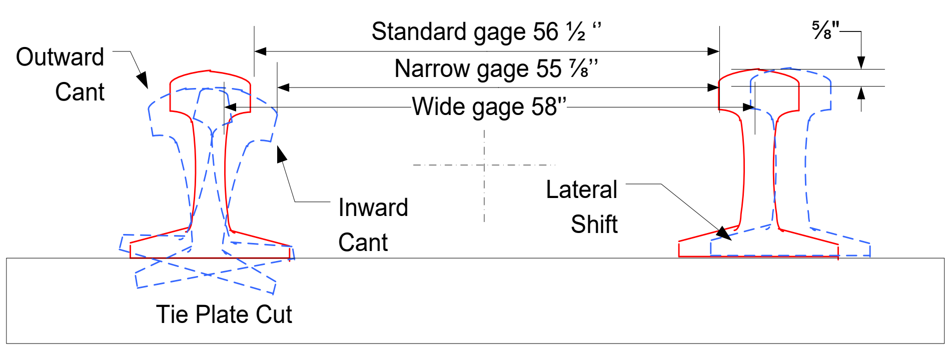
Guidance: See the following figure for an illustration of basic track geometry concepts.



§ 213.53 Gage

53(a) Gage is measured between the heads of the rails at right angles to the rails in a plane five-eighths of an inch below the top of the rail head.

Guidance: See the following figure for an illustration of gage measurements.



53(b) Gage must be within the limits prescribed in the following table:

Class of Track	***The gage must be at least -***	***But not more than -***
Excepted track	*N/A*	*4'10¼"*
Class 1 track	*4' 8"*	*4' 10"*
Class 2 and 3 track	*4' 8"*	*4' 9¾"*
Class 4 and 5 track	*4' 8"*	*4' 9½"*

Guidance: This rule establishes the minimum and maximum limits for gage on all tracks and differentiates with the authorized speed, including a maximum gage dimension of 4 feet 10¼ inches for track in excepted status under § 213.4.

Inspectors will make measurements at sufficient intervals to assure that track is being maintained within the prescribed limits. Particular attention should be given to track gage in turnouts or locations where high lateral train forces are expected or evident. These areas include the curved closure rails, the toe and heel of frogs, the curved track behind the frog and several feet ahead of the switch points.

Where line or surface irregularities are observed by the inspector, the gage should be measured. Remember to look for evidence of lateral rail movement as required in § 213.13.

An accurate standard track gage device or a rule graduated in inches is an acceptable measuring device. Gage not within the specified limits of the TSS is in noncompliance.

§ 213.55 Track alinement

55(a) Except as provided in paragraph (b) of this section, alinement may not deviate from uniformity more than the amount prescribed in the following table:

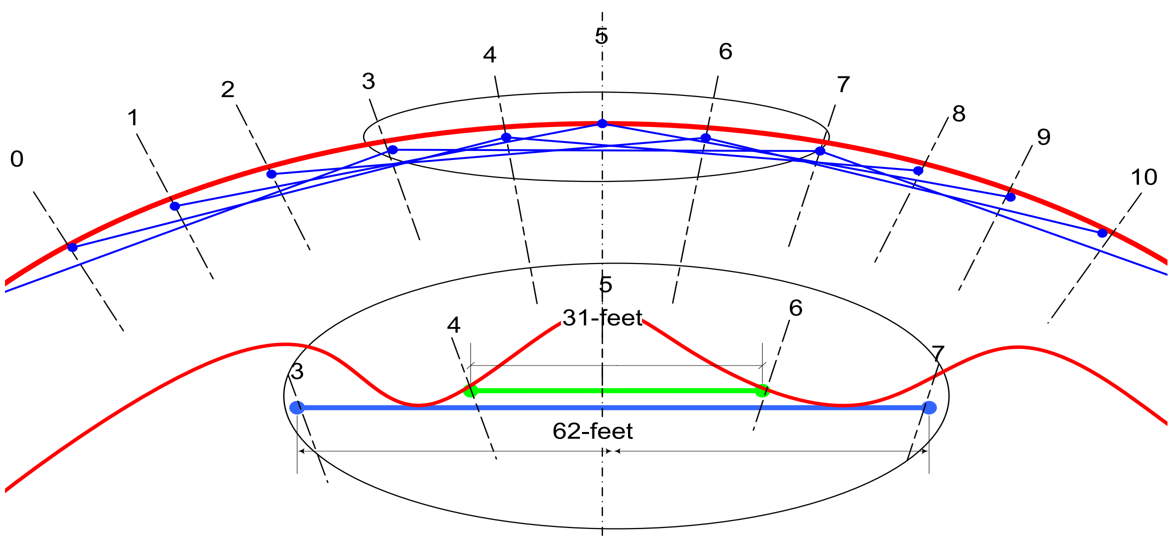
Class of Track	*Tangent Track*	*Curved Track*	
	The deviation of the mid-offset from a 62-foot line [1] may not be more than—(inches)	*The deviation of the mid-ordinate from a 31-foot chord[2] may not be more than—(inches)*	*The deviation of the mid-ordinate from a 62-foot chord [2] may not be more than—(inches)*
1	*5*	*N/A [3]*	*5*
2	*3*	*N/A [3]*	*3*
3	*1¾*	*1¼*	*1¾*
4	*1½*	*1*	*1½*
5	*¾*	*½*	*⅝*

[1] The ends of the line must be at points on the gage side of the line rail, five-eighths of an inch below the top of the railhead. Either rail may be used as the line rail, however, the same rail shall be used for the full length of that tangential segment of track.   *[2] The ends of the chord shall be at points on the gage side of the outer rail, five-eighths of an inch below the top of the railhead.*   *[3] N/A - Not Applicable.*

Guidance: This paragraph establishes the maximum alinement deviations allowed for tangent and curved track in Classes 1 through 5 track.

Alinement is the variation in curvature of each rail of the track. On tangent track, the intended curvature is zero; thus, the alinement is measured as the variation or deviation from zero. In a curve, the alinement is measured as the variation or deviation from the "uniform" alinement over a specified distance. The inspector should note that the procedures for determining uniformity in Classes 6 through 9 are similar to the procedures described below. However, there are differences in the spacing of the stations and the application of the chord measurements.

The point of greatest alinement deviation usually can be detected visually or may be located by moving the chord along the track in increments until the point with maximum deviation is found. In curves, the mid-ordinate, alternatively called mid-chord offset (MCO), require "stations" to be marked at regular intervals on the high rail in both directions from the point in question. In tangent track, the MCO is measured directly with a 62-foot chord and graduated ruler. In curves, a 62-foot chord is used in Classes 1 through 5 and a 31-foot chord is also used in Classes 3 through 5. The term MCO is used interchangeably for "mid-ordinate" and "mid-offset" and represents the distance from the rail to the chord at the mid-point of the chord. For curves in Classes 3 through 5 track, an alinement defect may be in noncompliance with either the maximum limits for the 31-foot chord or the 62-foot chord, or both. A 31-foot chord is particularly necessary for determining short alinement deviations. Inspectors must be aware that a 62-foot chord may be "blind" to short alinement conditions, whereby a 31-foot chord can detect those noncomplying conditions. See the following figure.



In Classes 3 through 5, both the 31-foot and 62-foot chords must be used, and corresponding measurements must be calculated to determine compliance with the required alinement thresholds. If alinement defects are found using both the 31-foot and the 62-foot chord, the inspector should report the item as one defect and note that the defect does not comply with the requirements for the second chord, e.g., "1¾ inches alinement deviation on curved track for 62-foot chord. Note: 1⅜ inches alinement deviation for 31-foot chord at this location."

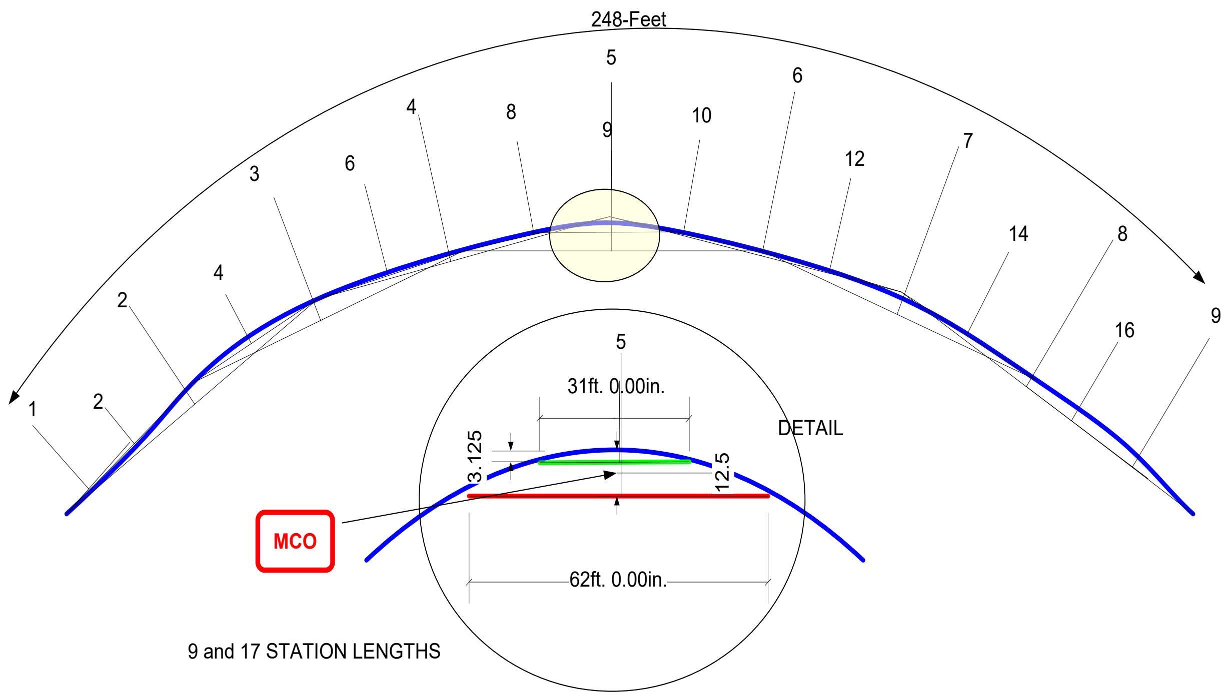
The chord line (string) will be stretched and held taut between two points on the rail, five-eighths inch below the top running surface of the rail. Measure the MCO between the rail and the string with a graduated ruler, using blocks to compensate for shallow curvature and special trackwork, if necessary.

Since a true tangent has zero MCO, the measurement taken can be compared directly to the alinement table under § 213.55 to determine compliance. On a curve of constant curvature or each arc of a compound curve, mid-ordinates at all station points are equal when measured from chords of equal length, exclusive of spirals. MCOs, when measured from chords of equal length, are nearly proportional to the degree of curvature.

Degree of curvature is the angle subtended at the center of a simple curve by a 100-foot chord. Degree of curvature can be conveniently measured using either a 31- or a 62-foot chord. Obtaining the degree of curvature coupled with the average elevation in the area in question is necessary to determine maximum authorized speed. Please refer to § 213.57 for a discussion on the determination of curvature.

Deviation of alinement on a curve requires determination of the MCO over a specified number of stations and the average of those values. The difference between the MCO at the point of concern and the average must not exceed the maximum deviation specified in the table in § 213.55(a).

An optional method to determine average alinement includes 17 stations spaced at 15 feet 6 inches (see table below). For curves in Classes 3 through 5, it is necessary to determine compliance with the requirement for the maximum deviation of the MCO from a 31-foot chord in addition to the 62-foot chord. The following figure illustrates the method to determine alinement deviation using both chords.



When using the above procedures, the distance between the first and last MCO will be 248 feet. However, note that in order to measure the MCO at the first and last stations, the inspector must place the end of the string a station beyond the first and last one measured. As a reference, the following table summarizes the acceptable proper chords, station spacing, and number of stations to determine alinement compliance.

Alignment Stations					
Geometry	Class	Chord (feet)	Total No. Stations	Station Spacing (feet)	Curve Length (feet)
Curve	1-2	62	9 or	31	248
		62	17	15½	248
	3-5	31	17	15½	248
		62	9 or	31	248
		62	17	15½	248
Tangent	1 - 5	62	1	n/a	n/a

As previously indicated, the suspected alinement location in a curve body is calculated by measuring an equal number of stations on each side of the area in question. For the majority of occurrences, averaging the MCOs on both sides of the location in question will develop sufficient data to determine "uniform alinement." However, if the location in question is close to or in a spiral, uniformity must be determined in a different manner. If the location is located at the portion of a curve body close to a spiral, measure the stations in the curve body only. That is, shift the averaging area sufficiently so that none of the MCOs are in the spiral.

When measuring the body of a curve with a length that is less than the distance spanned by the required number of stations, reduce the numbers of stations accordingly. When measuring a compound curve, it will be necessary to measure the MCOs within a sufficient portion of the entire curve to determine where the curve bodies exist. Treat each curve body as a separate curve and be governed by the above instructions.

Over the years, railroads have traditionally used a 31-foot chord to determine MCOs for higher degree curves. Although it is more difficult to measure from the rail to the MCO at high degree curves, the inspector must determine alinement compliance in accordance with both the 62 and 31-foot chords described in this section.

In spirals, the alinement gradually changes from tangent to the full degree of curvature at the curve body. The projected MCO values must be established, which is a function of actual curvature at a specific point on the spiral, curvature (of the curve body) and spiral length. The first step is to determine the tangent to spiral (TS) and spiral to curve (SC). There are several ways to determine TS and SC. An inspector can reference geometry car measurements, if available. Alternatively, he/she can measure alinement MCOs along the entire spiral length, ensuring a sufficient distance into the adjoining curve body and tangent track to accurately locate TS and SC.

Once TS and SC are determined and marked, the actual curvature at any point on the spiral can be easily calculated with known curvature of the curve body and spiral length - the distance between TS and SC. For example, at a point 100 ft from TS on a spiral, the curvature is

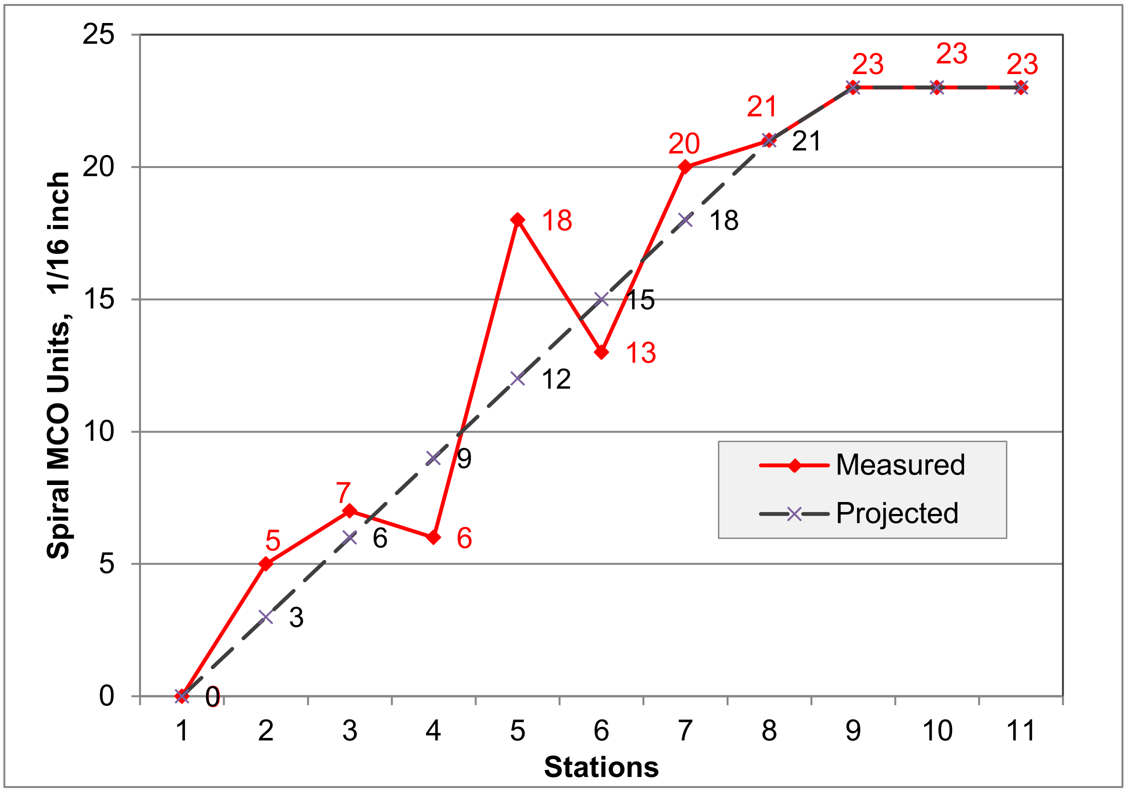
$$D_i = D \times \frac{100}{L_s}$$

Where
D_i = the actual curvature at the i^{th} point on the spiral, *degrees*
D = curvature of the curve, *degrees*,
L_s = spiral length, *ft*

With known spiral curvature, the 31-ft or 62-ft MCOs can be projected based on curvature-to-MCO extrapolation (e.g. 1 degree curvature yields approximately 1” 62-ft MCO or ¼” 31-ft MCO).

Plot the measured values along with projected values in a graph or construct a table of the measured and projected values. The deviation at the point of concern will be the difference between the measured and the projected MCO values. Use the curve values from the alinement table to determine compliance in spirals.

The following figure represents a hypothetically case where the spiral length is 248 ft. (9 stations spaced at 31 ft). The chart would approximate a 1.44 degree curve whose curvature is gradually increased from 0 (at TS) to 1.44 degrees (at SC). The figure shows a spiral calculation for 62-foot chord with MCO units in $^1/_{16}$-inch increments. A similar analysis is required for 31-foot chord for Classes 3 through 5. At Station 5, the measured value is 18 units (1⅛ inches) and the projected value is 12 units (¾ inch); therefore, the deviation from uniformity is 6 units (⅜ inch).



For long spirals, especially in higher speed curves, it could become arduous to measure the entire spiral. Where it's feasible to determine the approximate locations of TS and SC, the inspector can opt to measure several stations (no more than 6 for either TS or SC) around the two pre-identified areas to pinpoint TS and SC to determine the spiral length. The inspector can then calculate the actual spiral curvature using the equation shown above. This actual spiral curvature is then extrapolated into projected/alimenent MCO (1 degree to 1" 62-ft MCO or ¼" 31-ft MCO). The inspector can take one single MCO measurement at the point of concern to determine compliance. The difference between the projected and measured alinement will be used to assess compliance, referencing the allowable values from the alinement table.

55(b) For operations at a qualified cant deficiency, E_u, of more than 5 inches, the alinement of the outside rail of the curve may not deviate from uniformity more than the amount prescribed in the following table:

Class of track	***Curved track***	
	The deviation of the mid-ordinate from a 31-foot chord[1] may not be more than—(inches)	***The deviation of the mid-ordinate from a 62-foot chord[1] may not be more than—(inches)***
Class 1 track[2]	*[3]N/A*	*1 ¼*
Class 2 track[2]	*[3]N/A*	*1 ¼*
Class 3 track	*¾*	*1 ¼*
Class 4 track	*¾*	*⅞*

Class 5track	½	⅝

[1]The ends of the chord shall be at points on the gage side of the outer rail, five-eighths of an inch below the top of the railhead.
[2]Restraining rails or other systems may be required for derailment prevention.
[3]N/A—Not Applicable

Guidance: The guidance for paragraph 55(a) also applies to this paragraph. However, the limits in the table of this paragraph applies only to operations at a qualified cant deficiency of more than 5 inches, and to outside rail of the curve. . Note that the limits for Class 4 and lower track have been tightened – most notably for Class 1 and 2 track 62-ft MCO. These limits were established based on computer simulations to provide sufficient margins of safety, as higher cant deficiency operations will result in higher lateral wheel loads.

As for any operation involving more than 5 inches of cant deficiency, the track owner or railroad must have the necessary FRA approval/documentation showing that the operations are qualified for a cant deficiency higher than 5 inches.

If the track owner or railroad, in response to an alignment exception to table 55(b), has posted a speed restriction which no longer corresponds to a cant deficiency of more than 5 inches, the inspector should use the limits in table 55(a) to assess alignment compliance.

§ 213.57 Curves; elevation and speed limitations

57(a) The maximum elevation of the outside rail of a curve may not be more than 8 inches on track Classes 1 and 2, and 7 inches on track Classes 3 through 5. The outside rail of a curve may not be lower than the inside rail by design, except when engineered to address specific track or operating conditions; the limits in §213.63 apply in all cases.

Guidance: The term "elevation of the outside rail" is relevant to the inside rail. In literature and in practice, it is also referred as superelevation. This paragraph does not imply that more than 6 inches of superelevation is recommended in a curve; rather the paragraph limits the amount of superelevation in a curve to control the unloading of the wheels on the outer rail, especially at low speeds. The limits establish the maximum superelevation at any point on the curve; which may not be more than 8 inches on Classes 1 and 2, and 7 inches on Classes 3 through 5. In curves, superelevation is measured by subtracting the relative difference in height between the top surface (tread) of the inside (low) rail from the tread of the outside (high) rail. Both this section and § 213.63 limit the amount of reverse elevation (outside rail lower than the inside rail). While the table in § 213.63 permits reverse elevation on a curve, the V_{max} formula must also be checked when reverse elevation is encountered. The inspector must substitute a negative number for the actual elevation in the formula as discussed below. The V_{max} formula applies only in the body of a curve.

The phrase "except when engineered to address specific track or operating conditions" is intended to address special cases, such as a turnout that comes off the high rail in a curve, to allow reverse elevation to be designed into the curve out of necessity and for safety reasons.

57(b) The maximum allowable posted timetable operating speed for each curve is determined by the following formula –

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

Where:

V_{max} = Maximum allowable posted timetable operating speed (m.p.h.).

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

E_u = Qualified cant deficiency[2] (inches) of the vehicle type.

D = Degree of curvature (degrees).[3]

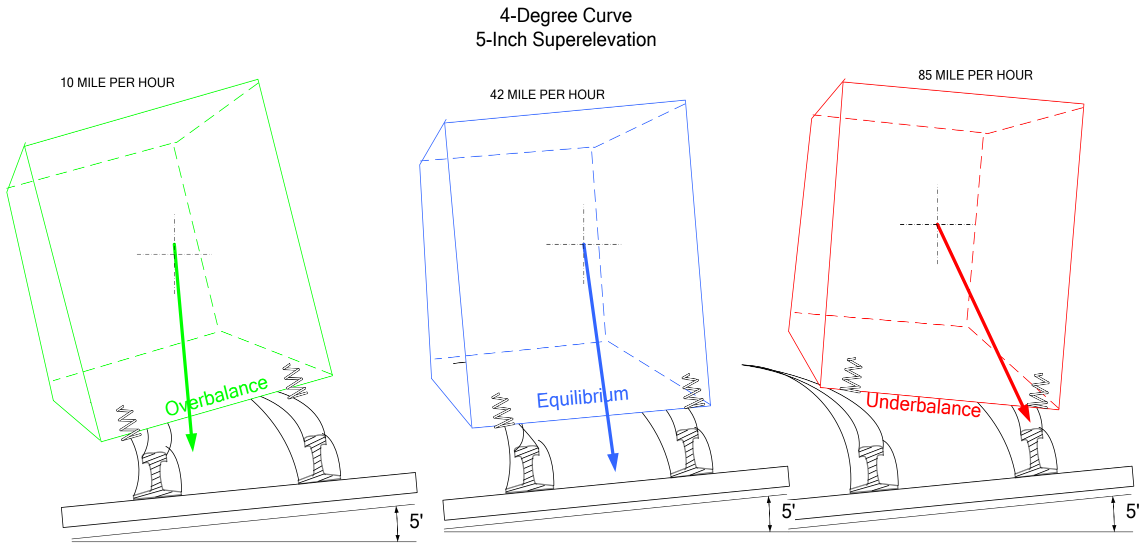
[1] Actual elevation, E_a, for each 15-foot track segment in the body of the curve is determined by averaging the elevation for 11 points through the segment at 15.5-foot spacing. If the curve length is less than 155 feet, the points are averaged through the full length of the body of the curve.

[2] If the actual elevation, E_a, and degree of curvature, D, change as a result of track degradation, then the actual cant deficiency for the maximum allowable posted timetable operating speed, V_{max}, may be greater than the qualified cant deficiency, E_u. This actual cant deficiency for each curve may not exceed the qualified cant deficiency, E_u, plus 1 inch.

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

Guidance: Paragraph (b) prescribes the formula to be used to determine the maximum train speed in curves based on average curve alinement in degrees, qualified cant deficiency, and the amount of superelevation at the same location.

A railroad car traveling around a curve is subjected to an outward horizontal centrifugal force that acts conceptually through a car's center of gravity away from the center of the curve and tends to overturn the car by directing its weight toward the outside rail. To counteract the centrifugal force, the outer rail is elevated over the lower rail, or superelevated. In effect, the combined effect of centrifugal force and weight produces a resultant force that is intentionally moved toward the center of the track. A balanced (equilibrium) condition implies the vertical forces on each rail are equal. The following figure illustrates three scenarios for the given curvature and superelevation. The chart in the center indicates that if the vehicle is traveling at 42 m.ph., the equilibrium will be achieved. The chart on the left is an overbalanced scenario, in which a net inward acceleration (weight shifting to low rail) will result as the vehicle travels slower than 42 m.p.h. The chart on the right represents an underbalanced scenario, in which a net outward acceleration (weight shifting to high rail) will result as the vehicle travels fasters than 42 m.p.h. Using the vMax formula in this example, 3 inches of unbalance allows a maximum posted timetable speed of speed of 54 mph. Tolerance for localized degradation of up to 1 inch (Eu+1) results in a maximum speed of 57 mph. (§213.57(a) would apply to overbalance)



In practice, railroads generally do not operate trains at balanced speed; that is, train speeds are set to move the resultant force toward the outer rail, resulting in an unbalance, typically less than 3 inches. Unbalance, also commonly referred as cant deficiency, is the theoretical amount of elevation that would have to be added to the existing elevation to achieve a balanced condition. The TSS for Classes 1 through 5 limits the amount of unbalance to 3 inches, except that higher unbalance is permitted for authorized and approved equipment types. Appropriate vehicle/track system qualification tests will apply to operations at cant deficiencies higher than 3 inches.

Safe curving speeds are dependent on the engineering characteristics of the specific equipment involved, as well as the track conditions. Equipment factors, such as center of gravity, suspension characteristics, and reaction to wind and other factors, are considered when FRA makes a decision to approve a particular level of cant deficiency for specified equipment.

Track inspectors can use the formula to assess compliance in two ways:

1) Calculating cant deficiency by inserting the posted timetable speed, actual superelevation (E_a), and curvature (D) at the time of inspection. If the resulting actual cant deficiency is higher than the qualified cant deficiency, there is a potential limiting speed defect.
2) Calculating maximum allowable operating speed by inserting the actual elevation (E_a), and curvature (D) at the time of inspection and qualified cant deficiency (E_u). If the resulting speed is lower than the posted timetable speed, there is a potential limiting speed defect.

Footnote 1 clarifies the procedure to establish the actual elevation E_a which states that 11 points at 15.5-foot spacing through the 155-foot evaluation segment will be averaged. In calculating elevation, 10 measurements are taken in addition to the point of concern — 5 on each side—so that a total of 11 points are actually averaged.

The method of 11-point average over 155-foot segment at 15.5-foot station spacing applies to both 31- and 62-foot chords and to the curve body only. If a curve's length is less than 155 feet, the measurements are averaged over the full length of the curve. In order to determine the average curvature, inspectors must calculate the degree of curvature based on the chord length used (either 31 or 62 feet) and the MCO measured at each station. For a 31-foot chord, the degree of curvature is determined by multiplying the MCO by a factor of four (e.g., one-quarter inch equals 1 degree). For a 62-foot chord, a one-to-one relationship exists (e.g., 1 inch equals 1 degree).

Footnote 2 permits the vehicle type to operate at the approved cant deficiency plus 1 inch, if the actual elevation, E_a, and the degree of track curvature, D, have changed as a result of track degradation. The note is intended to provide a tolerance to account for the effects of local superelevation or curvature conditions on V_{max} that may result in the actual cant deficiency exceeding the approved level for the equipment. The intent is to allow this tolerance for "local crosslevel or curvature conditions" that result in track degradation below the maintenance limits of the track owner/railroad. The footnote is not intended to provide a tolerance to be factored into the maintenance limits themselves. For example, if the "maximum allowable posted timetable operating speed" is based on a V_{max} corresponding to 3 inches of cant deficiency, the track owner/railroad should not establish maintenance practices that are intended to result in operation of equipment at a speed that produces up to 4 inches of cant deficiency. Yet in this example, should the equipment actually operate at a speed that produces over 3 inches of cant deficiency due to track degrading below the intended maintenance limits of the track owner/railroad, the track owner/railroad should not be penalized merely because the cant deficiency exceeds 3 inches.

Caution need to be paid when exercising this provision. Because a tolerance is now part of the regulation, not all exceedances are actual defects (i.e., actual instances of non-compliance). The Inspector should only record the condition as a defect if there is evidence that the maintenance practices of the track owner/railroad created a condition where the actual amount of cant deficiency exceeded the approved value. In this case FRA expects the track owner/railroad to take appropriate remedial action. The Inspector should consider writing a recommendation for civil penalty if the level of cant deficiency based on the maximum speed, elevation, and curvature exceeds the approved value, E_u, by more than 1 inch. When the actual cant deficiency is found to exceed the approved level, there are many scenarios that could involve compliance or non-compliance with the regulation, and all of these different scenarios cannot be easily described here. The Inspector should consider multiple factors when determining whether to assess a defect or recommend a violation. For example, if the Inspector can establish that a track has been recently machine-tamped and that it was not possible for the track to have degraded to the level of causing an exceedance of the approved cant deficiency in the time period after the tamping, the Inspector may assess a defect. In another example, if the track owner/railroad voluntarily performs spot maintenance on a curve, typically through spot-tamping, to bring the curve to uniformity (in terms of curvature and elevation), and the amount of cant deficiency still exceeds the approved level by a nominal amount, the Inspector should exercise his or her discretion whether to assess a defect. The Inspector should consider assessing a defect when the exceedance is close to the maximum tolerance, which leaves little room for further track degradation. In all cases, if the Inspector cannot determine whether a condition is out of compliance, or whether to assess a defect or recommend a civil penalty, he or she should consult with the Regional Track Specialist.

In addition to the limitations on reverse elevation contained in the table in § 213.63, the V_{max} formula limits the maximum authorized speed on a curve. Reverse elevation occurs when the inside rail is higher than the outside rail; that is usually the unintended consequence of track degradation. The condition can also occur where a turnout has been installed in a main track (e.g., an equilateral turnout constructed in a left-hand curve). Calculation of the maximum authorized speed for the curve with negative elevation is performed in the same manner as one with positive elevation. For example, the maximum authorized speed is approximately 13 mph for a curve segment with an average curvature of 4 degrees and 2½ inches of reverse elevation (both calculated over the 155 foot window or the length of the curve), the calculation for 3 inches of unbalance would be as shown below:

$$V_{\max} = \sqrt{\frac{E_a + E_u}{0.0007D}} = \sqrt{\frac{-2.5+3}{0.0007\times 4}} = 13\ mph$$

57(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 gives the speeds computed in accordance with the formula in paragraph 57(b), when E_u equals 3 inches, for various elevations and degrees of curvature.

Guidance: This paragraph provides that all vehicle types are considered qualified for up to 3 inches of cant deficiency.

57(d) Each vehicle type must be approved by FRA to operate on track with a qualified cant deficiency, E_u, greater than 3 inches. 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 four inch 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.

Guidance: The rule does not limit maximum level of cant deficiency in track Classes 1 through 5. However, the equipment must satisfy the requirements of this section. Consistent with the higher-speed standards in § 213.329, the requirements limit (1) vertical wheel load remaining on the raised wheels to no less than 60 percent of their static level values and (2) carbody roll for passenger cars to no more than 8.6 degrees with respect to the horizontal when the vehicle is standing (stationary) on track with a uniform superelevation equal to the proposed cant deficiency. The amount of superelevation will be the proposed cant deficiency.

For example, if the proposed cant deficiency is 5 inches, the superelevation used for demonstrating compliance with this paragraph is also 5 inches.

The requirements in paragraph (d) may be met by either static or dynamic testing. The static lean test limits the vertical wheel load remaining on the raised wheels and the roll of a passenger carbody with respect to the horizontal plane to the thresholds mentioned above. The dynamic test limits the steady-state vertical wheel load remaining on the low rail wheels to no less than 60 percent of their static level values and limits the lateral acceleration in a passenger car to 0.15g steady-state, when the vehicle operates through a curve at the proposed cant deficiency. This 0.15g steady-state lateral acceleration limit in the dynamic test is intended to provide consistency with the 8.6-degree roll limit in the static lean test, which corresponds to the lateral acceleration a passenger would experience in a standing vehicle with its carbody rolled 8.6 degrees with respect to the horizontal.

Measurements and supplemental research have indicated that a steady-state, carbody lateral acceleration limit of 0.15g is considered to be the maximum, steady-state lateral acceleration above which jolts from vehicle dynamic response to track deviations can present a hazard to passenger safety. While other FRA vehicle/track interaction safety criteria principally address external safety hazards that may cause a derailment, such as damage to track structure and other conditions at the wheel/rail interface, the steady-state, carbody lateral acceleration limit specifically addresses the safety of the interior occupant environment. This steady-state, carbody lateral acceleration will result in a lateral force, pulling passengers to one side of the carbody. It is not the same as sustained, carbody lateral oscillatory accelerations, or continuous side-to-side oscillations (hunting) of the carbody in response to track conditions, which could exist on both curved and tangent track.

57(e) 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[4] 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.

Guidance: This paragraph clarifies the submittal requirements to FRA to obtain approval

[4] The test procedure may be conducted whereby all the wheels on one side (right or left) of the vehicle are raised to the proposed cant deficiency, the vertical wheel loads under each wheel are measured, and a level is used to record the angle through which the floor of the vehicle has been rotated.

for the qualifying cant deficiency of a vehicle type. The load condition under which the testing is performed is required to be included in the description of the test procedure. The paragraph also includes the requirement for submitting suspension system maintenance information.

For vehicle types not subject to 49 CFR parts 238 or 229, such as a freight car operated in a freight train, the requirement for submitting suspension system maintenance information only to safety-critical components.

Footnote 4 specifies more detailed requirements if the cant deficiency requirement of 57(d)(1) is satisfied through static lean test.

57(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.

Guidance: The paragraph requires that a track owner/railroad notify FRA prior to the implementation of the approved higher curving speeds. The paragraph also clarifies that in approving the request made pursuant to paragraph (e), FRA may impose conditions necessary for safely operating at the higher curving speeds.

Where FRA has approved higher levels of unbalance, it becomes imperative that the inspector monitor the maximum authorized speeds based on the approved unbalance. The calculation of the maximum authorized speed for a particular segment of track involves the substitution of the approved unbalance in the V_{max} formula. For example, if FRA approved 5 inches of cant deficiency for a particular type of equipment, the maximum curving speed for a 6-degree curve segment with 4½ inches of elevation would be calculated as follows:

$$V\max = \sqrt{\frac{E_a + E_u}{0.0007D}} = \sqrt{\frac{4.5+5}{0.0007\times 6}} = 47 \text{ m.p.h.}$$

To determine an enforcement action, it is also necessary for the inspector to determine the actual unbalance based on the speed that the railroad is operating around the curve and the actual track conditions. In order to calculate the unbalance, the inspector must solve the following formula, which is the same V_{max} formula represented in a different form:

$$E_u = 0.0007 \cdot D \cdot V_{max}{}^2 - E_a$$

For example, if the railroad was operating around a curve at 89 m.p.h. and the inspector determined, by field measurements, that the average curvature and average elevation for a particular curve segment were 2 ¼ degrees and 5½ inches, respectively. The unbalance would be calculated as follows:

$$E_u = 0.0007 \cdot D \cdot V_{max}{}^2 - E_a = 0.0007 \times 2.25 \times 89^2 - 5.5 = 6.9 \text{ inch}$$

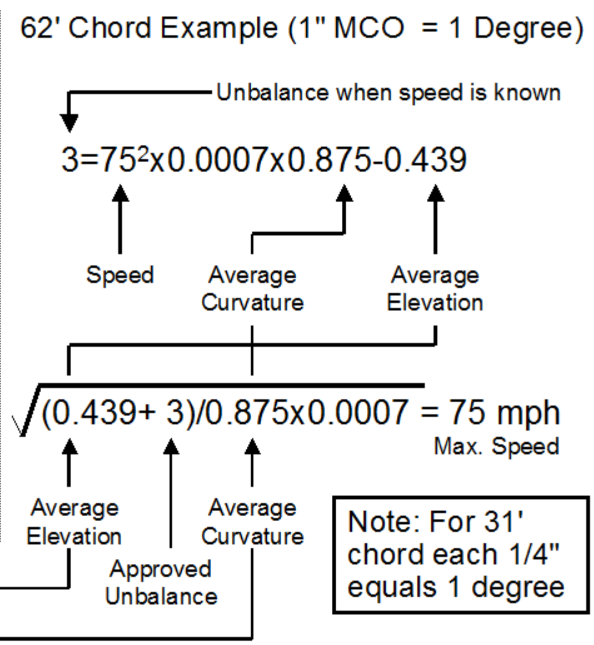
In this example, the operating speed has resulted in a cant deficiency of 6.9 inches, which is 1.9 inches over the approved level of 5 inches. As mentioned in the guidance for 57(b), the inspector should consider a recommendation for civil penalty. When vehicle types have been approved by FRA for curving speeds producing more than the approved level but not exceeding by more than 1 inch, inspectors may consider writing a defect according to the guidance in 57(b).

The following figure illustrates the relationship between curvature, elevation, and speed.

Stations Spaced 15.5'

Points	Elev. Inches	MCO Inches	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

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



57(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.

Guidance: This paragraph states that either a track owner or a railroad (operator), e.g. Amtrak or other commuter railroads, providing services over trackage of more than one track owner with the same vehicle type may provide the required documents to the FRA. However, the operator must have consent of each track owner.

By allowing the operator to submit the documents, FRA eliminates the potential of multiple submissions for the same vehicle type.

This paragraph is identical to two other provisions in § 213.329(g) - the subpart G counterpart to this section - and § 213.345(i).

57(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 on 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 segment(s).

Guidance: This paragraph concerns vehicle types that have been previously permitted by FRA to operate at cant deficiencies, E_u, greater than 3 inches.

Paragraph (h)(1) states these vehicle types previously approved by FRA to operate at cant deficiencies, E_u, between 3 and 5 inches are considered qualified under this section to operate at the approved cant deficiencies on any track segment. The rationale to allow this portability is that the requirements of this section are steady-state and do not directly reflect the "local" vehicle and the track interaction.

Nonetheless, a provision in paragraph (h)(1) required that written notice be provided to FRA no less than 30 calendar days prior to the proposed implementation of such curving speeds on another track segment in accordance with paragraph (f) of this section. This notice is intended to identify the new track segment(s) so that FRA is aware of the proposed operation to ensure that appropriate permission has been provided for it, and for administering the requirements of this rule.

However, the provision in paragraph (h)(2) restricts the "portability" of cant deficiency qualification for vehicle types that have been permitted by FRA to operate at cant deficiencies, E_u, greater than 5 inches. Operation at cant deficiencies greater than 5 inches over other track segments must be newly qualified in accordance with this rule, consistent with the additional requirements for the safety of operations at cant deficiencies greater than 5 inches.

57(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).

Guidance: The paragraph applies to operations at cant deficiencies greater than 5 inches. The requirements for operations of more than 5 inches cant deficiency apply to all classes of track. These requirements are specified in §§ 213.333, Automated vehicle-based inspection systems, paragraphs (a) through (g), (j)(1), (k) and (m); 213.345, Vehicle/track system qualification; and 213.369, Inspection records, paragraph (f). These requirements are briefly summarized below. For complete guidance on § 213.333 and other provisions of subpart G please see Volume II, Chapter 2 of this manual.

Section 213.333(a)(1) requires a Track Geometry Measurement System (TGMS) to be operated over Class 1 through 5 track that supports cant deficiency operations of more than 5 inches. The frequency for the TGMS inspections is at least twice per calendar year with not less than 120 days between inspections. Sections 213.333(b) through (e) list the TGMS system criteria. Section 213.333(f) continues to require that the track owner, within two days after the TGMS inspection, field verify and institute remedial action for all exceptions to the class of track. Section 213.333(g) requires the track owner or railroad to maintain a copy of the plot and the exception report for the required TGMS inspection. Section 213.333(j)(1) requires that a vehicle having dynamic response characteristics representative of other vehicles assigned to the service be operated over the route at the revenue speed profile. The vehicle shall be monitored for carbody accelerations with an onboard monitoring system at least once each calendar quarter. Section 213.333(k) describes the requirements for monitoring carbody lateral and vertical accelerations and track frame lateral acceleration. Section 213.333(m) requires the track owner or railroad to maintain a copy of the most recent exception records for the inspections required under paragraphs 333(j), (k).and (l).

57(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.

Guidance: Paragraph (j) clarifies “vehicle” and “vehicle type.” The paragraph is of particular importance when determining if a vehicle type is subject to the qualification requirements of this section. For example, a vehicle type with modified primary springs to improve performance at different speeds may be considered a new vehicle type and hence subject to the qualification requirements of this section.

§ 213.59 Elevation of curved track; (runoff)

59(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 shall be used in computing the maximum allowable posted timetable operating speed for that curve under § 213.57(b).

Guidance: When determining whether curved track is in compliance with the TSS, inspectors should consider §§ 213.57, 213.59, and 213.63 in conjunction with one another. Because the language in § 213.59 is explanatory in nature and intertwined with the requirements in §§ 213.57 and 213.63, this section should not stand alone in support of an alleged violation. FRA Inspectors should cite either § 213.57 or § 213.63, whichever is most applicable.

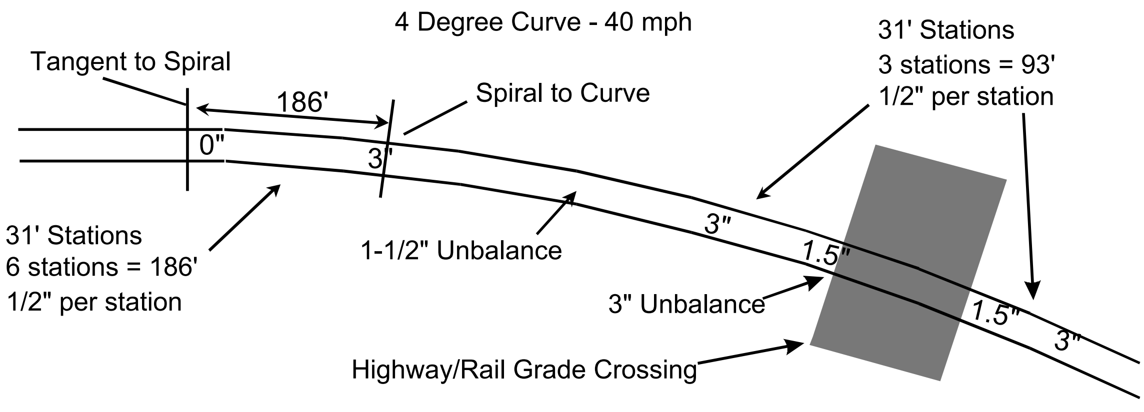
59(b) Elevation runoff shall be at a uniform rate, within the limits of track surface deviation prescribed in §213.63, and it shall extend at least the full length of the spirals. If physical conditions do not permit a spiral long enough to accommodate the minimum length of runoff, part of the runoff may be on tangent track.

Guidance: Items to consider with respect to runoff include the following:

- If elevation begins within the body of the curve rather than at the point of curve-spiral, the least average elevation that exists in the body of the curve will govern the allowable operating maximum speed throughout the full curve.
- Elevation at the end of curves, or between segments of compound curves, must be at a uniform rate within the limits of track surface deviations prescribed in the table under § 213.63.
- Particular attention must be given to the prescribed limits for difference in crosslevel between any two points less than 62 feet apart on spirals.

- If physical conditions do not permit a spiral long enough to accommodate the minimum length of runoff, the runoff may be carried into the tangent. In these circumstances, the surface table parameters under § 213.63 will govern.
- The actual minimum elevation and actual degree of curvature is determined by using the averaging techniques described under § 213.57.

The following figure illustrates how a railroad can reduce superelevation in the body of the curve to accommodate a highway-rail grade crossing for unqualified equipment (3 inches unbalance).



§ 213.63 Track Surface

63(a) Except as provided in paragraph (b) of this section, each track owner shall maintain the surface of its track within the limits prescribed in the following table:

Track surface (inches)	*Class of track*				
	1	*2*	*3*	*4*	*5*
The runoff in any 31 feet of rail at the end of a raise may not be more than ......………..	*3½*	*3*	*2*	*1½*	*1*
The deviation from uniform profile on either rail at the mid-ordinate of a 62-foot chord may not be more than …	*3*	*2¾*	*2¼*	*2*	*1¼*
The deviation from zero crosslevel at any point on tangent or reverse crosslevel elevation on curves may not be more than …..…………….	*3*	*2*	*1¾*	*1¼*	*1*
The difference in crosslevel between any two points less than 62 feet apart may not be more than[*1, 2] *…………*	*3*	*2¼*	*2*	*1¾*	*1½*
**Where determined by engineering decision prior to June 22, 1998, due to physical restrictions on spiral length and operating practices and experience, the variation in crosslevel on spirals per 31 feet may not be more than……………..….*	*2*	*1¾*	*1¼*	*1*	*¾*

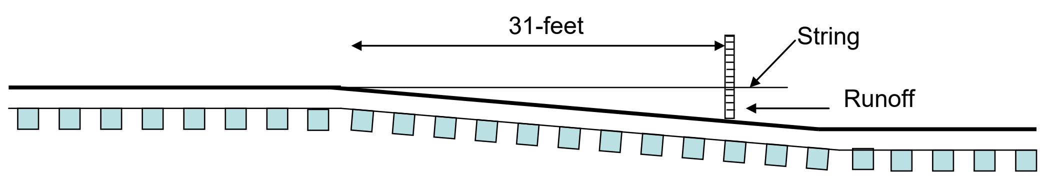
[1] Except as limited by § 213.57(a), where the elevation at any point in a curve equals or exceeds 6 inches, the difference in crosslevel within 62 feet between that point and a point with greater elevation may not be more than 1½ inches.

[2] However, to control harmonics on Class 2 through 5 jointed track with staggered joints, the crosslevel differences shall not exceed 1¼ inches in all of six consecutive pairs of joints, as created by seven low joints. Track with joints staggered less than 10 feet apart shall not be considered as having staggered joints. Joints within the seven low joints outside of the regular joint spacing shall not be considered as joints for purposes of this footnote.

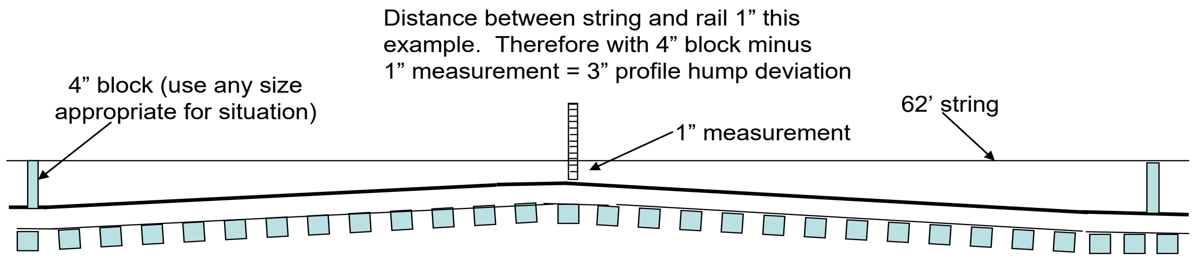
Guidance: Track surface is the evenness or uniformity of track in short distances measured along the tread of the rails. Under load, the track structure gradually deteriorates due to dynamic and mechanical wear effects of passing trains. Improper drainage, unstable roadbed, inadequate tamping, and deferred maintenance can create surface irregularities. Track surface irregularities can lead to serious consequences if ignored.

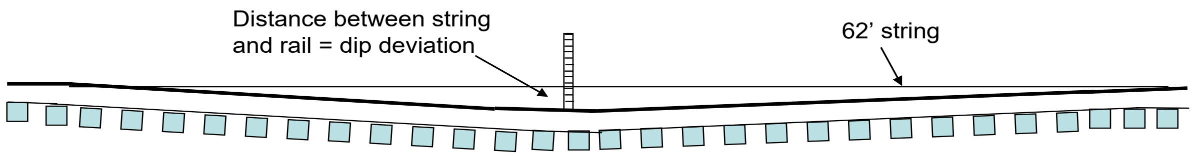
Allowable deviations in track surface include runoff at the end of a raise, deviation from uniform profile, deviation from zero crosslevel at any point on tangent or reverse crosslevel elevation on curves, and the difference in crosslevel between any two points less than 62 feet apart (referred as track warp), are specified in the track surface table. In addition, the table includes footnotes that address three special circumstances.

The first parameter in the table in this section refers to the runoff (ramp) in any 31-foot segment at the end of a raise where the track is elevated as a result of automatic or manual surfacing or bridge work. Conditions created by track degradation (e.g., settlement or frost heaves) are to be addressed using the uniform profile parameter, under this section. Trains encountering a ramp (up or down) will experience a vertical pitch or bounce if the change in elevation occurs in too short a distance. As in the more general profile parameter, damage to car components, undesirable brake applications or derailments may occur; especially when the vehicle experiences a lateral force such as a buff force. The following figure illustrates the measurement of the runoff of raised track.



The second parameter, profile, relates to the elevation of either rail along the track. When trains encounter short dips or humps in the track it can result in vertical separation of couplers, broken springs, bolsters, and truck frames. Dips can result from mud spots, or develop at the ends of fixed structures (e.g., bridges, highway rail grade and track crossings). A profile is determined by placing the mid-point of a 62-foot chord at the point of maximum measurement, irrespective of vertical curves. A profile may also be a track "hump" caused by a frost heave or other occurrence. The following figure illustrates the measurement of profile conditions.

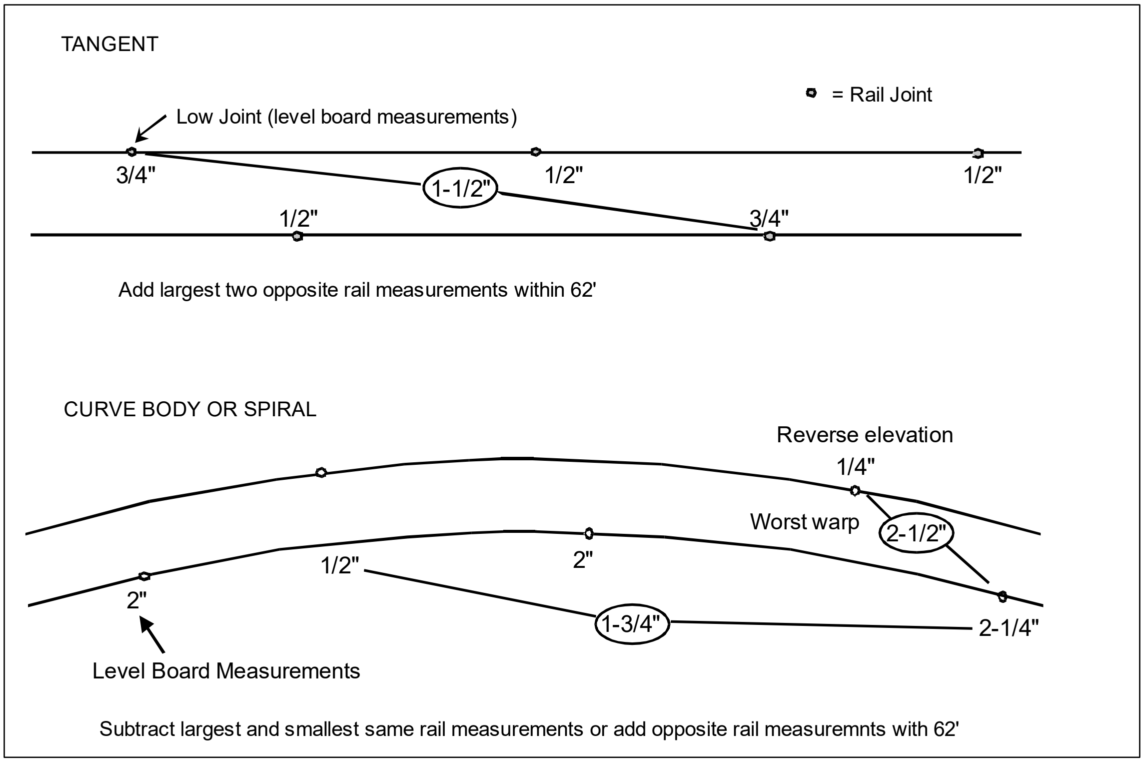




Remember to consider any combination of rail and tie plate or crosstie and ballast section voids to the mid-ordinate distance, according to § 213.13 (dynamic loading).
When encountering a hump (e.g., frost heaves over culverts), place two uniform (reference offset) blocks on top of the running rail. Stretch (taut) a 62-foot string over the blocks, with the observed highpoint at the midpoint of the string. Measure the distance from the string to the running surface of the rail. Subtract this distance from the height of the (offset) blocks to determine the mid-offset.

The third parameter in the table refers to the deviation from zero crosslevel at a point or reverse crosslevel in a curve. Crosslevel, utilizing a levelboard, is measured by subtracting the difference in height between the top surface (tread) of one rail to the tread of the opposite rail. On tangent track both rails by design should be the same height, a term known as zero crosslevel. On the spiral or body of a curve, the outer rail may not be lower than inner rail (reverse elevation) beyond the limits provided in the surface table. Also consider what implications, if any, V_{max} (§ 213.57) may impose at a curve body where reverse elevation is encountered.

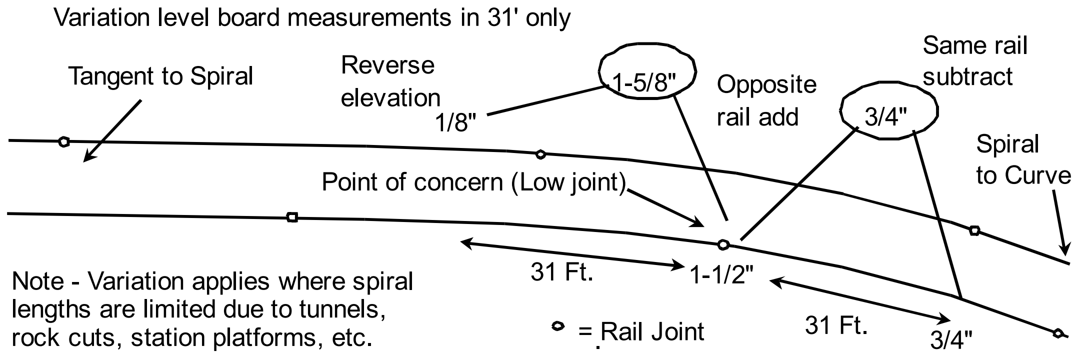
The parameter for the difference in crosslevel between any two points less than 62 feet apart is commonly referred to as the “warp” parameter. This parameter provides maximum change in crosslevel between two points within specific distances along the track. The warp parameter is, perhaps, the most critical of the surface parameters. Excessive warp contributes to wheel climb derailments. The following illustrates warp measurements.



The threshold values for warp represent minimum safety standards and encompass the full range of rolling stock in present-day operating fleets. Inspectors should be aware that some rolling stock, because of certain design and/or demonstrated performance characteristics, may be subject to additional operating restrictions and/or more restrictive warp thresholds as determined by individual railroads. The limits for warp apply anywhere along the track, (curves, spirals, and tangent segments), except that the limits shown in footnote "*" of the table apply in the special case in spirals where physical conditions prevent the more restrictive limits in the general warp parameter.

The footnote designated by a "*" of table is an exception to the above warp requirement in spirals in those few situations where the railroad has made a prior engineering decision, due to physical restrictions, to design a shorter spiral that would be found in standard construction. When encountering a spiral that does not have a sufficient length to "runoff" elevation in accordance with the warp parameter, the inspector must determine if the "short spiral" is a result of a man made or other natural obstruction. In short spirals, the amount of warp is determined by measuring the "variation" in crosslevel between two points 31 feet apart.

Examples of "short spiral" situations include rock cuts, tunnels, station platforms, etc. The following figure illustrates the application of the "*" footnote.

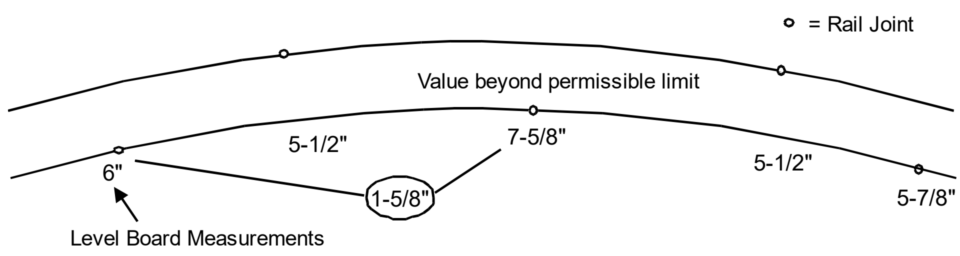


Railroads are expected to apply the variation parameter and thresholds only at locations where there is a clear history of restrictive physical characteristics.

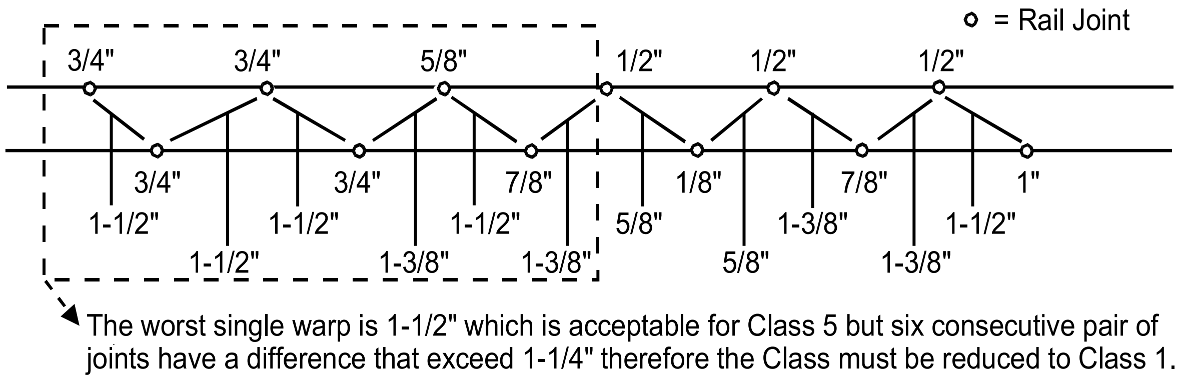
When measuring track surface parameters remember the location of the transition points between tangent, spiral, and curve body are determined by actual physical layout and are not assumed to be synonymous with railroad markers, tags, curve charts, or similar information. Therefore, be governed accordingly when applying the "*" footnote or any other track geometry parameter.

Under footnote 1 of the table, where the elevation at any point in a curve equals or exceeds 6 inches, the difference in crosslevel (warp) within 62 feet between that point and a point with greater elevation may not be more than 1½ inches regardless of track class. This footnote is included to address the condition where a vehicle is operating on a curve with a large amount of elevation and then encounters a warp condition. Since the vehicle is typically in an unbalanced condition, the warp may induce wheel climb. Slow speed curve negotiation is a particular concern since the wheels on the outside rail of the curve will tend to unload due to the overbalanced condition of the vehicle. Where this condition is found, the appropriate corrective action would be reduction to Class 1 speed under the provisions of § 213.9(b).

The following figure illustrates a warp exceeding 1½ inches at a curve with 6 inches of elevation.



Footnote 2 of the table addresses the critical harmonic rock-off condition that may result in the vehicle rocking back and forth and derailing following wheel climb. It is considered rare that this condition could occur in CWR, but it may occur where "joint memory exists." In this case, while the condition is not a defect unless it exceeds the warp limits specified in the table, the inspector should call the condition to the attention of the railroad. The crosslevel difference (warp) may not exceed 1¼ inches on all six consecutive pairs of joints, under the conventional joint spacing (33-, 36-, 39-foot long rails). Each one of the six pairs must exceed 1¼ inches for this condition to be a defect. Additional joints that have been introduced outside of the regular joint spacing, characteristically as a result of rail repair, are not considered harmonic "joints" for the purposes of this footnote. The following figure illustrates a harmonic rock-off condition.



A condition with consecutive low-bolted joints may be in noncompliance with either the warp limits specified in the table or the requirements of footnote 2 of the § 213.63 table. Inspectors shall consider any contiguous group of joints as one defect and note the number of joints. If the harmonic condition continues beyond the seven joints, the inspector is not required to record another defect, but must note the number of consecutive joints that make up the harmonic condition.

Jointed rail stagger that is not identical from stagger to stagger, such as in a curve or when a rail slightly longer than the original construction is installed, shall be considered in the harmonic calculation. Additional joints introduced by the installation of short rails are ignored in evaluating a harmonic condition.

Construction consisting of 79- or 80-foot rails does not result in harmonic rock-off conditions since they occur outside of vehicle truck spacing. For 79- or 80-foot rails and staggered spacing less than 10 feet, this footnote is not applicable and inspectors shall review the condition for compliance with other track surface parameters.

Inspectors shall carefully apply the provisions of footnote 2 of the § 213.63(a) table. An acceptable remedial action is to raise and tamp one or two joints in the middle of the consecutive low joints. This will break up the harmonics.

63(b) For operations at a qualified cant deficiency, E_u, of more than 5 inches, each track owner shall maintain the surface of the curve within the limits prescribed in the following table:

Track surface (inches)	*Class of track*				
	1	*2*	*3*	*4*	*5*
The deviation from uniform profile on either rail at the mid-ordinate of a 31-foot chord may not be more than …………………………………………..	*N/A*[1]	*N/A*[1]	*1*	*1*	*1*
The deviation from uniform profile on either rail at the	*2¼*	*2¼*	*1¾*	*1¼*	*1*

mid-ordinate of a 62-foot chord may not be more than ………………………………...................					
The difference in crosslevel between any two points less than 10 feet apart (short warp) shall not be more than …..………………………………….	2	2	1¾	1¾	1½

[1]*N/A—Not Applicable*

Guidance: Paragraph 63(b) was introduced by the VTI final rule (78 F 16101, Mar. 13, 2013). The paragraph contains tighter, single-deviation geometry limits for operations above 5 inches of cant deficiency on curves. These limits include tighter 62-foot mid-chord offset (MCO) track surface and 31-foot MCO limits for track surface and 10-foot warp - the difference in crosslevel between any two points less than 10 feet apart. The other limits in rows 1 and 3 to 5 in paragraph 63(a) are still applicable.

These limits provide an equivalent margin of safety for operations above 5 inches of cant deficiency. They are based on the results of simulation studies to determine the safe amplitudes of track geometry surface variations.

§ 213.65 Combined track alinement and surface deviations.

On any curved track where operations are conducted at a qualified cant deficiency, E_u, 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* $\frac{A_m}{A_L} + \frac{S_m}{S_L}$.

Guidance: This section contains limits addressing combined track alinement and surface deviations for operations above 5 inches of cant deficiency on curves.

The equation is given for computing the combined track alinement and surface deviations within a single chord length. The limits are intended to be used only with a TGMS, and applied on the outside rail in curves.

The Track Safety Standards have traditionally prescribed limits on geometry variations existing in isolation. However, a combination of track alinement and surface variations may result in undesirable vehicle response, even though neither the alinement nor the surface variation individually amounts to a deviation from the requirements in this part.

Section § 213.333(a)(1) contains TGMS inspection requirements for operations with cant deficiencies greater than 5 inches over Class 1 through 5 track. These requirements apply as required by § 213.57(i). Trains operating at high cant deficiencies increase the lateral wheel force exerted on the outside rail during curving, and hence decrease the margin of safety associated with the VTI safety limits in § 213.333. To address these concerns, simulation studies were performed to determine the safe amplitudes of combined track geometry variations. Results of this research showed that the equation-based safety limits in this section can provide a margin of safety for vehicle operations at any speeds and higher than 5 inch cant deficiencies.

Subpart D – Track Structure

§ 213.101 Scope

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

§ 213.103 Ballast; general

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

103(a) Transmit and distribute the load of the track and railroad rolling equipment to the subgrade;

103(b) Restrain the track laterally, longitudinally, and vertically under dynamic loads imposed by railroad rolling equipment and thermal stresses imposed by the rails;

Guidance: Ballast may consist of crushed slag, crushed stone, screened gravel, pit-run gravel, chat, cinders, scoria, pumice, sand, mine waste, or other native material, and is an integral part of the track structure. Ballast, regardless of the material, must satisfy the requirements stated in the TSS.

103(c) Provide adequate drainage for the track; and

103(d) Maintain proper track crosslevel, surface, and alinement.

Guidance: Inspectors should consider the overall condition of a track when citing fouled ballast. Because ballast conditions can be subjective in nature, inspectors should also look to other indicators, such as a geometry condition. For example, a fouled ballast violation might be appropriate if the track has poor drainage and there is a geometry condition or a series of fouled ballast locations with geometry conditions.

The term "geometry condition" used here and elsewhere in this manual means a track surface, gage, or alinement irregularity that does not exceed the allowable threshold for the designated track class. It exists due to the reduced or non-existent capability of one or more track structural components to hold the track to its preferred geometric position.

§ 213.109 Crossties

109(a) Crossties shall be made of a material to which rail can be securely fastened.

109(b) Each 39-foot segment of track shall have –

(1) A sufficient number of crossties which in combination provide effective support that will -

(i) Hold gage within the limits prescribed in §213.53(b);

(ii) Maintain surface within the limits prescribed in §213.63; and

(iii) Maintain alinement within the limits prescribed in §213.55.

(2) The minimum number and type of crossties specified in paragraphs (b)(4) of this section and described in paragraph (c) or (d), as applicable, of this section effectively distributed to support the entire segment; and

(3) At least one non-defective crosstie of the type specified in paragraphs (c) and (d) of this section that is located at a joint location as specified in paragraph (e) of this section; and

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

FRA Track Class	***Tangent track and curves # 2 degrees***	***Turnouts and curved track over 2 degrees***
Class 1	*5*	*6*
Class 2	*8*	*9*
Class 3	*8*	*10*
Class 4 and 5	*12*	*14*

Guidance: The TSS determines the adequacy of crosstie support by including its functional requirements to maintain track geometry within the limits specified in Subpart C. The failure of the crossties to meet any of the three above criteria constitutes a deviation from the TSS.

Effective distribution has not been defined, but must not be interpreted by the inspector as synonymous with equally spaced. The language is intended to address situations where all of the nondefective or defective ties exist in a group at a short area of the 39-foot segment of track in question. Evidence that crossties are not effectively distributed includes, primarily, indications of an actual deviation or a geometry condition.

No criterion exists for the maximum distance between nondefective ties, and this measurement should not be used to describe a tie defect. If such a description is appropriate, it should be in terms of the number of consecutive defective ties in a group.

When citing 213 defect code 0109B2 (Crossties not effectively distributed to support a 39-foot segment of track), the inspector must show evidence of one or more of the geometry conditions cited in § 213.109(b)(1). Several factors may be documented if the defect is being cited. These factors include, but are not limited to:

- Geometry conditions.
- Class of track.
- Curvature.
- Traffic density (annual tonnage).
- Rail weight and condition.
- Condition of other components of the track.

When determining compliance with this section, the inspector must determine that crossties meet the requirements of effectiveness as defined above and make geometry measurements to verify that each 39-foot segment of track has:

- A sufficient number of effective ties to maintain geometry.
- The required number of nondefective ties for the track class as described in paragraph (b)(4).
- The proper placement of nondefective ties as described in paragraph (b)(4) and positioned as required in paragraph (e) to support joints.

The majority of crossties throughout the nation are made from wood. However, there are varieties of alternate designed crossties made from materials such as composites, steel, and concrete. These types of crossties are becoming more common throughout the industry. Because of the increased use of these alternate design crossties and their associated resilient type rails fasteners, inspectors should more rigorously consider the rail/crosstie interface. Also, see § 213.127, Rail fastenings.

109(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 more than ½ inch relative to the crossties; or

(4) Cut by the tie plate through more than 40 percent of a ties' thickness.

Guidance: Paragraph (c) mainly applies to wooden ties, although it does not explicitly exclude composite and steel ties.

When a crosstie exhibits any one or more of the conditions described in the four criteria for evaluation [§ 213.109(c)1–4] it may be considered non-effective itself, although that determination may not always result in a defective condition that can be recorded under 213 Defect Codes 0109A, 0109B2, or 0109B3.

If track geometry measurements fail to meet the requirements of Subpart C, and there are an insufficient number of effective crossties, both geometry and crossties could be cited as defects. If geometry measurements exceed the allowable tolerance, but a determination cannot be made that crossties are the cause, it is appropriate to cite only the defective geometry.

FRA inspectors may use a PTLF described in § 213.110 for the purposes of measuring loaded gage to determine effective distribution of crossties. Refer to Appendix D–PTLF, instructions for non-GRMS territory under § 213.53.

109(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 ⅜ inch relative to the crosstie;

(3) Deteriorated such that the base of either rail can move laterally more than ⅜ inch relative to the crosstie on curves of 2 degrees or greater; or can move laterally more than ½ inch relative to the crosstie on tangent track or curves of less than 2 degrees;

(4) Deteriorated or abraded at any point under the rail seat to a depth of ½ 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).

Guidance: Crossties are evaluated individually by the definitional and functional criteria set forth in the regulations. Crosstie "effectiveness" is naturally subjective and requires good judgment in the application and interpretation of this standard. The soundness and durability of a crosstie is demonstrated when a 39-foot track segment maintains safe track geometry and structurally supports the imposed wheel loads with minimal deviation. Key to the track segment lateral, longitudinal, and vertical support is a strong track modulus, which is a measure of the vertical stiffness of the rail foundation. Continuous superior superstructure (including rails, crossties, fasteners, etc.) and high-quality ballast characteristics that transmit both dynamic and thermal loads to the subgrade are also important. Proper drainage that is free from the presence of excess moisture is an apparent and crucial factor in providing added structural support.

Section 213.109 contains specific performance requirements for FRA Classes 1 through 5 track that address the unique characteristics of fastener reliability, concrete crossties, and roadbed stability. Inspectors should be aware of the three modes of concrete crosstie failure: support, stability, and electrical isolation. The compressive strength of concrete and the amount of prestress in its section composition provide the strength and stiffness necessary to support expected wheel loads. There is a balance between excessive stiffness that can lead to higher stresses at the bottom of the crosstie and at the rail seat.

Conversely, a loss of stiffness, caused by ever increasing axle loading, can lead to excessive rail deflections and damage to the ballast and subgrade. Inspectors should be aware that failure modes are not isolated to crosstie defects. Combinations of compliant but irregular track and rail geometry, poor drainage, insufficient ballast depth and subgrade soil conditions may contribute to failure or root causal factors.

Paragraph (d) delineates the requirements related to concrete crossties. Modern concrete crossties are designed to accept the stresses imposed by irregular rail head geometry and loss, excessive wheel loading caused by wheel irregularities (out of round), excessive unbalance speed, and track geometry defects. Section 213.109 considers the worst combinations of conditions, which can cause excessive impact and eccentric loading stresses that would increase failure rates and other measures concerning loss of toeload, longitudinal and lateral restraint, in addition to improper rail cant.

Paragraph (d)(1) states that as with non-concrete crossties, concrete crossties counted to fulfill the requirements of paragraph (b)(4) must not be broken through or deteriorated to the extent that prestressing material is visible.

Crossties must not be so deteriorated that the prestressing material has visibly separated from, or visibly lost bond with, the concrete, resulting either in the crosstie's partial break-up, or in cracks that expose prestressing material due to spalls or chips, or in significant broken-out areas exposing prestressed material. Currently, metal reinforcing bars are used as the prestressing material in concrete crossties. FRA uses the term "prestressing material" in lieu of "metal reinforcing bars" to allow for future technological advances.

There is a distinction between the phrases "broken through" and "deteriorated to the extent that prestressing material is visible." Concrete crossties are manufactured in two basic designs: twin-block and mono-block. Twin-block crossties are designed with two sections of concrete connected by exposed metal rods. A mono-block crosstie is similar in dimension to a timber or wood crosstie and contains prestress metal strands embedded into the concrete. The prestressing material in the concrete is observed at the ends of the crosstie for proper tension position. Prestressed reinforced concrete crossties are made by stressing the reinforcing material in a mold, then pouring cement concrete over the reinforcing material in the mold. After the concrete cures, the tension on the reinforcing material is released, and the ends of the reinforcing material are trimmed, if appropriate for the use. The prestressing material remains in tension against the concrete, which is very strong in compression. This allows the prestressed concrete to withstand both compressive and tensile loads. If the concrete spalls, or if the prestressing material is otherwise allowed to come out of contact with the concrete, then the prestressing material is no longer in tension. A concrete crosstie's flexural strength and stiffness is lost when the prestress force is reduced through corrosion, concrete deterioration, or poor bond with the concrete due to improper manufacturing. The prestressing material may corrode if insufficient concrete cover or concrete cracking allows the intrusion of moisture and oxygen. When this happens, the once prestressed concrete crosstie can no longer withstand tensile loads, and it will fail very rapidly in service.

Prestressing material is often exposed in a concrete crosstie as a crack, but it can also be exposed on the side of the tie. When prestressing material becomes exposed on the side of a crosstie, the prestressing material is no longer in tension, the prestressed concrete can no longer withstand the tensile loads, and therefore a concrete crosstie can structurally fail. This does not apply to reinforcing material left visible at the end of the crosstie during the manufacturing process.

The compressive strength of the concrete material and the amount of prestress applied in the manufacturing process provide the strength and stiffness necessary to adequately support and distribute wheel loads to the subgrade. The prestressing material encased in concrete hold the crosstie together and provides tensile strength. However, significant cracking or discernible deterioration exposure of the reinforcing strands to water and oxygen produces loss of the prestress force through corrosion, concrete deterioration, and poor bonding. Loss of the prestress force renders the crosstie susceptible to structural failure and as a consequence, stability failure relating to track geometry noncompliance.

Crossties transversely broken between the rail seats and showing signs of further deterioration (loss of tension in prestressing material—upper and lower levels of exposure to metal strands) constitute failure. This means that there cannot be a <u>complete</u> separation of the concrete material making up the crosstie. Crossties must not be so deteriorated that the prestressing material has visibly separated from, or visibly lost bond with, the concrete, resulting either in the crosstie's partial break-up, or in cracks that expose prestressing material due to spalls or chips, or in significant broken-out areas exposing prestressed material.

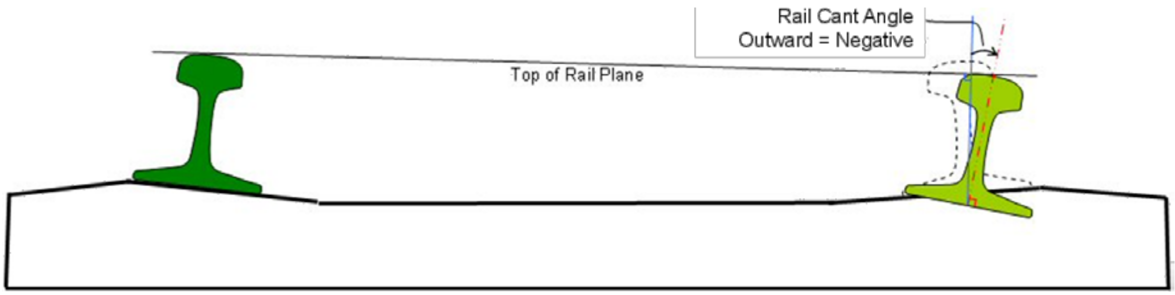
Crosstie failure is exhibited in three distinct ways: stress induced (breaks, cracks); mechanical (abrasion); or chemical decomposition. These conditions in small or large degrees compromise the crosstie's ability to maintain proper gage, alignment, and track surface. Walking inspections would demonstrate clearly visible spalls, chips, cracks, and similar breaks. However, the compression of prestressed concrete crossties may close cracks as they occur, making them difficult to observe. Even such closed cracks probably weaken the crossties.

Breaks or cracks are divided into three general conditions: longitudinal cracks, center cracks, and rail seat cracks. Longitudinal cracks are horizontal through the crosstie and extend parallel to its length. They are initiated by high impacts on one or both sides of the rail bearing inserts. Crosstie center cracks are vertical cracks extending transversely (across) the crosstie. These cracks are unusual and are the result of high negative bending movement (usually center bound), originating at the crosstie top and extend to the bottom. Generally, the condition is progressive, and adjacent crossties may be affected. Rail seat cracks are vertical cracks that are not easily visible. They usually extend from the bottom of the crosstie on one or both sides of the crosstie and are often hard to detect. It is possible for a crosstie to be broken through, but, due to the location of the break, the prestressing material may not be visible. Crosstie strength, generally, does not fail unless the crack extends through the top layer of the prestressing material. Once the crack extends beyond the top layer, there is usually a loss of prestressing material and concrete bond strength.

Paragraph (d)(2) makes clear that crossties counted to fulfill the requirements of paragraph (b)(4) of this section must not be 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 three-eighths inch relative to the crosstie, as these conditions weaken rail fastener integrity.

Paragraph (d)(3) provides that a crosstie counted to fulfill the requirements of (b)(4) must not be deteriorated such that the base of either rail can move laterally more than three-eighths inch relative to the crosstie on curves of 2 degrees or greater; or can move laterally more than one-half inch relative to the crosstie on tangent track or curves of less than 2 degrees. This section allows for a combination rail movement, inward and outward, up to the dimensions specified, but not separately for each rail. The rail and fastener assembly work as a system capable of providing electrical insulation, adequate resistance to lateral displacement, undesired gage widening, rail canting, rail rollover, and abrasive or excessive compressive stresses. In accordance with policy and procedures, inspectors are encouraged to use the assigned portable track loading fixture (PTLF) in assessing the amount of lateral rail movement, wherever applicable.

Paragraph (d)(4) requires that crossties counted to fulfill the requirements of paragraph (b)(4) of this section must not be deteriorated or abraded at any point under the rail seat to a depth of one-half inch or more. The measurement of one-half inch includes depth from the loss of rail pad material. The importance of having pad material in place with sufficient hysteresis (i.e., resilience (elasticity) to dampen high impact loading and recover) is paramount to control rail seat cracks caused by rail surface defects, wheel flats, or out of round wheels. Additionally, concrete crossties must be capable of providing adequate rail longitudinal restraint from excessive rail creepage or thermally induced forces or stress. “Rail creepage” is the tractive effort or pulling force exerted by a locomotive or car wheels, and “thermally induced forces or stress” is the longitudinal expansion and contraction of the rail, creating either compressive or tensile forces as the rail temperature increases or decreases, respectively. The loss of pad material causes a loss of toeload force, which may decrease longitudinal restraint. See the following figure. Note: inward or outward rail cant angle conventions are interchangeable among geometry measurement systems. FRA geometry cars record inward cant as positive, and outward cant as negative.



Paragraph (d)(5) requires that crossties counted to fulfill the requirements of paragraph (b)(4) of this section must not be deteriorated such that the crosstie's fastening or anchoring system including rail anchors is unable to maintain longitudinal rail restraint, maintain rail hold down, or maintain gage, due to insufficient fastener toeload. Inspectors evaluate crossties individually by "definitional and functional" criteria. A compliant crosstie is demonstrated when a 39-foot track segment maintains safe track geometry and structurally supports the imposed wheel loads. In addition to ballast, anchors bear against the sides of crossties to control longitudinal rail movement, and certain types of fasteners also act to control rail movement by exerting a downward clamping force (toeload) on the upper rail base. Part of the complexity of crosstie assessment is the fastener component. Both crossties and fasteners act as a system to deliver the expected performance effect. A noncompliant crosstie and defective fastener assembly improperly maintains the rail position and support in the rail seat and contributes to excessive lateral gage widening (rail cant-rail rollover), and longitudinal rail movement because of loss of toeload.

Fastener assemblies or anchoring systems allow a certain amount of rail movement through the crosstie to effectively relieve rail creepage (tractive and thermal force build-up). However, because of the unrestrained buildup caused by rail creep, the longitudinal expansion and contraction of the rail creates either compressive or tensile forces, respectively. When longitudinal rail movement is 'uncontrolled,' it may disturb the track structure, causing misalignment (compression) or pull-apart (tensile) conditions to catastrophic failure. Specific longitudinal performance metrics would be undesirable and restrict certain fastener assembly designs and capabilities to control longitudinal rail movement. Therefore, inspectors must use good judgment in determining fastener assembly and crosstie effectiveness.

Paragraph (d)(6) makes clear that crossties counted to fulfill the requirements of paragraph (b)(4) of this section must not be configured with less than two fasteners on the same rail, except as provided in amended § 213.127(c), which includes requirements specific to fasteners used in conjunction with concrete crossties. As with nonconcrete ties, one of the safety requirements of an effective concrete tie is its ability to hold fasteners.

109(e) Class 1 and 2 track shall have one crosstie whose centerline is within 24 inches of each rail joint (end) location. Class 3, 4, and 5 track shall have either one crosstie whose centerline is within 18 inches of each rail joint location or two crossties whose centerlines are within 24 inches either side of each rail joint location. The relative position of these crossties is described in the following three diagrams:

(1) Each rail joint in Classes 1 and 2 track shall be supported by at least one crosstie specified in paragraph (c) and (d) of this section whose centerline is within 48 inches as shown in Figure 1.

Classes 1 and 2

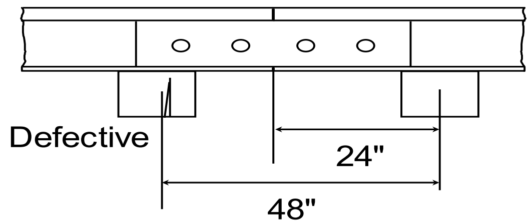


Figure 1

(2) Each rail joint in Class 3, 4, and 5 track shall be supported by either at least one crosstie specified in paragraphs (c) and (d) of this section whose centerline is within 36 inches as shown in Figure 2, or:

Classes 3 through 5

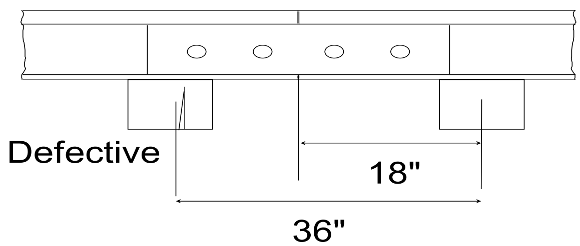


Figure 2

(3) Two crossties, one on each side of the rail joint, whose centerlines are within 24 inches of the rail joint location as shown in Figure 3.

Classes 3 through 5

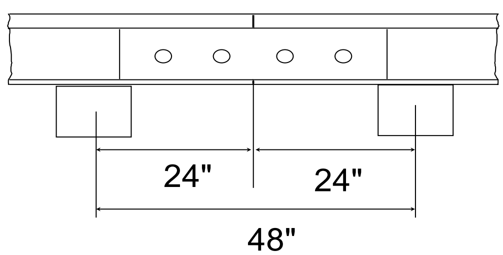


Figure 3

Guidance: A nondefective joint tie must be found within the prescribed distance of the centerline of the joint measured at the rail end. In Classes 3 through 5, joint tie placement can be satisfied by either a one tie configuration, or by a two-tie configuration.

For clarity of measurement and description:

1. Where a short piece of rail only inches in length is inserted between the rail ends and incorporated into the joint bar assembly, measure from the bar centerline. Also see § 213.121(d), Rail Joints.

2. Where nonsymmetrical bars exist, (e.g., five-hole heel block bars, five-hole compromise bars) measure from the design point where rail ends normally abut.

109(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.

Guidance: This paragraph addresses track constructed without crossties or bridge timbers, such as concrete-slab track, in which running rails are secured through fixation to another structural member.

In general, discrepancies may arise in evaluation of crosstie conditions, if decisions are based only on an inspector's maintenance experience, which varies widely among the inspectors. Inspectors should evaluate tie condition solely on the basis of the definitions provided in this section. Each crosstie must be evaluated individually by these criteria. As with all provisions of the TSS, the inspector must use judgment and discretion in the application of the crosstie standards. They should be used to describe conditions that constitute a risk to the safe operation of trains, and should not be applied in doubtful cases.

Gage rods are not an effective substitute for a proper crosstie and rail-fastening system. Gage rods can be subject to sudden failure, they provide no vertical rail support, and they provide no resistance to rail roll-over forces. However, gage rods may be installed when they are used as a secondary means of support for maintaining gage. Where gage rods are used and it is obvious that the condition of the crosstie and fastening system in the immediate vicinity is incapable of maintaining adequate gage, then the inspector should consider citing a crosstie or fastener defect.

Certain crossties may not be able to hold spikes or rail fasteners in their present condition. In these cases, it may be possible to bring the crossties into compliance by either plugging and re-spiking, or adding additional rail-holding or plate-holding spikes, or both.

Where conditions are closer to a rail-fastener issue (e.g., sound ties in track are not fastened to the rail), inspectors should refer to the guidance under § 213.127.

§ 213.110 Gage Restraint Measurement Systems

110(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.

Guidance: This paragraph provides for the implementation of a GRMS, supplemented by the use of a PTLF, to determine compliance with the crosstie and rail fastener requirements specified in §§ 213.109 and 213.127. Track owners electing to implement this technology must provide the appropriate FRA regional office with notification that specifically identifies the line segments where GRMS will be used. The appropriate FRA office is the headquarters location for the FRA region in which the GRMS designated line segment is located.

The notification must be provided to FRA at least 30 days prior to the designation of any line segment which will be subject to the requirements of this section. Even though the notification requirement is satisfied, and the GRMS vehicle is determined to meet the minimum design requirements, the actual “triggering event,” which places the line segment under the GRMS requirements, is the initial track survey with the GRMS vehicle.

Track owners must also provide FRA with at least 10 days notice prior to the removal of a line segment from GRMS designation. This requirement provides FRA with advance notice of the criteria change for the inspection of crossties and fasteners, and places some control over the random removal of line segments from GRMS designation.

110(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).

Guidance: This paragraph specifies what information track owners should include in their notifications to FRA about line segments designated for GRMS inspection. The information must include, at a minimum, the segment's timetable designation, milepost limits, track class, million gross tons of traffic per year, and any other identifying characteristics of the segment.

For reasons of safety, GRMS vehicles have their split-axle in the retracted position when testing through special trackwork such as turnouts at grade rail-to-rail crossings (diamond), expansion joints, lift rail assemblies, etc. Where certain trackage within is not part of the designation, notifications should identify what and where these locations are and what distance approaching and leaving these locations are also excluded from GRMS designation. Locations excluded from GRMS designation will be subject to the requirements of §§ 213.109 and 213.127.

110(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 1.2 [5] *, and a load severity greater than 3 kips but less than 8 kips per rail.*

Guidance: This paragraph describes minimum design requirements for GRMS vehicles. Track owners must submit to FRA sufficient technical data so that the agency can establish whether the track owner is in compliance with these design requirements. This paragraph requires that gage must be measured between the heads of the rail at an interval not exceeding 16 inches. The paragraph provides for design flexibility by establishing acceptable ranges for the lateral/vertical load ratio and the resulting lateral load severity, both of which can

[5] *GRMS equipment using load combinations developing L/V ratios that exceed 0.8 shall be operated with caution to protect against the risk of wheel climb by the test wheelset.*

be satisfied by various load configurations, provided that the applied vertical load is not less than 10 kips per rail.

The rule provides for design flexibility by establishing acceptable ranges for various loading requirements. These ranges are considered absolute, and loading configurations that fall outside of the prescribed ranges will not be considered acceptable. Some loading configurations may develop high lateral/vertical load ratios and therefore lubrication of the gage face of the rail ahead of the split axle may be required to reduce the coefficient of friction to prevent wheel climb. Footnote 5 to this section cautions operations at L/V ratios exceeding 0.8 to protect against the risk of wheel climb by the test wheelset. This footnote is identical to footnote 10, which applies to § 213.333, Automated vehicle-based inspection systems, to ensure conformity between this section and its subpart G counterpart.

110(d) Load severity is defined by the formula:

$$S = L - cV$$

Where-

S = Load severity, defined as the lateral load applied to the fastener system (kips).
L = Actual lateral load applied (kips).
c = Coefficient of friction between the rail/tie, which is assigned a nominal value of 0.4.
V = Actual vertical load applied (pounds), or static vertical wheel load if vertical load is not measured.

Guidance: This paragraph prescribes a formula for the calculation of "load severity" required by 110(c)(2) iii. The coefficient of friction at rail/tie interface can change the load severity level when the applied actual lateral and vertical loads are given. However, it is impractical to determine the actual coefficients of friction, which vary from place to place in the GRMS territory. A nominal value of 0.4 can always be used.

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

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

Where –

UTG = Unloaded track gage measured by the GRMS vehicle at a point no less than 10-feet from any lateral or vertical load application.
LTG = Loaded track gage measured by the GRMS vehicle at a point no more than 12 inches from the lateral load application point.
A = The extrapolation factor used to convert the measured loaded gage to expected loaded gage under a 24-kip lateral load and a 33-kip vertical load.

For all track –

$$A = \frac{13.513}{\left(L - 0.258 \times V\right) - .009 \times \left(L - 0.258 \times V\right)^2}$$

Note: The A factor shall not exceed a value of 3.184 under any valid loading configuration.

Where
L = Actual lateral load applied (kips).

V = Actual vertical load applied (kips), or static vertical wheel load if vertical load is not measured..

Guidance: This paragraphs prescribes the formula for the calculation of the projected loaded gage 24 (PLG 24). The formula provides a method to normalize the PLG regardless actual lateral load loads applied by different GRMS systems. Accurate measurements of unloaded gage, GRMS loaded gage, and the lateral load applied are of critical importance because these measurements are used in the calculation of PLG 24 values which constitute a direct measure of track strength.

To minimize the influence from adjacent loads, the unloaded track gage (UTG) must be measured by the GRMS vehicle at a point no less than 10 feet from any lateral or vertical load application and the loaded track gage (LPG) at a point no more than 12 inches from the lateral load application point.

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

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

Guidance: This paragraph prescribes the formula for the calculation of the gage widening projection (GWP). The GWP is intended to compensate for the weight of the testing vehicle. Use of the GWP is supported by research results documented in the report titled “Development of Gage Widening Projection Parameter for the Deployable Gage Restraint Measurement System” (DOT/FRA/ORD-06/13, October 2006), which is available on FRA’s Web site.

By making the criteria in this section consistent with those in § 213.333 in subpart G, the rule makes it easier for a track owner or railroad to comply with GRMS requirements regardless of the class of track.

110(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.

110(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.

110(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.

Guidance: Paragraphs (g), (h), and (i) require that GRMS vehicles be capable of producing a stripchart of all the parameters specified in paragraph (l) of this section, as well as a printed exception report listing, by magnitude and location, all exceptions from these parameters. The exception report listing must be provided to the appropriate persons designated as fully qualified under § 213.7 prior to the next inspection required under § 213.233 of the TSS.

Since the premise behind GRMS technology is to identify areas of weak gage restraint that either need immediate attention or must be continually monitored until the next GRMS inspection, the exception report listing must be retained and be available for review by the § 213.7 inspection personnel. FRA inspectors will obtain, or have access to, this exception report when conducting regular compliance inspections over GRMS designated line segments.

110(j) The track owner shall institute the necessary procedures for maintaining the integrity of the data collected by the GRMS and PTLF systems. At a minimum, the track owner shall–

(1) Maintain and make available to the Federal Railroad Administration documented calibration procedures on each GRMS vehicle which, at a minimum, shall specify a daily instrument verification procedure that will ensure correlation between measurements made on the ground and those recorded by the instrumentation with respect to loaded and unloaded gage parameters; and

(2) Maintain each PTLF used for determining compliance with the requirements of this section such that the 4,000-pound reading is accurate to within five percent of that reading.

Guidance: This paragraph requires the track owner to institute procedures that will ensure the integrity of data collected by the GRMS and PTLF systems. Track owners must maintain documented calibration procedures on each GRMS vehicle and make them available upon request from an FRA representative. A daily instrument verification procedure is required to ensure that measurements of loaded and unloaded gage recorded by the instrumentation correlate to actual field measurements. Track owners must also develop and implement the necessary PTLF inspection and maintenance procedures so that the 4,000-pound reading is accurate within plus or minus 5 percent.

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

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

Guidance: This paragraph recognizes the need for persons designated as fully qualified under § 213.7, and whose territories are subject to the requirements of this section, to receive training on the implementation of GRMS technology. The track owner therefore is required to develop a formal GRMS training program that must be made available to FRA upon request. The training of affected employees is another “triggering event” that must be satisfied prior to a line segment being designated as GRMS territory under this section.

The training program must provide detailed instruction on the specific areas identified in this paragraph. In particular, the training must address basic GRMS operational procedures, interpretation and handling of exception reports, how to locate and verify GRMS defects in the field, remedial action requirements to be initiated when defects are verified, how to use and calibrate the PTLF, and the recordkeeping requirements associated with the implementation of GRMS technology.

The requirement for GRMS training applies to fully qualified § 213.7 personnel under paragraphs (a) and (b) who are going to be subject to the requirements of this section. This is not to say that all fully qualified § 213.7 personnel need this training (e.g., welder foreman, production gang foreman, etc.). It is also not necessary for all fully qualified § 213.7 personnel who receive the GRMS training to be issued PTLFs. However, if circumstances arise where they need a PTLF, they should have access to one and be trained in how to use it and interpret the results.

The track owner must also take into consideration any relief personnel, newly qualified personnel, or personnel transferred from non-GRMS territory into a GRMS territory, which will be subject to the GRMS requirements. These personnel must be provided with sufficient instructions and training that enable them to demonstrate to the track owner that they know and understand the requirements of this section.

110(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–

<table>
<tr><th>GRMS parameters[1]</th><th>If measurement value exceeds</th><th>Remedial action required</th></tr>
<tr><td colspan="3">First Level Exception</td></tr>
<tr><td>UTG……</td><td>58 inches……</td><td rowspan="4">(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.</td></tr>
<tr><td>LTG…….</td><td>58 inches……</td></tr>
<tr><td>PLG24….</td><td>59 inches……</td></tr>
<tr><td>GWP……</td><td>1 inch……</td></tr>
<tr><td colspan="3">Second Level Exception</td></tr>
<tr><td>LTG……</td><td>57 ¾ inches on Class 4 and 5 track[2]……</td><td rowspan="3">(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.</td></tr>
<tr><td>PLG24……</td><td>58 inches……</td></tr>
<tr><td>GWP……</td><td>0.75 inch……</td></tr>
</table>

[1] Definitions for the GRMS parameters referenced in this table are found in paragraph (p) of this section.

[2] This note recognizes that good track will typically increase in total gage by as much as one-quarter of an inch due to outward rail rotation under GRMS loading conditions. For Class 2 and 3 track, the GRMS LTG values are also increased by one-quarter of inch to a maximum of 58 inches. However, for any class of track, GRMS LTG values in excess of 58 inches are considered First Level exceptions and the appropriate remedial action(s) must be taken by the track owner. This 1/4-inch increase in allowable gage applies only to GRMS LTG. For gage measured by traditional methods, or with the use of the PTLF, the table in §213.53(b) applies.

Guidance: The VTI final rule has corrected the table to renumber the remedial action specified for a second level exception. The remedial action has been designated as (1), (2), and (3) in the “Remedial action required” column, to be consistent with the remedial action specified for a first level exception. This paragraph specifies the parameters and threshold levels required to be reported as a record of lateral restraint following an inspection by a GRMS vehicle. The regulation requires that two levels of exceptions be reported during the GRMS inspection. Specific remedial actions are required for each level, as identified in the "Remedial action required" column. First level exceptions are required to be immediately protected by a 10 mph speed restriction until verification and corrective action can be instituted. Second level exceptions are to be monitored and maintained within the PTLF criteria outlined in paragraph (m) of this section.

The prior knowledge criteria is satisfied for those locations that are identified as first or second level exceptions on the record of lateral restraint which is generated following each GRMS inspection. Where field inspections conducted between GRMS inspections reveal an exception location that does not comply with either the track strength requirement or the gage requirement that are identified in paragraph (m) of this section, the inspector should consider recommending civil penalties. For locations that do not comply with the requirements of paragraph (m), and have not been identified on the record of lateral restraint as either a first or second level exception, the inspector shall exercise discretion to determine whether or not civil penalties should be recommended.

Footnote 2 in the table recognizes that typical good track will increase in total gage by as much as one-quarter inch due to outward rail rotation under GRMS loading conditions. Accordingly, for Class 2 and Class 3 track, the GRMS loaded track gage values are also increased by one-quarter inch to a maximum of 58 inches. GRMS loaded track gage values in excess of 58 inches must always be considered first level exceptions. This ¼-inch increase in gage applies only to GRMS loaded gage, and does not apply to PTLF gage measurements or to measurements made by more traditional methods.

110(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 exceed ⅝ inch when increasing the applied force from 0 to 4,000 pounds; and

(ii) The gage of the track under 4,000 pounds of applied force does not exceed the allowable gage prescribed in §213.53(b) for the class of track.

(2) Gage widening in excess of ⅝ 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.

Guidance: While the remedial action table in paragraph (l) requires the use of the PTLF to measure compliance with the lateral restraint and gage requirements at identified exception locations in GRMS territory, paragraph (m) also provides for the use of a PTLF as an additional analytical tool by fully qualified § 213.7 individuals at other locations in GRMS territory. Paragraph (m) also describes the manner in which a PTLF must be used in GRMS territory, whether it is being used as an additional analytical tool or being used to meet the remedial action requirements set forth in paragraph (l). Compliance with §§ 213.109 and 213.127 will be demonstrated when a PTLF is applied and (1) the total gage widening at that location does not exceed five-eighths inch when increasing the applied force from 0 to 4,000 pounds; and (2) the gage of the track measured under 4,000 pounds of applied force does not exceed the allowable gage prescribed in § 213.53(b) of this section for the class of track involved. Gage widening in excess of five-eighths inch shall constitute a deviation from Class 1 standards.

At locations where compliance with the crosstie and rail fastener requirements have been demonstrated through the use of a PTLF, a fully qualified § 213.7 individual retains the discretionary authority to prescribe additional remedial actions, such as the placement of speed restrictions, if the individual deems it necessary. FRA inspectors will determine compliance with the crosstie and fastener requirements for gage restraint solely on the basis of the PTLF measurements.

Where crossties are found to be so severely split or plate-cut to the extent that they are incapable of providing adequate vertical support, and conditions have degraded to the point where track surface conditions are approaching the allowable limit for the class of track, inspectors shall continue to consider writing a defect. In such a case use 213 defect code 0109B2, “crossties not effectively distributed to support a 39-foot segment of track.” Inspectors should record the track surface geometry condition as well as the contributing condition of the crossties in the description column.

When a functional PTLF is not available to a fully qualified § 213.7 individual during a scheduled inspection under § 213.233 of this part, the track owner must repair or replace the PTLF prior to the next inspection required under § 213.233, or crosstie and rail fastener compliance will be based solely on the requirements specified in §§ 213.109 and 213.127.

At locations where crosstie or rail fastening compliance is questioned and vertical loading of the track structure is necessary to restore contact with the lateral rail restraint components, the crossties must be raised until lateral restraint contact is restored and a PTLF measurement must then be made.

If the track owner fails to immediately restore contact between the rail and the fastening system so that a valid PTLF test can be performed, this non-action will in effect remove this location from the GRMS standard and the inspector will determine compliance based on §§ 213.109 and 213.127.

Likewise, where gage rods have been installed which preclude a valid PTLF test to determine gage restraint of crossties and fasteners, this action will in effect remove the location from the

GRMS standard and the inspector will determine compliance based on §§ 213.109 and 213.127.

110(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.

Guidance: This paragraph requires the track owner to maintain a record of the two most recent GRMS inspections at locations meeting the requirements specified in § 213.241(b). The records must indicate the location and nature of each First Level exception, and the nature and date of initiated remedial action, if any, for each First Level exception. First Level exceptions are described in the Remedial Action Table in paragraph (l).

The record required under paragraph (n) is also the official record of lateral restraint and needs to identify both exception levels; however, the remedial action taken is required to be shown only for First Level exceptions. Records will be maintained at locations that meet the requirements specified in § 213.241(b).

110(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 m.p.h., 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 m.p.h., the interval between GRMS inspections must not exceed 24 months.

Guidance: Paragraph (o) details the GRMS inspection requirements which is illustrated in the following table:

TRAFFIC	GRMS INSPECTION INTERVAL
If annual tonnage exceeds 2MGT, or passenger train speeds (if applicable) exceed 30 mph, then	GRMS inspections must be performed annually at an interval not to exceed 14 months [1]
If annual tonnage is 2MGT or less, and where passenger train speeds (if operated) do not exceed 30 mph, then	The interval between GRMS inspections must not exceed 24 months [2]

[1] The maximum interval of 14 months is intended to provide some flexibility for scheduling when it may not be possible to schedule annual inspections within the same calendar month each year.

[2] This extended frequency is an attempt to make the technology more accessible to short line operators who may not have the financial or equipment resources available to larger railroads. For example, a GRMS inspection may be scheduled at up to 24-month intervals if the railroad had 2 million annual tons or less and passenger trains were not authorized to operate at more than 30 mph.

110(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.

(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.

Guidance: This paragraph prescribes a list of definitions of terms essential to the implementation of GRMS technology.

A well-documented pattern of repeated or widespread deviations from the requirements of this section by the track owner will effectively terminate the options afforded by this section. The affected track would then become subject to the requirements of §§ 213.109 and 213.127.

§ 213.113 Defective rails

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

REMEDIAL ACTION

	Length of defect (inch)		*Percent of rail head cross-sectional area weakened by defect*		*If defective rail is not replaced, take the remedial action prescribed in note*
Defect	*More than*	*But not more than*	*Less than*	*But not less than*	

Transverse fissure			*70……. 100….*	*5……. 70…… 100….*	*B. A2. A.*
Compound fissure			*70……. 100….*	*5 70 100*	*B. A2. A.*
Detail fracture Engine burn fracture Defective weld			*25…… 80…… 100…..*	*5 25 80 100*	*C. D. A2 or [E and H] A or [E and H]*
Horizontal or Vertical split head Split web Piped rail Head web separation	*1 2 4….. (1)*	*2…… 4…… ……. (1)*	*…… …… …… (1)*	*…… …… …… ……*	*H and F. I and G. B. A.*
Bolt hole crack	*½ 1 1½ (1)*	*1 1½ …… (1)*	*…… …… …… (1)*	*…… …… …… ……*	*H and F. I and G. B. A.*
Broken base	*1 6*	*6 ……*	*…… ……*	*…… ……*	*D A or [E and I]*
Ordinary break	*……*	*……*	*……*	*……*	*A or E.*
Damaged rail	*……*	*……*	*……*	*……*	*D.*
Flattened rail	*Depth ≥ ⅜ and Length ≥ 8*	*……*	*……*	*……*	*H.*

(1)Breakout in rail head.

Notes:

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

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

B. Limit operating speed over defective rail to that as authorized by a person designated under §213.7(a), who has at least one year of supervisory experience in railroad track maintenance. The operating speed cannot be over 30 m.p.h. or the maximum allowable speed under §213.9 for the class of track concerned, whichever is lower.

C. Apply joint bars bolted only through the outermost holes to defect within 20 days after it is determined to continue the track in use. In the case of Classes 3 through 5 track, limit operating speed over defective rail to 30 m.p.h. until joint bars are applied; thereafter, limit *speed to 50 m.p.h. or the maximum allowable speed under §213.9 for the class of track concerned, whichever is lower. When a search for internal rail defects is conducted under §213.237, and defects are discovered in Classes 3 through 5 which require remedial action C, the operating speed shall be limited to 50 m.p.h., or the maximum allowable speed under §213.9 for the class of track concerned, whichever is lower, for a period not to exceed 4 days. If the defective rail has not been removed from the track or a permanent repair made within 4 days of the discovery, limit operating speed over the defective rail to 30 m.p.h. until joint bars are applied; thereafter, limit speed to 50 m.p.h. or the maximum allowable speed under §213.9 for the class of track concerned, whichever is lower.*

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

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

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

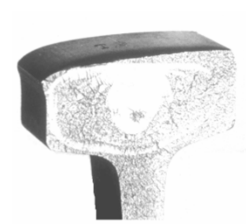
G. Inspect rail 30 days after it is determined to continue the track in use.

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

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

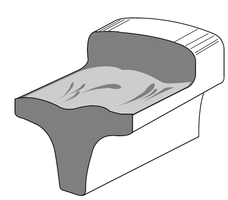
113(b) As used in this section --

(1) Transverse fissure means a progressive crosswise fracture starting from a crystalline center or nucleus inside the head from which it spreads outward as a smooth, bright, or dark, round or oval surface substantially at a right angle to the length of the rail. The distinguishing features of a transverse fissure from other types of fractures or defects are the crystalline center or nucleus and the nearly smooth surface of the development which surrounds it.

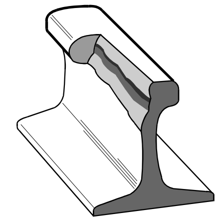


(2) Compound fissure means a progressive fracture originating in a horizontal split head which turns up or down in the head of the rail as a smooth, bright, or dark surface progressing until substantially at a right angle to the length of the rail. Compound fissures require examination of both faces of the fracture to locate the horizontal split head from which they originate.

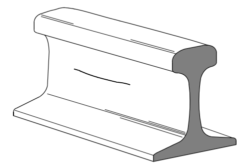
(3) Horizontal split head means a horizontal progressive defect originating inside of the rail head, usually ¼ inch or more below the running surface and progressing horizontally in all directions, and generally accompanied by a flat spot on the running surface. The defect appears as a crack lengthwise of the rail when it reaches the side of the rail head.



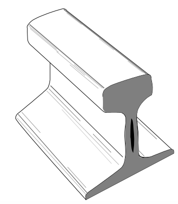
(4) *Vertical split head means a vertical split through or near the middle of the head, and extending into or through it. A crack or rust streak may show under the head close to the web or pieces may be split off the side of the head.*



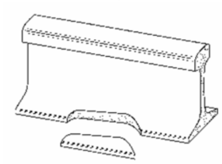
(5) *Split web means a lengthwise crack along the side of the web and extending into or through it.*



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

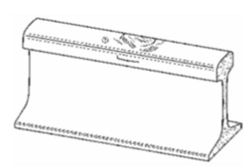


(7) *Broken base means any break in the base of the rail.*



(8) *Detail fracture means a progressive fracture originating at or near the surface of the rail head. These fractures should not be confused with transverse fissures, compound fissures, or other defects which have internal origins. Detail fractures may arise from shelly spots, head checks, or flaking.*

(9) *Engine burn fracture means a progressive fracture originating in spots where driving wheels have slipped on top of the rail head. In developing downward they frequently resemble the compound or even transverse fissures with which they should not be confused or classified.*



(10) *Ordinary break means a partial or complete break in which there is no sign of a fissure, and in which none of the other defects described in this paragraph (b) are found.*

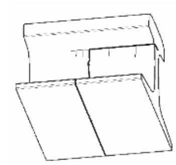
(11) *Damaged rail means any rail broken or injured by wrecks, broken, flat, or unbalanced wheels, slipping, or similar causes.*

(12) Flattened rail means a short length of rail, not at a joint, which has flattened out across the width of the rail head to a depth of ⅜ inch or more below the rest of the rail. Flattened rail occurrences have no repetitive regularity and thus do not include corrugations, and have no apparent localized cause such as a weld or engine burn. Their individual length is relatively short, as compared to a condition such as head flow on the low rail of curves.

(13) Bolt hole crack means a crack across the web, originating from a bolt hole, and progressing on a path either inclined upward toward the rail head or inclined downward toward the base. Fully developed bolt hole cracks may continue horizontally along the head/web or base/web fillet, or they may progress into and through the head or base to separate a piece of the rail end from the rail. Multiple cracks occurring in one rail end are considered to be a single defect. However, bolt hole cracks occurring in adjacent rail ends within the same joint must be reported as separate defects.

(14) Defective weld means a field or plant weld containing any discontinuities or pockets, exceeding 5 percent of the rail head area individually or 10 percent in the aggregate, oriented in or near the transverse plane, due to incomplete penetration of the weld metal between the rail ends, lack of fusion between weld and rail end metal, entrainment of slag or sand, under-bead or other shrinkage cracking, or fatigue cracking. Weld defects may originate in the rail head, web, or base, and in some cases, cracks may progress from the defect into either or both adjoining rail ends.

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



Guidance: The remedial actions required for defective rails specify definite time limits and speeds. The remedial actions also allow certain discretion to the track owner for the continued operation over certain defects. Inspectors should consider all rail defects dangerous and care should be taken to determine that proper remedial actions have been accomplished by the railroad. When more than one defect is present in a rail, the defect requiring the most restrictive remedial action shall govern.

The remedial action table and specifications in the rule address the risks associated with rail failure. These risks are primarily dependent upon defect type and size and should not be dependent upon the manner or mechanism that reveals the existence of the defect. Failure of the track owner to comply with the operational (speed) restrictions, maintenance procedures and the prescribed inspection intervals specified in this section and § 213.237 (Defective rails and Inspection of rail, respectively), may constitute a violation of the TSS.

Note “A2” addresses mid-range transverse defect sizes. This remedial action allows for train operations to continue at a maximum of 10 mph up to 24 hours, following a visual inspection by a person designated under § 213.7. If the rail is not replaced, another 24-hour cycle begins.

Note “B” limits speed to that as authorized by a person designated under § 213.7(a) who has at least 1 year of supervisory experience in track maintenance. The qualified person has the responsibility to evaluate the rail defect and authorize the maximum operating speed over the defective rail based on the size of the defect and the operating conditions; however, the maximum speed over the rail may not exceed 30 mph or the maximum speed under § 213.9 for the class of track concerned, whichever is lower.

Notes “C,” “D,” and "H" limit the operating speed, following the application of joint bars, to 50 m.p.h. or the maximum allowable speed under § 213.9 for the class of track concerned, whichever is lower. When the maximum speed specified in notes "B," "C," "D," and "H" exceeds the current track speed, the railroad is required to record the defect. For example, when a railroad determines that remedial action "B" is required and the track speed already is 30 mph or less, the railroad must record the defect. This indicates that the railroad is aware of the characteristics of the defective rail and has designated a permissible speed in compliance with the regulation.

When an FRA inspector discovers a defective rail that requires the railroad representative to determine whether to continue the track in use and to designate the maximum speed over the rail, the inspector should inquire as to the representative's knowledge of the defect and remedial action. If the railroad was not aware of the defect prior to the FRA inspection, the FRA inspector should observe the actions taken by the railroad representative to determine compliance. If the railroad had previously found the defective rail, the FRA inspector should confirm the proper remedial action was taken. During records inspections, the FRA inspector should confirm that the defects were recorded and proper remedial actions were taken.

The remedial action table for defects failing in the transverse plane (transverse and compound fissures, detail and engine burn fractures, and defective welds) specifies a lower limit range base of 5 percent of the railhead cross-sectional area. If a transverse defect is reported to be less than 5 percent, the track owner is not legally bound to provide corrective action under the TSS. Defects reported less than 5 percent are not consistently found during rail breaking routines and therefore, defect determination within this range is not always reliable.

Transverse and compound fissure defects, weakened between 5 and 70 percent of cross-sectional head area require remedial action (note B). Defects in the range between 70 and less than 100 percent of cross-sectional head area require remedial action (note A2), as prescribed. Defects that affect 100 percent of the cross-sectional head area require remedial action (note A) as prescribed, the most restrictive. Inspectors should be aware that transverse and compound fissures are defects that fail in the transverse plane and are characteristic of rail that has not been control-cooled (normally rolled prior to 1936).

Defects identified and grouped as detail fracture, engine burn fracture, and defective welds, will weaken and also fail in the transverse plane. Detail fractures are characteristic of control-cooled rail [usually indicated by the letters CC or CH on the rail brand (i.e., 1360 RE CC CF&I 1982 1111). Their prescribed remedial action relates to a low range between 5 and 25 percent and a mid-range between 25 and 80 percent, for note (C) and note (D), respectively. Those defects require joint bar applications and operational speed restrictions within certain time frames. Defects extending less than 100 and more than 80 percent require a visual inspection. If the rail is not replaced, effectively repaired, or removed from service, an elective would be to restrict operation to a maximum of 10 mph for up to 24 hours, then perform another visual inspection.

The second sentence in remedial action note (C) addresses defects which are discovered in Classes 3 through 5 track during an internal rail inspection required under § 213.237, and which are determined not to be in excess of 25 percent of the rail head cross-sectional area. For these specific defects, a track owner may operate for a period not to exceed 4 days, at a speed limited to 50 mph or the maximum allowable speed under § 213.9 for the class of track concerned, whichever is lower. If the defective rail is not removed or a permanent repair is not made within 4 days of discovery, the speed is limited to 30 mph, until joint bars are applied or the rail is replaced.

The requirements specified in this second paragraph are intended to promote better utilization of rail inspection equipment and therefore maximize the opportunity to discover rail defects, which are approaching service failure size. The results of FRA's research indicate that defects of this type and size range have a predictable slow growth life. Research further indicates that even on the most heavily utilized trackage in use today, defects of this type and size are unlikely to grow to service failure size in four days.

In the remedial action table, all longitudinal defects are combined within one group subject to identical remedial actions based on their reported size. These types of longitudinal defects all share similar growth rates and the same remedial actions are appropriate to each type.

Defective rails categorized as horizontal split head, vertical split head, split web, piped rail, and head-web separation, are longitudinal in nature. When any of this group of defects is more than 1 inch, but not more than 2 inches, the remedial action initiated, under note (H), is to limit train speed to 50 mph, and note (F) requires reinspecting the rail in 90 days, if deciding operations will continue. Defects in the range of more than 2 inches, but not more than 4 inches, require complying with notes (I) and (G), speed is limited to 30 mph and the rail reinspected in 30 days, if they decide operations will continue. When any of the five defect types exceed a length of 4 inches, under note (B) a person designated under § 213.7(a) who decides opertions will continue must authorize the operating speed, up to but not to exceed 30 mph, under note (B).

Another form of head-web separation, often referred to as a "fillet cracked rail," is the longitudinal growth of a crack in the fillet area, usually on the gage side of the outer rail of a curve. The crack may not extend the full width between the head and the web, but it is potentially dangerous. Evidence of fillet cracking is a hairline crack running beneath the head of rail with "bleeding" or rust discoloration. Fillet cracks often result from improper superelevation or from stress reversal as a result of transposing rail. The use of a mirror is an effective aid in examining rail and the determination of head-web cracks or separation in the body of the rail.

A "bolt hole crack" is a progressive fracture originating at a bolt hole and extending away from the hole, usually at an angle. They develop from high stress risers, usually initiating as a result of both dynamic and thermal responses of the joint bolt and points along the edge of the hole, under load. A major cause of this high stress is improper field drilling of the hole. Excessive longitudinal rail movement can also cause high stress along the edge of the hole.

When evaluating a rail end, which has multiple bolt hole cracks, inspectors will determine the required remedial action based on the length of the longest individual bolt hole crack.

Under note (H) and (F), the remedial action for a bolt hole crack, more than one-half inch, but not more than 1 inch, if the rail is not replaced, is to limit speed to 50 mph, or the maximum allowable under § 213.9 for the class of track concerned, whichever is lower, then reinspect the rail in 90 days, if operations will continue.

For bolt hole cracks greater than 1 inch, but not exceeding 1½ inches, notes (H) and (G) apply. These rails are required to be limited to 50 mph and reinspected within 30 days. For a bolt hole crack exceeding 1½ inches, a person qualified under § 213.7(a) may elect to designate a speed restriction, which cannot exceed 30 mph, or the maximum allowable under § 213.9 for the class of track concerned, whichever is lower.

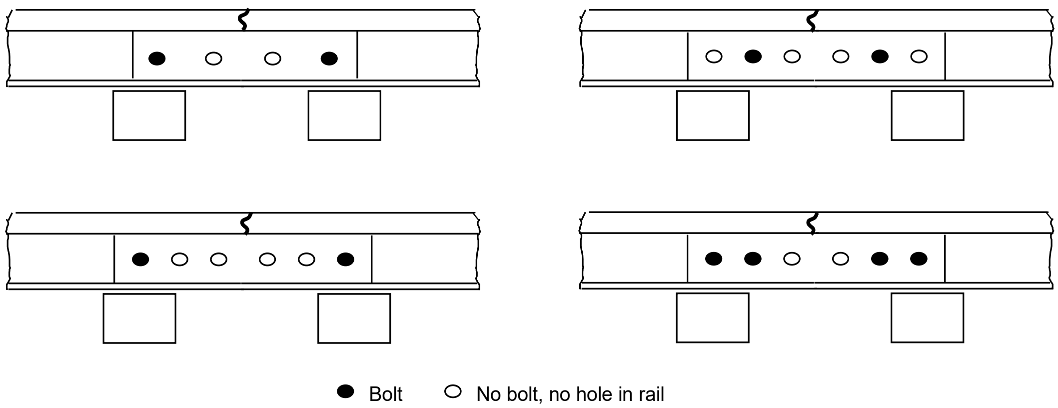
Under notes (F) and (G), where corrective action requires rail to be reinspected within a specific number of days after discovery, several options for compliance may be exercised depending on the nature of the defect. For those defects, which are strictly internal and are not yet visible to the naked eye, the only option would be to perform another inspection with rail flaw detection equipment, either rail-mounted or hand-held. For defects that are visible to the naked eye and therefore measurable, a visual inspection or an inspection with rail flaw detection equipment are acceptable options. For certain defects enclosed within the joint bar area, such as bolt hole cracks and head-web separations, the joint bars must be removed if a visual reinspection is to be made.

The reinspection prescribed in notes (F) and (G) must be performed prior to the expiration of the 30 or 90 day interval. If the rail remains in track and is not replaced, the reinspection cycle starts over with each successive reinspection unless the reinspection reveals the rail defect to have increased in size and has therefore become subject to a more restrictive remedial action. This process continues indefinitely until the rail is removed from track.

Where corrective action requires rail to be reinspected within a specific number of days after discovery, the track owner may exercise several options for compliance. One option would be to perform another inspection with rail flaw detection equipment, either rail-mounted or hand-held. Another option would be to perform a visual inspection where the defect is visible and measurable. In the latter case, for certain defects enclosed within the joint bar area such as bolt hole breaks, removal of the joint bars will be necessary to comply with the reinspection requirement. If defects remain in track beyond the reinspection interval, the railroad must continue to monitor the defects and take the appropriate actions as required in the remedial action table.

A broken base can result from improper bearing of the base on a track spike or tie plate shoulder, and from over crimped anchors, or it may originate in a manufacturing flaw. With today's higher axle loads, inspectors can anticipate broken base defects in 75-pound, and smaller, rail sections with an irregular track surface, especially on the field side. For any broken base discovered that is more than 1 inch, but less than 6 inches in length, the remedial action (note D) is to apply joint bars bolted through the outermost holes to defect within 10 days, if operations will continue. In Classes 3 through 5 track, the operating speed must be reduced to 30 mph or less, as authorized by a person under § 213.7(a), until joint bars are applied. After that, operating speed is limited to 50 mph or the maximum allowable under § 213.9 for the class of track concerned, whichever is lower.

Under note D, there are several acceptable “outermost hole” bolting arrangements for joint bars centered on a rail defect. See the following figure for an illustration of acceptable bolting arrangements. In all cases, railroads may not drill a bolt hole next to a defect that is being remediated with the application of joints bars (pursuant to note D). The reason for not drilling next to the defect is to prevent the propagation of the crack into the hole closest to the defect.



A broken base in excess of 6 inches requires the assignment of a person designated under § 213.7 to visually supervise each train operation over the defective rail. The railroad may apply joint bars to the defect and bolt them in accordance with §§ 213.121(d) and (e) and thereafter must limit train operations to 30 mph or the maximum allowable under § 213.9 for the class of track concerned, whichever is lower. As reference, the dimensions between the outermost holes of a 24-inch joint bar vary between approximately 15 and 18 inches and a 36-inch joint bar approaches 30 inches.

Inspectors should point out to the track owner that broken bases nearing these dimensions may negate the purpose for which the joint bars are applied. A broken base rail may be caused by damage from external sources, such as rail anchors being driven through the base by a derailed wheel. It is improper to consider them “damaged rail,” as this defect is addressed by more stringent provisions applicable to broken base rails, under note (A) or (E) and (I).

Damaged rail can result from flat or broken wheels, incidental hammer blows, or derailed or dragging equipment. Reducing the operational speed in Classes 3 through 5 track to 30 mph until joint bars are applied, lessens the impact force imparted to the weaken area. Applying joint bars under note (D) ensures a proper horizontal and vertical rail end alinement in the event the rail fails.

Flattened rails (localized collapsed head rail) are also caused by mechanical interaction from repetitive wheel loadings. FRA and industry research indicate that these occurrences are more accurately categorized as rail surface conditions, not rail defects, as they do not, in themselves, cause service failure of the rail. Although it is not a condition shown to affect the structural integrity of the rail section, it can result in less than desirable dynamic vehicle responses in the higher speed ranges. The flattened rail condition is identified in the table, as well as in the definition portion of § 213.113(b), as being three-eighths inch or more in depth below the rest of the railhead and 8 inches or more in length. As the defect becomes more severe by a reduced rail head depth, wheel forces increase.

The rule addresses flattened rail in terms of a specified remedial action for those of a certain depth and length. Those locations meeting the depth and length criteria shall be limited to an operating speed of 50 mph or the maximum allowable under § 213.9 for the class of track concerned, whichever is lower.

“Break out in rail head” is defined as a piece that has physically separated from the parent rail. Rail defects meeting this definition are required to have each operation over the defective rail visually supervised by a person designated under § 213.7. Inspectors need to be aware that this definition has applicability across a wide range of rail defects, as indicated in the Remedial Action Table. Where rail defects have not progressed to the point where they meet the definition of a break out, but due to the type, length and location of the defect, they present a hazard to continued train operation, inspectors should determine what remedial actions, if any, track owner should institute.

The following are two rail head break out examples where the “A” corrective action would be necessary:

> Example One: There is a bolt hole break where the head of the rail is totally separated from the parent rail (either tight or loose), but that piece of rail will not physically lift out of the joint bars by hand. The inspector might determine that the separation was total by the fact that the separated piece rattled when tapped. It is important that railroads take the appropriate remedial action in this situation, because it is potentially very unsafe. It is impossible to know what will happen when the next train operates over this defect. That train could cause the piece to become so loose that it comes out of the place, cocks at an angle and causes a wheel to ramp up.
>
> Example Two: A vertical split head defective rail where rail head separation is apparent because the inspector can determine that a physical separation has occurred through the rail head, but the rail head has not entirely separated over the entire length of the defect.

The issue of “excessive rail wear” continues to be evaluated by the Rail Integrity Task Force. The FRA believes that insufficient data exists at this time to indicate that parameters for this condition should be proposed as a minimum standard.

The Sperry Rail Service prints an excellent reference manual on rail defects. Inspectors are expected to be conversant with rail defect types, appearance, growth, hazards, and methods of detection.

Some railroads apply safety “weld straps” to thermite type field welds. These straps do not provide the same support of a joint bar. They would provide only limited support if a weld were to break under a train movement and as such, they do not comply with the provisions of corrective actions C, D, or E (installation of joint bars). Only a joint bar with full contact with the bottom of the rail head and rail base [see § 213.121 (a)] and with a manufactured relief for the weld material would comply with corrective actions C, D, or E.

When an FRA inspector finds a rail defect that appears to originate from fatigue at a bond wire attachment weld, the inspector should cite the railroad for 213 defect code 0113B.

Inspectors must also identify in their narrative the type of the rail defect (e.g., defective weld, detail fracture, etc.). FRA has added this defect code based on a National Transportation Safety Board (NTSB) recommendation arising from the NTSB investigation of a February 9, 2003, Canadian National Railway (CN) derailment in Tamaroa, Illinois. The NTSB determined that the probable cause of this accident was CN's placement of bond wire welds on the head of the rail just outside the joint bars, where untempered martensite associated with the welds led to fatigue cracking that, because of increased stresses associated with known soft ballast conditions, rapidly progressed to rail failure.

§ 213.115 Rail end mismatch

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

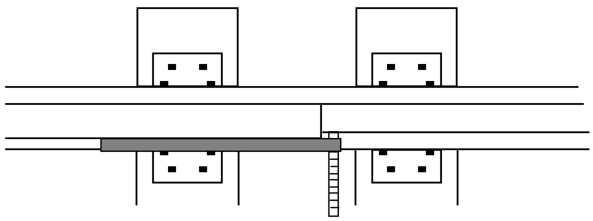
Class of track	***Any mismatch of rails at joints may not be more than the following-***	
	On the tread of the rail ends (inch)	***On the gage side of the rail ends (inch)***
1	*¼*	*¼*
2	*¼*	*3/16*
3	*3/16*	*3/16*
4 and 5	*⅛*	*⅛*

Guidance: Use a straightedge to determine the mismatch by holding the straightedge longitudinally along the higher rail (tread) or along the gage side (five-eighths inch down from the running surface) of the rail. Measure the distance directly between the straightedge and the rail. Disregard plastic overflow (gage side rail edge lipping), if any.

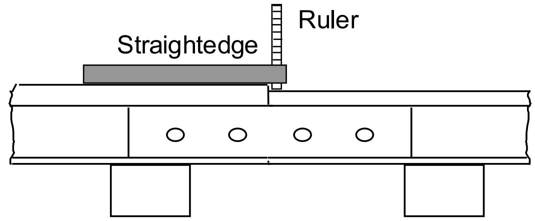
One example of mismatch occurs when a section of a rail is placed in the track where the existing rail head is gage- and/or treadworn. Mismatch can also occur when the joint bars are loose. However, if the loose bars do not result in mismatch exceeding the thresholds under this section, report the defect as loose joint bars (see § 213.121).

The standards prescribe both tread and gage mismatch thresholds. A mismatch may result in high impact forces especially at higher speeds. If a mismatch in excess of the allowable results in significant rail end damage, a violation should be considered.

Particular attention should be given to the mismatch on the gage side of a rail. A thin flange, skewed truck, or combination of both may cause a wheel to climb, particularly on the outer rail of a curve. The following figure shows the proper method to measure gage and tread mismatch.



Gage mismatch



Tread mismatch

§ 213.118 Continuous welded rail (CWR); plan review and approval.

118(a) Each track owner with track constructed of CWR shall have in effect and comply with a plan that contains written procedures which address: the installation, adjustment, maintenance, and inspection of CWR; inspection of CWR joints; and a training program for the application of those procedures.

118(b) The track owner shall file its CWR plan with the FRA Associate Administrator for Railroad Safety/Chief Safety Officer (Associate Administrator). 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 submitted plan, and will provide written notice of its determination.

118(c) The track owner's existing plan shall remain in effect until the track owner's new plan is approved or conditionally approved and is effective pursuant to paragraph (d) of this section.

118(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.

118(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 FRA.

Guidance: All CWR plans must be submitted to FRA for review by the Track Division and then approval by the Associate Administrator for Railroad Safety/Chief Safety Officer. FRA reviews each plan for compliance with §§ 213.119(a) through (l). Regional track specialists may be requested to provide recommendations concerning the comprehensiveness of those procedures.

When conducting track inspections, an FRA inspector should have with him the most recent copy of a railroad's CWR plan. This is important because it will enable the inspector to perform a proper inspection and determine compliance with the plan. Finalized CWR plans are posted on the FRA secured Web site for the inspector's review and enforcement. If an inspector discovers substantial discrepancies between the official plan on file at FRA headquarters and the plan in the field (or that there are substantial discrepancies between the official plan on file with FRA and a railroad field manual), the inspector should notify the regional Track specialist.

FRA may also conditionally approve a plan. There might be instances where it would be beneficial for the agency to conditionally approve a plan. For example, FRA might decide that a plan should be approved, but might need to look into new technology proposed in the plan. FRA reserves the ability to later approve or disapprove a plan that it has formally conditionally approved.

A track owner may update or modify CWR procedures as necessary, but must resubmit any new or modified plan to FRA pursuant to § 213.118. Until the new plan is approved or conditionally approved and effective pursuant to paragraph (d), the track owner's existing plan will remain in effect.

§ 213.119 Continuous welded rail (CWR); plan contents.

Guidance, General: In addition to safety-critical procedures listed in this section, the railroad may decide to include procedures based on administrative or economic considerations. For example, a railroad may choose to include instructions that limit the use of worn secondhand replacement rail because of an economic concern about the length of time that it might take to perform a satisfactory weld. The railroad may also include specific actions in their procedures that are to be taken when installation or maintenance work does not comply with its overall procedures.

Recording an activity that does not conform to the railroad's CWR procedures does not provide the railroad with indefinite relief from responsibility for compliance when its procedures are not followed. Continued noncompliance may lead to an unsafe condition. The recordkeeping procedure is intended to provide a safety net by flagging those activities of noncompliance, which, if not brought into compliance in a timely manner, could lead to an unsafe condition. For example, CWR installed in the winter months without adequate rail anchors as prescribed by the written procedures and discovered in late summer would clearly be a deficient condition, regardless of if it was recorded. When in doubt as to what activities are considered safety related, the inspector should consult with the regional Track specialist.

Whenever conducting inspections on a railroad and that activity includes observation of CWR, FRA inspectors are to include only one "CWRP" unit on the header of their Railroad Inspection System for Personal Computers (RISPC) inspection report. Record one CWRP unit, regardless of the amount of CWR mileage inspected. Record the actual track mileage units using the activity codes MTH, MTW, etc. When a defect is taken for any aspect of § 213.119, FRA inspectors are to also designate CWRP for the line item "activity" cell. In addition, inspectors are to use CWRP in each line item activity cell when performing records inspections and recording deficiencies concerning CWR joint records.

The definition of a "buckling incident" explains the industry definition for such an event. However, the rule recognizes the importance of conditions that are precursors to buckles.

The two failure modes associated with track constructed with CWR are track buckles and pull-aparts. A track buckle is considered the more serious of the two and is characterized by the formation of a large lateral misalinement caused by:
- High compressive forces in the rail (thermal and mechanical loads).
- Weakened track conditions (weak track resistance, alinement deviations).

- Vehicle loads (a dynamic "wave" uplift and lateral vs. vertical ratios).

The track owner shall comply with the contents of the CWR plan approved or conditionally approved under § 213.118. The plan shall contain the following elements—

119(a) Procedures for the installation and adjustment of CWR which include—

(1) Designation of a desired rail installation temperature range for the geographic area in which the CWR is located; and

(2) De-stressing procedures/methods which address proper attainment of the desired rail installation temperature range when adjusting CWR.

Guidance: Track owners with track constructed of CWR are required to have in effect and comply with a CWR plan. This includes track owners who operate entirely on CWR track that has been designated as excepted track, pursuant to § 213.4. The procedures under § 213.119 do not apply to excepted track. (See § 213.5(b)). However, where a railroad designates a segment of track as excepted, it still must meet the requirements of at least Class 1 track for any portion of that track that is: (1) located within 30 feet of an adjacent track that is subjected to simultaneous use at speeds in excess of 10 mph, or (2) located on a bridge or on a public street or highway and there are trains with placarded cars. (See § 213.4(d).)

Railroads typically establish a desired rail installation temperature range for the geographical area that is higher than the annual mean temperature. This higher installation temperature will account for the expected reduction of the force-free temperature caused by track maintenance, train traffic, and other factors. As reference, the term for this expected occurrence is "rail neutral temperature shift." A railroad's failure to establish a designated installation temperature range for a specific territory is addressed under § 213.119(a).

119(b) Rail anchoring or fastening requirements that will provide sufficient restraint to limit longitudinal rail and crosstie movement to the extent practical, and specifically addressing CWR rail anchoring or fastening patterns on bridges, bridge approaches, and at other locations where possible longitudinal rail and crosstie movement associated with normally expected train-induced forces, is restricted.

119(c) CWR joint installation and maintenance procedures which require that—

(1) Each rail shall be bolted with at least two bolts at each CWR joint;

Guidance: The track inspector should determine that any joints installed in CWR or connecting to CWR must have at least two bolts in each rail end, a minimum of four bolts installed in the joint bars, if not field welded at the time of installation. § 213.121(e).

This requirement serves as a reminder to track owners that they cannot create their own joint bolt requirements in their CWR plans that are less restrictive than those specified in the TSS.

(2) In the case of a bolted joint installed during CWR installation after October 21, 2009, the track owner shall either, within 60 days—
(i) Weld the joint;
(ii) Install a joint with six bolts; or
(iii) Anchor every tie 195 feet in both directions from the joint; and

Guidance: This section applies to major installations of CWR, such as more than 400 feet. It is not intended for plug rails. Note that the applicability date published in the final rule for this section (August 25, 2009) was corrected via the amendment published on October 21, 2009, at 74 FR 53889.

(3) In the case of a bolted joint in CWR experiencing service failure or a failed bar with a rail gap present, the track owner shall either—

Guidance: This section addresses CWR joints that experience a failure with a rail gap present. The definition for rail gap for this section is that the rail is under tension. An example of a joint failure under tension is a joint where the rail ends could not be pulled back together manually, as with the use of a drift pin, or if mechanical or thermal assistance is needed. A remedial action from § 213.119(c)(3) must be taken. Check for evidence of tension (such as bent and broken bolts) or application of thermal force (heat from repair rope, sawdust, or flammable mix).

(i) Weld the joint;

Guidance: The rail is welded at the time the joint is repaired.

(ii) Replace the broken bar(s), replace the broken bolts, adjust the anchors and, within 30 days, weld the joint;

Guidance: The 30-day time limit is only to allow the railroad adequate time to gather resources to weld the joint. If a CWR joint becomes battered before a repair can be completed and the track owner decides to cut in a plug rail to remove the battered joint, the track must immediately be brought into compliance as specified in § 213.121(e). The 30-day time limit starts from the original joint installation date for both joints. The remedial action 30-day period does not begin again when both CWR rail joints are required to be removed. If the joints have not been welded on the 31st day, a violation may be submitted to the track owner for failure to take the appropriate remedial action. The track owner must have selected the planned remedial action to be taken on the inspection report or other documentation that may be addressed in the CWR plan at the time the defect was discovered, and it must be documented. This written or electronic documentation must be made available upon request by FRA during regular business hours.

(iii) Replace the broken bar(s), replace the broken bolts, install one additional bolt per rail end, and adjust anchors;

(iv) Replace the broken bar(s), replace the broken bolts, and anchor every tie 195 feet in both directions from the CWR joint; or

(v) Replace the broken bar(s), replace the broken bolts, add rail with provisions for later adjustment pursuant to paragraph (d)(2) of this section, and reapply the anchors.

Guidance: The track owner should ensure that any rail added during the repair of a CWR pull-apart is properly adjusted back to the required safe neutral temperature in accordance with the railroad's CWR plan. As the rail temperature rises, the expansion of rail increases. The track owner must have provisions in the CWR plan to slow order the affected track and make repairs and adjustment to bring the track into compliance. For example, in many cases, the addition of 1 inch of rail in a 1,000-foot string of CWR will lower its rail neutral temperature by 13 degrees.

If the remedial actions, described in §§ 213.119(c)(iii), (iv), or (v); are used and the affected joint fails again (with a rail gap present after the initial repair), additional, more restrictive repairs are required. This shows that the rail tension was not adequately addressed during the initial remedial action. CWR joints must be inspected for compliance with additional parts of the TSS, such as tie condition, surface, rail end mismatch, and properly fitting joint bars.

119(d) Procedures which specifically address maintaining a desired rail installation temperature range when cutting CWR including rail repairs, in-track welding, and in conjunction with adjustments made in the area of tight track, a track buckle, or a pull-apart. Rail repair practices shall take into consideration existing rail temperature so that—

(1) When rail is removed, the length installed shall be determined by taking into consideration the existing rail temperature and the desired rail installation temperature range; and

(2) Under no circumstances should rail be added when the rail temperature is below that designated by paragraph (a)(1) of this section, without provisions for later adjustment.

119(e) Procedures which address the monitoring of CWR in curved track for inward shifts of alinement toward the center of the curve as a result of disturbed track.

Guidance: Thermal and mechanical loads affecting track structure are decreased by the track owner's adherence to the track engineering standards. Adherence to the track owner's standards and the CWR plan promote CWR track stability and safety. Three engineering elements resist mechanical loads and thermal loads: lateral resistance, longitudinal resistance, and rail neutral temperature. Track buckles can be expected to occur predominately in the lateral dimension. Lateral resistance is critical to being dependent upon weight and size of crosstie material, ballast material type, shoulder width, crib content, and its level of consolidation. As degree of curvature increases, the buckling resistance decreases. A crosstie's base, side (crib) friction, and ballast shoulder resistance contribute to the overall lateral resistance sustained. In general, each contributes (base 50 percent, side 20–30 percent, and shoulder 20–30 percent) to this resistance, but the ratios can vary depending on ballast condition. Lateral resistance varies in location depending on the ballast shoulder geometry, crosstie size and type, and state of ballast consolidation.

Thermal loads, by themselves, can cause a buckle and are often called "static buckling." However, most buckling occurs under a combination of thermal and vehicle loads, termed "dynamic buckling." Inspectors should place emphasis on vehicle (dynamic) effects on track lateral stability, where high rail temperatures and vehicle loading could progressively weaken the track due to dynamic uplift (flexural waves) and a buckle mechanism response induced by misalignment "growth."

Because the majority of buckles occur under dynamic train movements, loading is an important element in the buckling mechanism. Elements of track lateral instability include:

- Formation of initial track misalinement caused by reduced local resistance.
- High impact loads, initial rail surface (weld) imperfections, "soft" spots in ballast, and curve (radial breathing) shifting.
- Misalinement growth caused by high lateral loads, increased longitudinal forces, track uplifts due to vertical loads, and train-induced vibration.

Inspectors may consider the above elements, combined with related evidence of actual defects, geometry conditions, or other defective structural conditions, when evaluating the adequacy of a railroad's CWR stability procedures under §§ 213.119(b), (c), (d), and (e). Locations where track buckling are more likely to occur include: horizontal and vertical curves, bottom of grades, bridge approaches, highway-rail grade crossings, recently-disturbed track, and areas of heavy train starting or braking.

The signs or precursors of buckles include:

- Newly formed alinement deviations: wavy, kinky, snaky, etc.
- Rails rotating or lifting out of the tie plates and intermittent loose tie plates.
- Excessive “running” rail causing ties to plow or churn the ballast.
- Insufficient anchors and anchors not installed tightly against the tie.
- Insufficient ballast section in the crib and shoulder areas.
- Gaps at crosstie ends, especially on the low (inner) rail.

Curves are more prone to buckling because of the curvature effect, alinement imperfection sensitivity, and train loads. It is important for inspectors to consider when and where a buckle may occur (e.g., on track segments where the CWR installation occurred below the desired rail installation temperature range and there was inadequate control of the laying temperature or inadequate adjustment of the rail afterwards). In addition, inspectors should observe areas of recent maintenance involving either the ballast or rail, where there was inadequate reconsolidating time for a disturbed ballast or inadequate temperature adjustment when replacing a defective rail. As curvature increases, the buckling resistance decreases. Under some conditions, high degree curvature can undergo gradual lateral shift (progressive buckling). Lateral alinement deviations reduce the track buckling strength and can initiate growth to critical levels. Vertical alinement deviations can also influence buckling.

Lateral misalinement is an important consideration because it reduces the ability of the track to resist buckling. An alinement offset or mid-ordinate within allowable limits may “escalate” under the imposed loads. This is called “track shift.” A longitudinal force in curved track will cause CWR rail to move radically. Compressive loads in the rail during the summer tend to move the track outwards, and tensile loads in the winter will pull the track inward, a term known as “radial breathing.” Inspectors should review the allowable limits, under § 213.55, and evaluate the relevant alinement and track strength (§ 213.13, Movement under load) due to repeated thermal and vehicle loadings.

Generally speaking, a decrease in the rail neutral temperature of 30–40 degrees from the installation temperature can be critical and lead directly to buckling. Inspectors should monitor the following factors that may influence shifts in the force-free temperature: improper rail installation, inadequate rail anchors or fastenings, lateral movements in curves through lining operations, “skeletonized” track segments (ballast removed for maintenance purposes), and inadequate ballast section. Lateral and longitudinal restraint is influenced by the factors mentioned above and, if improperly maintained or allowed to exist in a defective state, it increases the opportunity for a track buckle.

Track buckles occur less frequently in tangent track than in curves. However, buckling in tangent track will generally occur suddenly and with more severe consequences.

The second of the two failure modes that can be associated with track constructed with CWR is a pull-apart. A rail’s decrease in temperature in the winter will create tensile forces. The maximum tensile load in the rail is determined by the difference in the installation or force-free temperature and the lowest rail temperatures. Enough tensile force can cause direct fracture at rail cross-sections with prior cracks, weak welds, or sheared joint bolts at CWR string end locations.

119(f) Procedures which govern train speed on CWR track when—

(1) Maintenance work, track rehabilitation, track construction, or any other event occurs which disturbs the roadbed or ballast section and reduces the lateral or longitudinal resistance of the track; and

(2) The difference between the average rail temperature and the average rail neutral temperature is in a range that causes buckling-prone conditions to be present at a specific location; and

Guidance: This requires that the railroad needs to record the new rail neutral temperature when performing rail repair and installation.

(3) In formulating the procedures under paragraphs (f)(1) and (f)(2) of this section, the track owner shall—

(i) Determine the speed required, and the duration and subsequent removal of any speed restriction based on the restoration of the ballast, along with sufficient ballast re-consolidation to stabilize the track to a level that can accommodate expected train-induced forces. Ballast re-consolidation can be achieved through either the passage of train tonnage or mechanical stabilization procedures, or both; and

(ii) Take into consideration the type of crossties used.

119(g) Procedures which prescribe when physical track inspections are to be performed.

(1) At a minimum, these procedures shall address inspecting track to identify—

(i) Buckling-prone conditions in CWR track, including—
(A) Locations where tight or kinky rail conditions are likely to occur; and
(B) Locations where track work of the nature described in paragraph (f)(1)(i) of this section has recently been performed; and
(ii) Pull-apart prone conditions in CWR track, including locations where pull-apart or stripped-joint rail conditions are likely to occur; and

(2) In formulating the procedures under paragraph (g)(1) of this section, the track owner shall—

(i) Specify when the inspections will be conducted; and
(ii) Specify the appropriate remedial actions to be taken when either buckling-prone or pull-apart prone conditions are found.

119(h) Procedures which prescribe the scheduling and conduct of inspections to detect cracks and other indications of potential failures in CWR joints. In formulating the procedures under this paragraph, the track owner shall—

Guidance: This paragraph requires each track owner to include in its CWR plan provisions for the scheduling and conducting of joint inspections. A person who is qualified under § 213.7(c) will perform the inspections required by this paragraph on foot at the joint.

(1) Address the inspection of joints and the track structure at joints, including, at a minimum, periodic on-foot inspections.

Guidance: This paragraph governs on-foot periodic inspections of CWR joints. Track owners are required to establish procedures for conducting these inspections. Upon identifying actual conditions of joint failures (i.e., broken or cracked joints bars) or potential conditions of joint failure, track owners must initiate the appropriate corrective action and keep the appropriate records. See §§ 213.119(h)(5) and 213.119(h)(7). In addition, when a track owner discovers CWR joints that are not in compliance with the requirements of the TSS, the track owner must take the appropriate remedial action required by Part 213.

Inspectors should note that nothing in this paragraph interferes with the track owners' continuing obligation to conduct track inspections under § 213.233. In addition, on-foot periodic inspections can be performed concurrently with § 213.233.

Periodic inspections, as referenced herein, are on-foot inspections of CWR joints that track owners must conduct on a regular basis. Track owners are required to conduct on-foot periodic inspections at the minimum intervals specified in paragraph (h)(6). Track owners, of course, are free to conduct these inspections more frequently than required.

(2) Identify joint bars with visible or otherwise detectable cracks and conduct remedial action pursuant to § 213.121;

Guidance: This paragraph requires track owners to identify joint bars with visible or otherwise detectable cracks and conduct remedial action pursuant to § 213.121. Railroad inspectors must know to distinguish between joint bars that are already cracked and joint bars that have the potential of cracking in the future. When a track owner discovers a cracked joint bar, the owner must take any remedial action specified in § 213.121; however, if the owner discovers a joint bar with actual or potential joint failure, the owner must take the corrective action specified by the CWR plan. Corrective action will be further addressed in paragraph (h)(5).

(3) Specify the conditions of actual or potential joint failure for which personnel must inspect, including, at a minimum, the following items:

(i) Loose, bent, or missing joint bolts;

(ii) Rail end batter or mismatch that contributes to instability of the joint; and

(iii) Evidence of excessive longitudinal rail movement in or near the joint, including, but not limited to; wide rail gap, defective joint bolts, disturbed ballast, surface deviations, gap between tie plates and rail, or displaced rail anchors;

Guidance: This paragraph identifies those items relating to joint inspections that track owners must address in their CWR plans. Inspectors should note that these items are the minimum that track owners should address. Of course, track owners are free to include additional items in their respective CWR plans. Railroad track inspectors are to identify and record action items listed during their inspection of joints because these items are related to the integrity of the joint, and thus, to the safety of trains that operate over these joints.

Inspectors should note that this list is not all-inclusive. There are other conditions that could indicate failure, and inspectors should urge track owners to consider all conditions, not just these listed examples.

(4) Specify the procedures for the inspection of CWR joints that are imbedded in highway-rail crossings or in other structures that prevent a complete inspection of the joint, including procedures for the removal from the joint of loose material or other temporary material;

Guidance: This paragraph requires track owners to include procedures in their CWR plans for the inspection of CWR joints that are imbedded in highway-rail grade crossings or in other structures that prevent a complete inspection of the joint (e.g., pans in fueling facilities, scales, passenger walkways at stations that cover the track, etc.). The plans must also include procedures for the removal of loose material or other temporary material from the joint.

With respect to the procedures for “imbedded” joints, inspectors should not expect railroads to disassemble or remove the track structure (e.g., remove pavement or crossing pads) to conduct an inspection of CWR joints. However, FRA expects that railroads will make every effort, to the extent practicable, to inspect the joints in these structures.

Inspectors need to be aware that CWR joints may sometimes be temporarily buried during maintenance (e.g., where ballast is distributed in the middle of the track and along the track) and therefore unavailable for inspection. FRA expects that railroads will take necessary measures to conduct inspections of these CWR joints and expects that railroads will schedule their maintenance to allow for a complete inspection of these joints. Where CWR joints are buried (e.g., by ballast), inspectors should understand that railroad maintenance personnel will wait for the completion of the track surfacing and dressing of the ballast before conducting their joint bar inspections. However, railroad employees may use hand tools or mechanical means to remove ballast from the sides of track joints, so that they can conduct an inspection of those track joints.

Finally, FRA notes that components of the track (such as crossties, fasteners, tie plates, etc.) are also not fully visible in highway-rail grade crossings and similar structures. Inspectors should note that FRA has never specifically exempted these items from the inspections required under Part 213. Inspectors should continue to expect that the railroads will inspect these areas to the maximum extent possible.

(5) Specify the appropriate corrective actions to be taken when personnel find conditions of actual or potential joint failure, including on-foot follow-up inspections to monitor conditions of potential joint failure in any period prior to completion of repairs;

Guidance: This paragraph requires track owners to specify in their plans the appropriate corrective actions that must be taken when track inspectors find conditions of actual or potential joint failure. Inspectors should note the difference between the terms “remedial actions” and “corrective action” and apply accordingly. Remedial actions are those actions which track owners are required to take as a result of requirements of Part 213 to address a noncompliant condition. For example, if a track owner discovers a cracked joint bar, the owner must replace it. See § 213.121 or the parallel requirement in the railroad’s CWR plan. Corrective actions, on the other hand, are those actions that track owners specify in their CWR plans to address conditions of potential joint failure, including, as applicable, repair, restrictions on operations, and/or additional on-foot inspection. To ensure clarity, FRA has defined these terms in § 213.119(j).

On-foot followup inspections, as referenced herein, are joint-specific and conducted in response to conditions that a track owner discovers during periodic inspections. Track owners will identify in their CWR plans the conditions that trigger followup inspections. For example, where a track owner identifies “replace bolt or inspect weekly” as a corrective action for a bent bolt, if a track inspector discovers a bent bolt during a periodic inspection and does not immediately replace it, then the track inspector will have to conduct followup inspections at that joint at the specified frequency (in this case, weekly).

(6) Specify the timing of periodic inspections, which shall be based on the configuration and condition of the joint:

Guidance: This paragraph requires railroad owners to specify the timing of on-foot periodic inspections. The minimum number of required joint inspections is addressed in the table in paragraph (h)(6)(i). The timing periods in this paragraph represent the minimum of what is expected. Railroad owners are encouraged to implement additional inspection periods as they determine necessary.

In paragraphs (h)(6)(ii) through (iv), inspectors should be aware that FRA is allowing exceptions to the minimum inspection frequencies for unscheduled detours, certain passenger trains, and items that are already inspected on a monthly basis pursuant to § 213.235. Each of these exceptions will be discussed in more detail below.

(i) Except as provided in paragraphs (h)(6)(ii) through (h)(6)(iv) of this section, track owners must specify that all CWR joints are inspected, at a minimum, in accordance with the intervals identified in the following table:

Minimum Number of Inspections per Calendar Year[1]

	Freight trains operating over track with an annual tonnage of:			*Passenger trains operating over track with an annual tonnage of:*	
	Less than 40 mgt	*40 to 60 mgt*	*Greater than 60 mgt*	*Less than 20 mgt*	*Greater than or equal to 20 mgt*
Class 5 & above	*2*	*3[2]*	*4[2]*	*3[2]*	*3[2]*
Class 4	*2*	*3[2]*	*4[2]*	*2*	*3[2]*
Class 3	*1*	*2*	*2*	*2*	*2*
Class 2	*0*	*0*	*0*	*1*	*1*
Class 1	*0*	*0*	*0*	*0*	*0*
Excepted track	*0*	*0*	*0*	*n/a*	*n/a*

4 = Four times per year, with one inspection in each of the following periods: January to March, April to June, July to September, and October to December; and with consecutive inspections separated by at least 60 calendar days.

3 = Three times per calendar year, with one inspection in each of the following periods: January to April, May to August, and September to December; and with consecutive inspections separated by at least 90 calendar days.

2 = Twice per calendar year, with one inspection in each of the following periods: January to June and July to December; and with consecutive inspections separated by at least 120 calendar days.

1 = Once per calendar year, with consecutive inspections separated by at least 180 calendar days.

[1]*Where a track owner operates both freight and passenger trains over a given segment of track, and there are two different possible inspection interval requirements, the more frequent inspection interval applies.*

[2] *When extreme weather conditions prevent a track owner from conducting an inspection of a particular territory within the required interval, the track owner may extend the interval by up to 30 calendar days from the last day that the extreme weather condition prevented the required inspection*

Guidance: The first footnote provides that where a track owner operates both freight and passenger trains over a given segment of track, and there are two different possible inspection interval requirements, the more frequent inspection interval applies. This footnote was developed to address concerns over track shared by freight and passenger trains. It was anticipated that there could be a potential conflict with the inspection frequency required for the track if the track owner were to follow the chart for both types of trains. By requiring the more frequent inspections in situations of conflict, this footnote ensures greater safety and protection to track used for mixed purposes.

The second footnote was added in response to concerns regarding sensitivity of extreme regional weather conditions. Concern was raised with regard to the difficulty of inspecting CWR joints in northern regions when there is a large amount of snow. FRA notes that there could be times when it would be extremely difficult for a track owner to clear snow and ice from the joint in order for it to be seen for inspection. This footnote allows some flexibility for track owners in such a situation.

(ii) Consistent with any limitations applied by the track owner, a passenger train conducting an unscheduled detour operation may proceed over track not normally used for passenger operations at a speed not to exceed the maximum authorized speed otherwise allowed, even though CWR joints have not been inspected in accordance with the frequency identified in paragraph (h)(6)(i) of this section, provided that:

(A) All CWR joints have been inspected consistent with requirements for freight service; and

(B) The unscheduled detour operation lasts no more than 14 consecutive calendar days. In order to continue operations beyond the 14-day period, the track owner must inspect the CWR joints in accordance with the requirements of paragraph (h)(6)(i) of this section.

Guidance: This paragraph allows track owners, for a limited period of time, to operate passenger trains without lowering the track speed and without adhering to the required inspection frequencies for passenger trains pursuant to the table in § 213.119(h)(6)(i). This provision accommodates for unplanned outages, derailments, accidents, and other emergency situations. Track owners are still required to adhere to the applicable freight inspection frequencies. This provision is intended to provide relief to railroads that operate passenger trains and that have a last-minute emergency situation. However, if a track owner operates passenger trains at the normal track speed for more than 14 days, the track must be inspected at the appropriate passenger train levels, as detailed in the chart at § 213.119(h)(6)(i).

(iii) Tourist, scenic, historic, or excursion operations, if limited to the maximum authorized speed for passenger trains over the next lower class of track, need not be considered in determining the frequency of inspections under paragraph (h)(6)(i) of this section.

Guidance: As defined in § 213.119(l), tourist, scenic, historic, or excursion operations are railroad operations that carry passengers with the conveyance of the passengers to a particular destination not being the principal purpose. These operations run less frequently than intercity or commuter passenger trains, and occur most often on shortline railroads. If a track owner has an operation of this type on the track and does not want to take that operation into account in determining inspection frequency, the owner must drop the track speed one class with regard to that operation. This way, the track owner will be still be in compliance with the inspection frequency mandated by the table in paragraph (h)(6)(i), regardless of the class of freight the owner runs on the track. As the first footnote to the table in paragraph (h)(6)(i) states, where there are two different possible inspection interval requirements, the more frequent inspection interval applies.

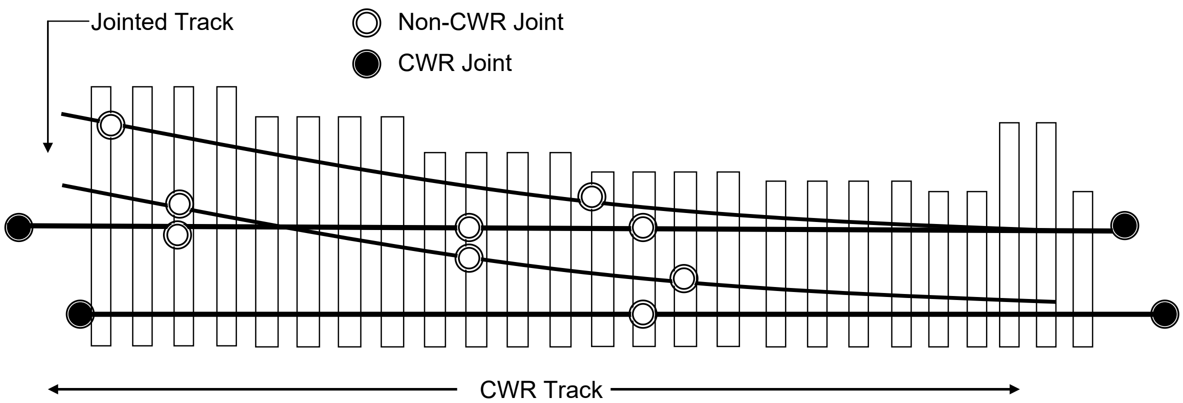
The above is a consideration for situations where tourist trains operate on the general system of transportation. For tourist trains on track other than the general system of transportation, such operations are normally not subject to the TSS. See Part 209, Appendix A.

(iv) All CWR joints that are located in switches, turnouts, track crossings, lift rail assemblies or other transition devices on moveable bridges must be inspected on foot at least monthly, consistent with the requirements in § 213.235; and all records of those inspections must be kept in accordance with the requirements in § 213.241. A track owner may include in its § 213.235 inspections, in lieu of the joint inspections required by paragraph (h)(6)(i) of this section, CWR joints that are located in track structure that is adjacent to switches and turnouts, provided that the track owner precisely defines the parameters of that arrangement in the CWR plans.

Guidance: This paragraph exempts the following items from the periodic inspection frequency intervals: switches, turnouts, track crossings, lift rail assemblies, or other transition devices on moveable bridges. Track owners already inspect these items on a monthly basis pursuant to § 213.235. Rather than apply the additional periodic inspection requirements (i.e., apply the intervals in the table in § 213.119(h)(6)(i) to switches and turnouts, etc.), FRA believes it is more appropriate to have track owners conduct their inspections of joints at these locations during their monthly § 213.235 inspections.

FRA has historically understood and operated under the assumption that a turnout extends from the point of the switch to the heel of the frog. Inspectors should continue to operate under that assumption, and accordingly, all joints in turnouts, switches, etc. must be inspected monthly, pursuant to § 213.235, and records of these inspections must be kept in accordance with § 213.241. The regulation does not require that the data elements listed in § 213.119(h)(7)(i) appear on the § 213.235 inspection record.

All joints that extend beyond the point of a switch or beyond the heel of the frog must be inspected at the frequency intervals identified in § 213.119(h)(6)(i). However, track owners are free to include, in their monthly § 213.235 inspection, these joints that are located in track structure that is adjacent to turnouts and switches. If track owners choose to do this, they must clearly define the parameters of that arrangement in their CWR plan. In other words, the track owner should clearly identify the physical limits of the adjacent track structure (e.g., insulated joints up until the signal), and they must clearly identify the inspection interval for joints in that adjacent track (e.g., “inspect all insulated joints to the signal during the monthly § 213.235 inspection”).



In addition, as long as track owners clearly define the parameters in the CWR plans, the track owner does not need to keep two sets of records (e.g., a record from the § 213.235 inspection and a record from the § 213.119(h)(6)(i) inspection) for inspections of these "adjacent" joints. For example, if the track owner's CWR plan indicates that joints in crossovers between turnouts must be inspected during the monthly § 213.235 inspection, and a railroad track inspector inspects the joints in the crossover during the monthly § 213.235 inspection, then it is sufficient for the track owner to create and maintain only the § 213.235 record.

FRA believes this option is useful because it avoids the confusion and duplication that might otherwise result. In addition, FRA notes that it would be burdensome for track inspectors to inspect those "adjacent" joints monthly and make a note of the inspection in the monthly § 213.235 record, and also be required to make an additional § 213.119(h)(6)(i) record every few months.

(7) Specify the recordkeeping requirements related to joint bars in CWR, including the following:

(i) The track owner shall keep a record of each periodic and follow-up inspection required to be performed by the track owner's CWR plan, except for those inspections conducted pursuant to § 213.235 for which track owners must maintain records pursuant to § 213.241. The record shall be prepared on the day the inspection is made and signed by the person making the inspection. The record shall include, at a minimum, the following items: the boundaries of the territory inspected; the nature and location of any deviations at the joint from the requirements of this part or of the track owner's CWR plan, with the location identified with sufficient precision that personnel could return to the joint and identify it without ambiguity; the date of the inspection; the remedial action, corrective action, or both, that has been taken or will be taken; and the name or identification number of the person who made the inspection.

Guidance: This paragraph addresses the inspection reports that have to be created after periodic inspections required by paragraph (h)(6)(i), and followup inspections as required by the track owner's CWR plan. The inspection reports of the periodic inspections shall be prepared on the day the inspection is made and are to contain the required information. The periodic inspection record can be combined with other records required pursuant to § 213.241.

(ii) The track owner shall generate a Fracture Report for every cracked or broken CWR joint bar that the track owner discovers during the course of an inspection conducted pursuant to

§§ 213.119(g), 213.233, or 213.235 on track that is required under § 213.119(h)(6)(i) to be inspected.

(A) The Fracture Report shall be prepared on the day the cracked or broken joint bar is discovered. The Report shall include, at a minimum: the railroad name; the location of the joint bar as identified by milepost and subdivision; the class of track; annual million gross tons for the previous calendar year; the date of discovery of the crack or break; the rail section; the type of bar (standard, insulated, or compromise); the number of holes in the joint bar; a general description of the location of the crack or break in bar; the visible length of the crack in inches; the gap measurement between rail ends; the amount and length of rail end batter or ramp on each rail end; the amount of tread mismatch; the vertical movement of joint; and in curves or spirals, the amount of gage mismatch and the lateral movement of the joint.
(B) The track owner shall submit the information contained in the Fracture Reports to the FRA Associate Administrator twice annually, by July 31 for the preceding six-month period from January 1 through June 30 and by January 31 for the preceding six-month period from July 1 through December 31.

(C) After February 1, 2010, any track owner may petition FRA to conduct a technical conference to review the Fracture Report data submitted through December of 2009 and assess whether there is a continued need for the collection of Fracture Report data. The track owner shall submit a written request to the Associate Administrator, requesting the technical conference and explaining the reasons for proposing to discontinue the collection of the data.

Guidance: This paragraph requires railroads to generate Fracture Reports that are also required to be submitted to the Associate Administrator twice annually, pursuant to § 213.119(h)(7)(ii)(B). Railroads must complete Fracture Reports when they find cracks or breaks during routine inspections pursuant to §§ 213.119(g), 213.233, or 213.235, on track that is required to be inspected under § 213.119(h)(6)(i). FRA intends to use the Fracture Reports to collect CWR rail joint data; FRA does not intend to use the Fracture Reports for enforcement purposes. Inadvertent errors on Fracture Reports submitted by railroads employees should not be subject to civil penalties. Although, pursuant to § 213.119(h)(6)(i), track owners are not required to complete a Fracture Report for cracks or breaks found in excepted track, Class 1 track, and Class 2 track without passenger service, inspectors should encourage track owners to complete Fracture Reports whenever cracks or breaks are discovered, in addition to the required inspections.

If an FRA inspector encounters repeated failure to prepare and complete reports or comes upon a persistent and recurring pattern of non-reporting, inspectors are to inform their regional specialist of the non-reporting. The regional specialist will confer with Division staff to determine appropriate enforcement action. Track owners are not required to keep the Fracture Reports pursuant to the requirements of § 213.241. However, Fracture Reports should be kept until the track owner has received confirmation from headquarters that the data has been received.

FRA has provided four options as a means for the track owner to submit Fracture Reports. The first option is through an electronic data submission using Extensible Markup Language (XML) format. This option allows the railroad to decide how best to capture the information, yet still submit it to FRA in a standard and valid way. The railroads can submit the information to FRA by sending the XML files directly to FRA via email. The second option, the fillable PDF format, uses a fillable Adobe PDF file to capture and submit the data. The railroad can complete each report and submit the Adobe-generated XML file to FRA via a submit button located on the form. Third, FRA has made available a formatted Excel spreadsheet, into which railroads can input their Fracture Reports. This spreadsheet can be submitted via email, electronic media, or uploaded to the FRA Office of Safety Analysis' Web site. As a final option, FRA has made a printable version of the OMB-approved Fracture Report form available for download. See Appendix E to this compliance manual for an unofficial copy of the form; however, railroads wishing to submit the form in hard copy should use the fracture report form that is available for download, rather than this unofficial copy. More specific instructions regarding submission of the report are available on the Office of Safety Analysis' Web site at the following address: http://safetydata.fra.dot.gov/CWR/.

Paragraph (A) requires that the Fracture Report be prepared on the day the cracked or broken CWR joint bar is found. The Fracture Report is to be completed whenever a cracked or broken joint bar is discovered during the periodic inspections required by § 213.119(h)(6)(i), as well as those currently required by §§ 213.233 and 213.235.

The annual million gross tonnage information requested in the Fracture Report can be entered on the report by another designated employee of the railroad, since the railroad track inspector may not have ready access to this information. However, the inspector should be made aware of the range within which the value falls as a result of instructions provided concerning the frequency of inspection required.

Paragraph (B) requires the track owner to submit the information contained in the Fracture Reports twice annually to FRA. FRA is collecting the Fracture Report data and will review and analyze it to better determine the root causes of joint failures.

In addition, FRA inspectors will be expected to submit Fracture Reports when cracked or broken CWR joint bars are found during an inspection that are a defect or an exception to the railroad's CWR plan, in addition to noting the defect on their report. However, only one Fracture Report is to be submitted for a defective joint. An FRA inspection is not one of the required times that a railroad must submit a Fracture Report. However, the railroad may voluntarily complete the form; therefore, the FRA inspector would not complete and submit the form. Inspectors are to complete their reports on the fillable PDF form, which can be found on the FRA's Office of Safety Analysis Web site under the "CWR" toolbar tab. The submit button will email the Adobe-generated XML file to a predetermined address.

Paragraph *(C)* allows any track owner to petition FRA after February 1, 2010, to conduct a technical conference to assess whether there is a continued need for the collection of Fracture Report data. During the technical conference, FRA would review the data collected and the analysis done to date, and determine if sufficient data has been collected to enable FRA to make a technically competent determination of CWR joint bar failure causes and contributing conditions.

(8) In lieu of the requirements for the inspection of rail joints contained in paragraphs (h)(1) through (h)(7) of this section, a track owner may seek approval from FRA to use alternate procedures.

(i) The track owner shall submit the proposed alternate procedures and a supporting statement of justification to the Associate Administrator.

(ii) If the Associate Administrator finds that the proposed alternate procedures provide an equivalent or higher level of safety than the requirements in paragraphs (h)(1) through (h)(7) of this section, the Associate Administrator will approve the alternate procedures by notifying the track owner in writing. The Associate Administrator will specify in the written notification the date on which the procedures will become effective, and after that date, the track owner shall comply with the procedures. If the Associate Administrator determines that the alternate procedures do not provide an equivalent level of safety, the Associate Administrator will disapprove the alternate procedures in writing, and the track owner shall continue to comply with the requirements in paragraphs (h)(1) through (h)(7) of this section.

(iii) While a determination is pending with the Associate Administrator on a request submitted pursuant to paragraph (h)(8) of this section, the track owner shall continue to comply with the requirements contained in paragraphs (h)(1) through(h)(7) of this section.

Guidance: This paragraph permits a track owner to devise an alternate program for the inspection of joints in CWR. A track owner seeking to deviate from the minimum inspection frequencies specified in § 213.119(h)(6) should submit the alternate procedures and a supporting statement of justification to FRA's Associate Administrator for Railroad Safety/Chief Safety Officer. In the supporting statement, the track owner must include data and analysis that establishes (to the satisfaction of the Associate Administrator for Railroad Safety/Chief Safety Officer) that the alternate procedures provide at least an equivalent level of safety across the railroad.

If the Associate Administrator for Railroad Safety/Chief Safety Officer approves the alternate procedures, the Associate Administrator for Railroad Safety/Chief Safety Officer will notify the track owner of such approval in writing. In that written notification, the Associate Administrator for Railroad Safety/Chief Safety Officer will specify the date that the alternate procedures will become effective. After that date, the track owner shall comply with the approved procedures. If the Associate Administrator for Railroad Safety/Chief Safety Officer determines that the alternate procedures do not provide an equivalent level of safety, the Associate Administrator for Railroad Safety/Chief Safety Officer will disapprove the alternate procedures in writing. While a determination is pending with the Associate Administrator for Railroad Safety/Chief Safety Officer, the track owner shall continue to comply with the requirements contained in § 213.119(h)(6).

Technology (including frequent automated track geometry surveys) and sound CWR management, including prompt removal of "temporary" joints, may provide the additional information required to verify the ongoing integrity of joints in CWR. The alternative procedures provision of this final rule will allow track owners to take advantage of these new approaches as they become available.

119(i) The track owner shall have in effect a comprehensive training program for the application of these written CWR procedures, with provisions for annual re-training, for those individuals designated under § 213.7(c) as qualified to supervise the installation, adjustment, and maintenance of CWR track and to perform inspections of CWR track. The track owner shall make the training program available for review by FRA upon request.

Guidance: All railroad employees designated under § 213.7(c) as qualified to supervise the installation, adjustment, and maintenance of CWR track and to perform inspections of CWR track must be trained on the track owner's CWR plan. The track owner shall maintain a written record of this training in accordance with § 213.7(d). Inspectors should refer any requests for training programs to their regional office. Railroad representatives agree to voluntarily make an initial submission of their CWR training programs to FRA. Track inspectors should not request the training program of a specific track owner unless under the specific direction of FRA management. Rather, FRA headquarters staff will undertake the responsibility of obtaining and disseminating this information, as needed, to both FRA inspectors and State inspectors participating in rail safety enforcement activities under Title 49 Code of Federal Regulations (CFR) Part 212. However, inspectors can request a copy of the track owner's qualification list during regular business hours.

119(j) The track owner shall prescribe and comply with recordkeeping requirements necessary to provide an adequate history of track constructed with CWR. At a minimum, these records must include:

(1) Rail temperature, location, and date of CWR installations. Each record shall be retained for at least one year;

(2) A record of any CWR installation or maintenance work that does not conform to the written procedures. Such record shall include the location of the rail and be maintained until the CWR is brought into conformance with such procedures; and

(3) Information on inspection of rail joints as specified in paragraph (h)(7) of this section.

Guidance: Paragraph (j) contains the recordkeeping requirements for railroads that have track constructed of CWR. At a minimum, a track owner must keep records of the items listed in paragraphs (j)(1) through (j)(3). Paragraph (j)(1) requires each railroad to keep a record of the rail temperature, location, and date of the CWR installations. Paragraph (j)(2) requires a track owner to keep a record of any CWR installation or maintenance work that does not conform with the written procedures. Also, (f)(2) requires the railroad to determine the difference between the average rail temperature and the average rail neutral temperature. This necessitates the recording of rail neutral temperatures at rail repair locations that do not conform to the procedures. Paragraph (j)(3) requires a track owner to keep records of information on inspection of rail joints as specified in paragraph (h)(7).

119(k) The track owner shall make readily available, at every job site where personnel are assigned to install, inspect or maintain CWR, a copy of the track owner's CWR procedures and all revisions, appendices, updates, and referenced materials related thereto prior to their effective date. Such CWR procedures shall be issued and maintained in one CWR standards and procedures manual.

Guidance: Since the implementation of the CWR regulations, FRA has noted that a number of rail carriers maintain two different sets of CWR procedures. Additionally, some railroads have been maintaining the set of CWR procedures submitted to FRA as required by this section (§ 213.119), as well as a separate set of CWR procedures that is used by personnel in the field. While it may be acceptable for a railroad to instruct its personnel to maintain more restrictive CWR procedures in the field than what is on file with FRA, it is important to note that railroads must train their personnel on the plan formally submitted and filed with FRA. As FRA enforces the track owner's CWR plan on file with its Office of Railroad Safety, it is critical to have these procedures at every job site where personnel are assigned to install, inspect, or maintain CWR. Specifically, this will ensure that personnel in the field understand which set of procedures FRA will hold them responsible for compliance with the TSS.

119(l) As used in this section—

***Adjusting/de-stressing** means the procedure by which a rail's temperature is re-adjusted to the desired value. It typically consists of cutting the rail and removing rail anchoring devices, which provides for the necessary expansion and contraction, and then re-assembling the track.*

***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 compressive forces caused by critical rail temperature combined with insufficient track strength and/or train dynamics.*

***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.*[1]

***CWR joint** means any joint directly connected to CWR.*

***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.*

***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** means those devices which are attached to the rail and bear against the side of the crosstie to control longitudinal rail movement. Certain types of rail fasteners also act as rail anchors and control longitudinal rail movement by exerting a downward clamping force on the upper surface of the rail base.*

[1] *Note, this term is used in § 213.119(h)(5).*

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 *mean 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.*

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.*

Track lateral resistance *means the resistance provided by 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.*

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.*

§ 213.121 Rail joints

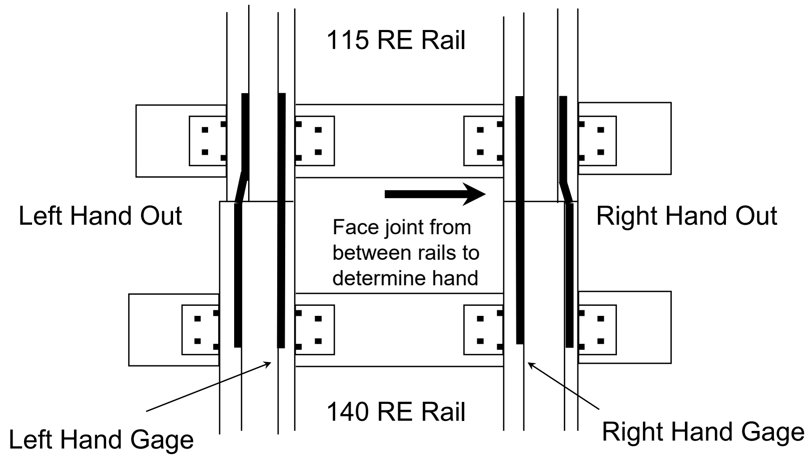
121(a) Each rail joint, insulated joint, and compromise joint shall be of a structurally sound design and dimensions for the rail on which it is applied.

Guidance: For proper rail load transfer to occur, rail joints must contact the head and base of the rails when the bolts are tight. Many rail joint designs have been used with varying degrees of success, and the TSS does not attempt to single out any particular design as the only acceptable joint. This could inhibit innovation in modern track design.

The TSS requires structural soundness and bolt condition based on maximum authorized train speed. Inspectors must be attentive to locations where standard joint bars are used to join dissimilar rail sections where it would be proper to have compromise bars.

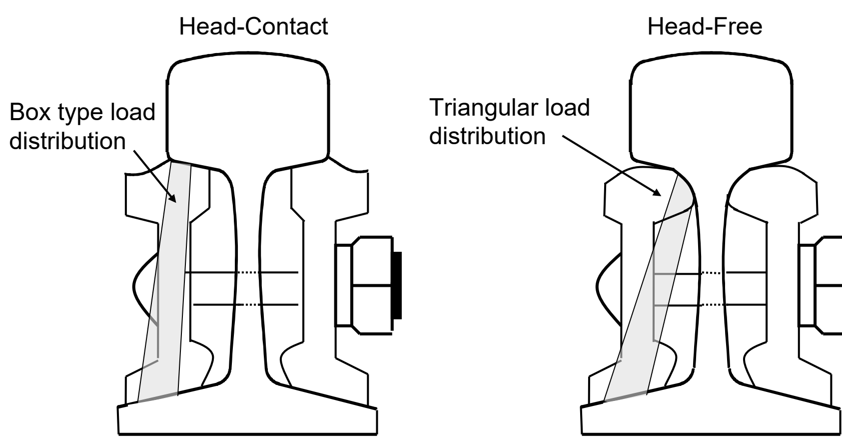
The TSS recognize these important aspects of rail joints and begin this section with a requirement that rail joints have a structurally sound design and dimension for the rail on which they are applied.

Rail joints are considered to be a necessary discontinuity and require special attention by railroad maintenance personnel, railroad inspectors, and FRA inspectors. As far as possible, a rail joint should provide the same relative strength, stiffness, flexibility, and uniformity as the rail itself. The following figure illustrates the proper application of compromise joint bars.



As shown in the following figure, one of the design elements of joint bars to consider is if it's a head-contact or head-free design:

- The head-contact bar supports the rail ends with a box-type construction, carrying the load between the underside of the head and the base of the rail.
- The head-free joint bar does not contact the underside of the rail heads, but instead contacts the rail in the fillet area. The load distribution is referred to as a triangular load distribution.



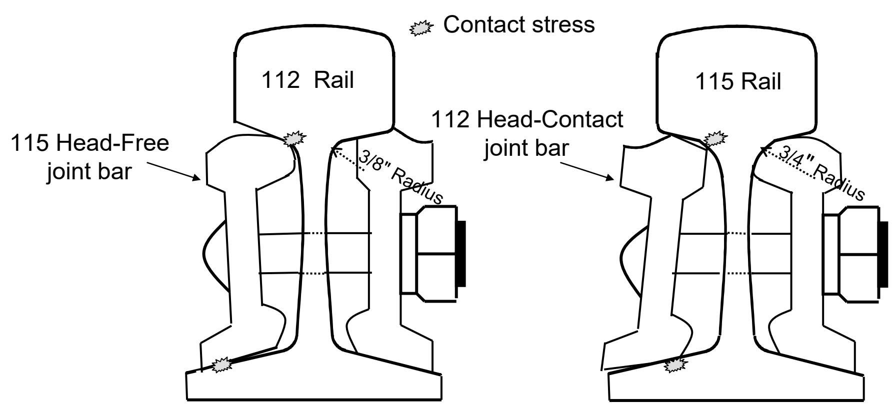
The use of a standard (noncompromise) joint bar of head-contact design on a rail section other than for designed may constitute a deviation. The differences between the head-contact joint bar and the head-free joint bar are significant.

It is evident the joint bar and the rails do not bend or flex exactly with each other along their length. Tests and measurements show that for positive bending, there exists a downward bearing pressure of the under side of the head of the rail on the top surface of the joint bars for some distance along the bar away from the rail ends, (approximately 2 inches). There is also an upward bearing pressure of the upper surface of the base of the rails at parts of the length of the bar further away from the rail end, (bearing distance approximately 3 inches). The converse is true for negative bending.

The head-free joint bar accepts bearing and shear forces from vertical loads in the rail's upper fillet. A head-contact bar is not designed to fit into the filet. Specifically, the head-contact joint bar accepts bearing from vertical loads on the flat underside of the rail's head: generally on a 1 to 4 slope. It is not designed to seat into the rail's upper filet. Although the vertical fishing dimension for the 112 and 115 RE rail sections is identical ($3^3/_{16}$ inches), the head filet radius is different:

- For the 115-pound section, radius equals three-fourths of an inch
- For the 112-pound section, radius equals three-eighths of an inch

As shown in the following figure, the 115 head-free bar fits the 112 rail filet practically at a point, most probably inducing joint bar stresses in excess of design which is a deviation from § 213.121(a). The 112 head-contact bar does properly not fit into the 115 rail fillet as it bears in very small areas beneath the head of the rail, possibly inducing joint bar stresses in excess of design and exerting a wedge action between the rail head and rail web, promoting head and web separation. In addition, the joint bar may experience a twist, or torsional force from the tightening of the track bolts when used as a compromise between 115 and 112 rail. The torsional stress from twist will be the greatest at the head and toe of the bar at the rail ends.



There are exceptions to the use of a joint bar of head-contact design on a rail section other than for designed. For example, a 131-pound or 132-pound head-contact joint bar may be used in lieu of a 131/132 or 131/136 compromise joint bar if rail drilling and joint bar punching is the same. The width of the rail head in these configurations is sufficient to allow full contact in the upper fishing wear surface. In summary:

- 112-pound RE joint bars should not be used as compromise joint bars between 112 RE and 115 RE rail.
- 115-pound RE joint bars should not be used as compromise joint bars between 112 RE and 115 RE rail.
- 131 RE head-contact bars or 132 RE head-contact bars may be used as compromise joint bars between 131 RE and 132 RE rail or 136 RE rail where rail drilling and joint bar punching are the same. (Note: FRA Standards do not prohibit the track owner from field drilling bolt holes to fit).

While the above addresses compromise joint bars, it is stressed that 112 RE bars are not to be used on 115 RE and 119 RE rail and vice versa. Joint bars with 131 RE head-free and 132 RE head-free design, or 131 RE head-free and 136 RE head-free joint bars, are not interchangeable and are not to be intermixed.

For a compendium of rail section dimensions in order to compare other rail sections for compatibility between joint bars on various rail sections refer to Appendix C of this manual.

121(b) If a joint bar on Classes 3 through 5 track is cracked, broken, or because of wear allows excessive vertical movement of either rail when all bolts are tight, it shall be replaced.

Guidance: Joint bars are designed to fit into the space between the bottom of the rail head and rail base (fishing). With the bolts tight, the joint bars are wedged into the fishing space to provide lateral and vertical beam strength thereby supporting the abutting rail ends. When held up against the rail with bolts, joint bars contact the rail at two points; bottom of the rail head (or fillet) and top of the rail base. These contact points, known as the "fishing surfaces," can experience metal loss due to abrasion and mechanical wear that occurs during the cyclical train dynamic loading. After long-term service, the fishing surfaces of the rails and bars can wear to the point that joint bars are no longer wedged into the rail, even with tight bolts. In such cases, the joint assembly will no longer optimally support the abutting rail ends.

Joints with minimally worn fishing surfaces can provide for the safe passage of wheels in Classes 1 through 5. As a guide, excessive vertical movement would exist when there is significant fishing surface wear and wheel loads cause the abutting rail ends to exhibit tread mismatch approaching the thresholds under § 213.115. If excessive vertical movement occurs, or there are any cracks, corrective action would be to replace the bars or take other proper corrective action.

Proper corrective action for a joint bar cracked or broken, other than center break, in Classes 3 through 5 track, would be replacement or a reduction to Class 2. If both joint bars are cracked or broken between the 1st and 2nd bolt hole (including through the 2nd bolt hole), it should be considered Class 1. This is because there is only one bolt in a rail end that is within the remaining section of the joint bar that is providing support.

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

Guidance: For a center cracked or broken bar, the appropriate corrective action would be replacement or reduction to Class 1 speeds under the provisions of § 213.9(b).

121(d) In the case of conventional jointed track, each rail shall be bolted with at least two bolts at each joint in Classes 2 through 5 track, and with at least one bolt in Class 1 track.

Guidance: Track owners must have the number of required bolts in each rail in a joint. This paragraph does not prescribe a tightness (torque) standard for each bolt. A bolt that no longer can support the joint bar against the rail will continue to provide resistance to pull aparts when the rail is in tension. The ability of the bolts to hold bars against the rail to support the abutting rail ends is covered under § 213.121(f).

A bolt does not fulfill the requirements of this paragraph if it is in imminent danger of complete failure (it no longer is holding the bar to the rail and no longer resists pull apart forces). For example, the nut is missing (it will likely fall out under subsequent train movements) or the bolt shaft is fractured.

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

Guidance:

Rail installed as CWR remains as CWR, regardless of whether a joint or plug is installed at a later time. If there is only one bolt in a rail end at a joint, in a CWR string, that one bolt will be subject to all the tensile axial forces and will easily shear (break) resulting in a pull-apart.

121(f) Each joint bar shall be held in position by track bolts tightened to allow the joint bar to firmly support the abutting rail ends and to allow longitudinal movement of the rail in the joint to accommodate expansion and contraction due to temperature variations. When no-slip, joint-to-rail contact exists by design, the requirements of this paragraph do not apply. Those locations when over 400-feet in length, are considered to be continuous welded rail track and shall meet all the requirements for continuous welded rail track prescribed in this part.

Guidance: If the joint bars are loose, the joint is not in compliance with § 213.121(f). In addition, a joint assembly is not in compliance when inadequately tightened bolts prevent it from supporting the abutting rail ends under the expected traffic loads.

Joint bolts can deteriorate sufficiently as to create a condition where the bars may become completely detached from the rail or cause a total lack of support, which can contribute to a broken rail. Such a condition can create a mismatch which exceeds the limits specified in § 213.115 (Rail end mismatch). In such a case, the defect would be rail end mismatch (class specific) and inspectors should also include a notation about the loose joint bars.

This paragraph also recognizes the design characteristic that enables the rail ends in a joint to move longitudinally to handle temperature changes (expansion/contraction) or rail creep (traffic flow). This type of joint bar assembly is standard for jointed rail because that type of track construction has lower axial forces than CWR. In CWR, it is desirable to contain the rail expansion and contraction in the remaining joints (i.e., insulated joints) in order to eliminate the pull-apart action that occurs in regular joints. In CWR, the track structure, by design, dissipates the axial forces. Accordingly, this paragraph allows joint designs that stop the axial rail movement within the assembly.

Except for the axial movement component of this paragraph, joint bars such as glued insulated joints are subject to all of the remaining requirements of this paragraph and all other paragraphs of § 213.121. These types of assemblies are considered to be joints, even in CWR (see § 213.119). However, for the definition as to what constitutes CWR, a glued joint is not a longitudinal discontinuity in a rail string. Glued joints are also considered joints under § 213.109 with respect to the required positioning of nondefective ties at joints.

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

Guidance: This paragraph prohibits the use of a rail containing a bolt hole that has been torch cut or burned in Classes 2 through 5 track.

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

Guidance: This paragraph prohibits the reconfiguration of joint bars by torch cutting in Classes 3 through 5 track. By omission of the reference to Classes 1 and 2 track, this practice of reconfiguration is allowed in those classes. However, the joint bars that are reconfigured by torch cutting must meet certain criteria for structural soundness of design and dimension, which is required under (a) of this section.

§ 213.122 Torch cut rail

122(a) Except as a temporary repair in emergency situations no rail having a torch cut end shall be used in Classes 3 through 5 track. When a rail end is torch cut in emergency situations, train speed over that rail end shall not exceed the maximum allowable for Class 2 track. For existing torch cut rail ends in Classes 3 through 5 track the following shall apply –

(1) Within one year of September 21, 1998, all torch cut rail ends in Class 5 track shall be removed;

(2) Within two years of September 21, 1998, all torch cut rail ends in Class 4 track shall be removed; and

(3) Within one year of September 21, 1998, all torch cut rail ends in Class 3 track over which regularly scheduled passenger trains operate, shall be inventoried by the track owner.

Guidance: The regulation prohibits the torch cutting of rail ends in Classes 3 through 5 track except as a temporary repair in emergency situations. In such emergency situations, train speed shall not exceed the maximum allowable for Class 2 track.

Existing torch cuts must be removed from track in the following time frames:
- Class 5 track – by September 21, 1999.
- Class 4 track – by September 21, 2000.
- Class 3 track with passenger trains – by September 21, 1999, all torch cuts shall be inventoried by the track owner.

122(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, shall be removed within 30 days of discovery. Train speed over that rail end shall not exceed the maximum allowable for Class 2 track until removed.

Guidance: Those torch cuts inventoried will be “grandfathered in” and any torch cuts found after the expiration of one year that are not inventoried must be slow ordered to Class 2 speed and removed within 30 days of discovery. If a railroad chooses to upgrade a segment of track to Class 3, and passenger trains are operated, all torch cuts must be removed before speeds can exceed the maximum for Class 2 track. If a railroad chooses to upgrade a segment of track from any lower class to Class 4 or 5, it must remove all torch cuts.

§ 213.123 Tie plates

123(a) In Classes 3 through 5 track, where timber crossties are in use, there must be tie plates under the running rails on at least 8 of any 10 consecutive ties.

123(b) In Classes 3 through 5 track no metal object which causes a concentrated load by solely supporting a rail shall be allowed between the base of the rail and the bearing surface of the tie plate. This paragraph (b) is applicable September 21, 1999.

Guidance: Inspectors should consider this section jointly with the requirements for crossties and rail fastenings and report tie plate conditions as defects where safety is impaired by the absence of tie plates.

In Classes 3 through 5 track no metal object that causes a concentrated load by solely supporting a rail shall be allowed between the base of rail and the bearing surface of the tie plate. The specific reference to “metal object” is intended to include only those items of track material that pose the greatest potential for broken base rails such as track spikes, rail anchors, and shoulders of tie plates. The phrase “causes a concentrated load by solely supporting a rail” further clarifies the intent of the regulation to apply only in those instances where there is clear physical evidence that the metal object is placing substantial load on the rail base, as indicated by a lack of loading on adjacent ties.

§ 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.

Guidance:“Rail fastening systems” include modern-day elastic fastening systems, which can consist of abrasion pads, insulator clips, shoulder inserts cast into concrete ties, as well as the fastener itself, of which many different designs are in use today. The fastening system can also be of the traditional cut spike variety, with or without tie plates. The failure of certain critical components within a particular system could adversely affect the ability of the individual fastener to provide adequate gage restraint. The wording of this regulation provides for an evaluation of all components within the system, if necessary, when degradation of the fastening system has resulted in problems maintaining gage within the limits prescribed in § 213.53(b).

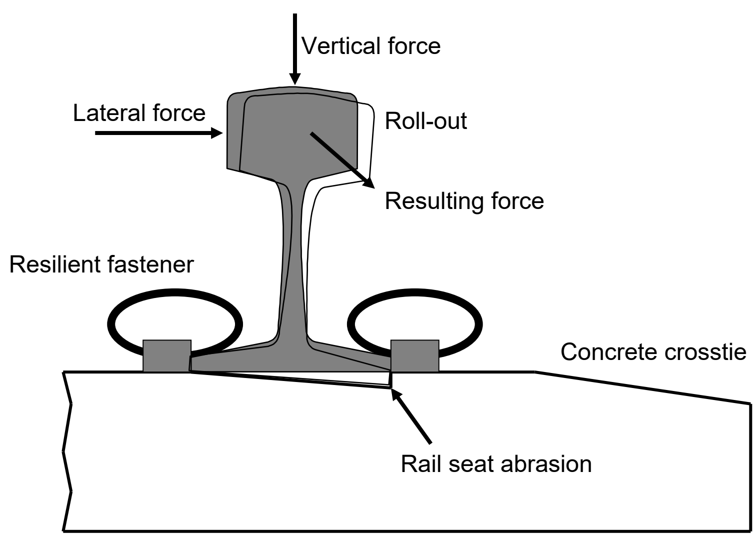
When an inspector identifies a gage geometry condition where the fastener system has degraded and the location in question meets the factors described below, the inspector must examine each component of the fastener system (e.g., clip, insulating pad, bolts, spiking pattern, etc.). The inspector should describe the nature of the failed components on the F6180.96 form. If a fastener condition causes the gage to exceed the limits of § 213.53, the inspector shall report the condition as a gage defect and describe the nature of the fastener condition on the same defect line of the report.

This section requires the inspector to exercise judgment in evaluating the condition of fasteners. The following factors should be considered in the evaluation:

- Gage exceeding the limits of § 213.53 (in such cases gage and track class will govern).

- Gage close to the limits of § 213.53 with evidence of recent widening.
- Evidence of recent rapid deterioration of gage with probable continued deterioration.
- Evidence of recent significant damage to rail fasteners to the extent that gage widening is probable.
- Evidence of recent maintenance work improperly performed resulting in lack of sufficient fasteners to prevent gage widening under expected traffic.
- Traffic conditions, including speed, tonnage, and type of equipment.
- Conditions of curvature and grades.

FRA inspectors may use a PTLF described in § 213.110 for the purposes of measuring the effectiveness of fasteners. Refer to Appendix D - PTLF instructions for non-GRMS territory under § 213.53.
A unique attribute of concrete crossties is the abrasion that can occur between the base of the rail and the rail-seat on the crosstie, a component of the rail fastening system. A variety of tie pad designs and materials are placed between the rail and the ties to mitigate abrasion. However, unequal or "wedged" abrasion of the rail seat can be problematic for a high-speed or high-tonnage operating environment that may cause rail fasteners to become loose under load or in extreme cases cause rail-tilt or rollout. See the following figure. Accordingly, inspectors should look for rail rollout due to rail seat abrasion on concrete crossties, particularly in territory with heavy traffic levels and moderate curvature. The mechanics of this condition on concrete crossties include the following elements:



- Concrete wear or abrasion resulting in loose rail clips, insulators, and pads.
- Loose components allow more moisture and abrasives to enter rail seat.
- Once the field side of the rail base wears through the tie pad and contacts the concrete tie rail seat, rapid cutting into the concrete (accelerated abrasion) can occur.
- Signs and symptoms of concrete crosstie rail seat abrasion include.
- Tie pad crushed or squeezed out (maintaining integrity of the tie pad is essential).

- Insulators crushed, moving, or missing.
- Clips loose indicating loss of pressure on the rail base (loss of toe load).
- Longitudinal rail movement.
- Indications of cement colored paste in the ballast from the abraded rail seat.
- Metal flaking or grease streaks in the center of the low rail in a curve caused by the outer rim of wheel (or false flange) placing excessive pressure on the head of the rail, a condition generally created by gage-widening.

Based on the above discussion, it is apparent that rail-seat abrasion on concrete ties causes rail rollout. As rail rollout occurs, it decreases the effectiveness of the rail fasteners and will often lead to gage geometry conditions. As a general rule, inspectors should cite this condition as a rail fastener defect (213 defect code 0127A). However, where rail rollout causes the gage to exceed the threshold for the designated class of track, inspectors should cite this condition as a gage defect (see § 213.53).

Rail anchors are not considered to be a rail fastener. In areas where rail anchors are used in combination with resilient fasteners on concrete ties, the resilient rail fasteners that normally perform a dual function to restrain rail laterally and longitudinally should only be evaluated on their ability to provide lateral restraint to prevent gage-widening in regard to this section.

An insufficient fastener defect should be written when an unsafe condition results from missing or defective fasteners (e.g., heads of cut spikes sheared off at throat) on otherwise supportive crossties.

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

Guidance: This paragraph requires that if rail anchors are applied to concrete crossties, then the combination of the crossties, fasteners, and rail anchors must provide effective longitudinal restraint. “Effective longitudinal restraint” is a performance-based standard.

(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.

Guidance: addresses instances where fastener placement impedes insulated joints from performing as intended by permitting the fastener to be modified or removed, provided that the crosstie supports the rail. “Support” means that the crosstie is in direct contact with the rail or leaves an incidental space between the tie and rail. Certain joint configurations do not permit conventional fasteners to fit properly. As a result, manufacturers offer a modified fastener to fit along the rail so that the fastener provides the longitudinal requirement, or it is removed completely, providing lateral restraint is accomplished by ensuring full contact with the rail or additional placement of anchors on the base of the rail.

Additionally, FRA notes that the requirement of having an effective crosstie within a prescribed distance of a joint contained in § 213.109(e) would apply, without modification for insulated joints. FRA has not mandated what type of equipment or what manufacturer a track owner must use, but instead has determined to regulate the performance of the material to the minimum safety standards promulgated in Part 213.

§ 213.133 Turnouts and track crossing generally

133(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 guardrail must be kept free of obstructions that may interfere with the passage of wheels.

Guidance: The rule specifies that all components and fastenings shall be intact and maintained securely in place. There are several types of fastenings, which include reinforcing straps, connecting rods, rail hold down clips, and braces. (For a more extensive compilation of fastenings, see the fasteners listed in defect codes 213.133. Where fastenings are loose or missing, inspectors should cite the railroad using 213 defect code 0133A15 (Turnout or track crossing fastenings not intact or maintained.) In addition, where fasteners are loose or missing and there is an apparent contributing condition (e.g., a large section of the casting is broken out at an at-grade rail to rail crossing), inspectors should include a description of that contributing condition in their inspection report.

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

Guidance: A turnout is a track arrangement consisting of a switch and frog extending from the point of the switch to the heel of the frog. This arrangement allows engines and cars to pass from one track to another. Because of the operating or movable parts and lateral thrust, it is essential that fastenings be in place, tight, and in sound condition.

A track crossing (diamond) is an assembly used where two tracks intersect at grade permitting traffic on either track to cross the rails of the other. It may consist of four frogs connected by short rails, or a plant manufactured "diamond." Because of the impact a crossing is subjected to, it is essential that fastenings be in place, tight, and in sound condition. Each switch, frog, and guardrail must be kept free of obstruction.

Anchors on each side of a turnout or crossing and through a turnout are required on Classes 4 through 5 track. For Class 3 track, this requirement is effective on September 21, 1999. In determining the adequacy of anchors at and on each side of a turnout or crossing and through turnouts, inspectors should determine the capability of these devices to:

- Restrain rail.
- Assure proper fit of switch points.
- Prevent line irregularities.

Ties and timbers at switches and crossings must be of sound condition, well-tamped, and the roadbed must be adequately drained.

Flangeways at turnouts and track crossings must be at least 1½ inches wide.

Turnouts and track crossings must be walked and measurements made before they can be included on the F6180.96 form as a unit inspected.

§ 213.135 Switches

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

Guidance: The TSS under § 213.135 specifies the requirements for switch restraint, movement, and fit. Each stock rail must be securely seated in the switch plates. Various conditions, such as loose braces or hanging ties, can cause a stock rail to become unseated. In these situations, inspectors should cite the railroad with 213 defect code 0135A1. Alternatively, a stock rail can become unseated if the braces are overtightened during maintenance. In these situations, inspectors should cite the railroad with 213 defect code 0135A2.

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

Guidance: This paragraph recognizes the existence of reinforcing bars or straps on switch points where joint bars cannot be applied to certain rail defects, as required under § 213.113(a)(2), because of the physical configuration of the switch. In these instances, remedial action B will govern, and a person designated under § 213.7(a), who has at least 1 year of supervisory experience in track maintenance, will limit train speed to that not exceeding 30 mph or the maximum allowable under § 213.9(a) for the appropriate class of track, whichever is lower. Of course, the person may exercise the options under § 213.5(a) when appropriate.

Section 213.135(b) addresses cracks in the switch rail (point) with reinforcing straps acting as surrogate joint bars. If the switch point rail is not cracked, and only the straps are cracked, then it is not appropriate to cite § 213.135(b); and inspectors should cite the appropriate defects under § 213.133(a). Normally, minor cracks in a strap are not a major concern. However, if a strap is fully broken and causing other problems (e.g., loose switch clip, etc.), then § 213.133 (Turnouts and track crossing generally) would be appropriate. If the straps and switch point rail are both broken, then there is an unprotected rail break and inspectors should cite the appropriate defect under § 213.113.

Most industry standards call for a 4¾-inch opening between the switch point and the stock rail, measured at the No. 1 switch rod. As components wear, "lost motion" will result. When the problem of elongated switch clip and/or rod holes is encountered, the switch rods may be adjusted at the clip (e.g., adjustable side jaw clips, rocker clips, etc.). Adjustment may also be accomplished at the switch stand depending on the design of the assembly. In some cases, lost motion may be compensated by the addition of properly designed shims between the switch clip assembly and the switch rail.

When the opening is substantially less than the standard dimension, wheels can still pass through the switch as intended. However, the backs of wheels may contact the inside rail head of the open switch rail. This interaction can cause undesirable lateral pressure against the switch rail. This pressure can contribute to broken heel block bolts, cause cracked or broken switch clips, and broken switch crank cross pins. In extreme circumstances, the closed point can open under movement because of the transfer of lateral loads through the switch rods. In these circumstances, inspectors should make an extra effort to determine the condition of all affected components. The amount of throw is one of the many factors that must be taken into consideration when determining the railroad's compliance with §§ 213.133 and 213.135.

Based on the above, make sure that switch points fit snugly against the rail when the switch is thrown in either position. As appropriate, request that the railroad representative operate the switch to test for lost motion and/or loose connections.

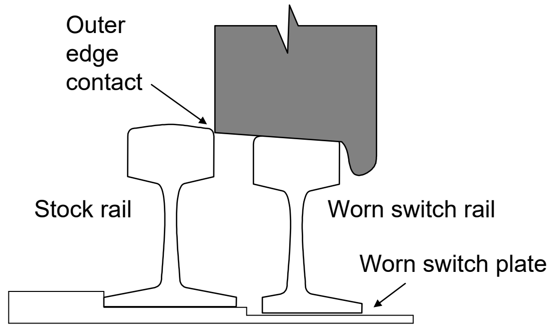
The Appendix to the American Railway Engineering and Maintenance of Way Association (AREMA) Portfolio of Trackwork Plans contains the following split switch terms:

- "Split Switch with Uniform Risers - A split switch in which the switch rails have a uniform elevation on riser plates for the entire length of the switch, and therefore not having a heel slope, the point rail rise being runoff back of the switch in the closure rails."
- "Split Switch with Graduated Risers - A split switch in which the switch rails are gradually elevated by means of graduated riser plates until they reach the required height above the stock rail, and therefore having a heel slope."

The heel of the switch point is higher than the stock rail at the heel joint with the uniform riser layout while, on the graduated layout, the switch point is at the same elevation as the stock rail. The mixing of uniform riser and graduated riser plates in the same switch, while not specifically addressed in the TSS, can cause undesired stress in the switch rails and closure rails. Inspectors should make a note of the intermixing of switch plates in turnouts that have a high amount of traffic.

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

Guidance: : Inspectors are to examine the seating of stock rails in the switch plates to ensure that the outer tread of a wheel cannot engage the gage side of these rails. Grease lines or slight groves running at a slight angle on the tread of a stock rail can provide inspectors with clues about the wheel/rail interface. These marks can be found in the area where wheel treads transition from the switch rail to the stock rail. When found, inspectors should closely examine the gage side of the stock rail to make sure the outer edge of wheel treads are not contacting the gage side of the stock rail. As shown in the following figure, this type of defect can occur when a worn switch rail and switch plates remain in place after a stock rail has been renewed. This causes the switch rail to drop down from the same level as its corresponding stock rail. The danger associated with this condition is the possibility that the outer edge of a wheel can contact the gage side of the stock rail during a trailing movement through a switch, thereby turning over the stock rail.



Other items that can cause outer edge wheel contact include improper surface, poor crosstie condition, loose rail braces, stock rails not securely seated, switches where the majority of the traffic uses one side of the turnout, and insecure jointed heel blocks with improper elevation.

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

Guidance: At least two tight bolts in each rail are required to ensure that the heel of each switch rail is “secure” for purposes of determining compliance with § 213.135(d). Examine the heel assembly, its fastenings, and bars, along with the surface condition of the heel. Improper elevation of the heel assembly relative to the stock rail can lead to outer edge wheel contact and excessive vertical movement of the switch point.

If heel joints were considered to be a normal joint, only one bolt per rail end would be required in the heel for Class 1 track. However, the heel joint functions in a different manner than a normal track joint. The heel joint serves as the pivotal point for the rotation of the switch point. It helps maintain the proper horizontal, vertical, and longitudinal fit of the switch point against its stock rail. One bolt per rail end in Class 1 track at the heel joint does not provide redundancy. The loss of the single bolt in the rail end at the heel joint could have serious safety consequences.

Some railroad heel joints have as many as six bolts for the higher track classes. Typically, when railroads plan to field weld, they do not drill the middle two bolt holes in the rail of a six-hole joint bar. This practice, which provides for at least two bolts in each rail end of the heel, satisfactorily secures the assembly.

The switch heel assembly with joint bars also performs the function of a joint. As such, where there is an improper joint bar at a heel block, an inspector should cite § 213.121 (Rail joints). One example of an improper joint bar is the installation of a six-hole joint bar where a five-hole bar, by design, should be used. This would be a deviation of § 213.121, because it is an improperly designed bar for that application, which may make it difficult to throw the switch or may cause gapping.

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

Guidance: For hand-operated switch stands of virtually all types, rotary motion imparted to the vertical spindle within the stand by the person operating the hand lever is translated into (practically) linear movement of the connecting rod by the right angle combination of the end of the spindle beneath the stand and its attached crank. Unless cranks are integrated with the spindle by casting during manufacture, they are separate pieces that must be joined. Cranks are attached to spindles in one of two ways: (1) they may be turned into a threaded opening in the side of the spindle or (2) the crank may be fabricated to have a square or rectangular smooth opening at one end, which can be moved from below, up onto a spindle having a similar cross-section to a position where it can be secured in place by a horizontally inserted cross pin that simultaneously engages the crank with the spindle. For ease of reference in this discussion, the first case will be referred to as Type A and the second case as Type B. An undesired decoupling of the connecting rod and the switch stand can occur in Type A if the bolt attaching a connecting rod to a threaded crank comes out and, in Type B, separation of the crank and the spindle can occur in the absence of the cross pin. Either instance could result in the gapping of the closed switch point under train movement, unless some other device is in place to physically restrain the points.

Type B switch stands may at times have a plate-like arrangement of sheet metal suspended from the headblock timbers beneath the assembly. This device, generally a shallow “U” shape, is commonly referred to as a “safety plate.” The function of the plate is twofold: (1) to restrict the downward movement of the crank on the spindle, should the cross pin be absent, so the crank does not completely separate from the spindle, and (2) to keep a vertically unrestrained crank from sliding down the spindle far enough to permit the connecting rod enough space below the bottom of the switch stand to move up off the lug of the crank. There have been cases where cross pins have fractured. The plate itself is deformed so that the downward displacement of the crank was sufficient to enable the connecting rod to clear the crank lug without contacting the base of the stand. This leads to decoupling of the switch stand and the connecting rod.

Inspectors must constantly bear in mind those aspects of switch stand performance that are crucial to functional safety. This discussion concentrates on that region of the mechanical linkage between the switch points and the switch stand that may be difficult to observe in the course of a turnout inspection.

There are several different styles of Type B switch stands that are in use on main tracks and yards in the railroad industry. These models differ in minor ways. Nevertheless, they rely on the cross pin restraint of the spindle/crank subassembly and they all share vulnerability to the uncoupling of the switch stand and connecting rod. A turnout inspection must include examination of these hard to see parts even.

Inspectors should examine the effectiveness of the fastening system of the switch stand to the head block ties and look for signs of movement of the switch stand which can result in loss motion leading to a gapped switch point.

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

Guidance: Inspectors must examine each switch lock and keeper. Certain types of switch stands “internally toggle” when the handle is thrown all the way in either position to hold the switch point against its stock rail. These types of switch stands are used in other than main track and often are a “semi-automatic” design whereby a train trailing the turnout, with the switch in the incorrect position, will initially force the points over. The final throw is completed by the internal toggling action of the switch stand. By design and application preference, these switch stands might not have a lock or keeper for other than main track applications (see the following figure).

There is a concern associated with this type of switch stand retrofitted with an “S”-shaped strap, bolted and welded to one of the two flanges of the throw lever stop. The bolt has been proven to be ineffective in preventing rotation of the strap, and the bead weld, placed by the manufacturer at the top of the strap, cracks from repeated depression of the keeper. The strap rotates downward, altering the location of the lock shackle or keeper, allowing the throw of the switch lever without removal of the lock or keeper.

If the above types of switch stands are used at switches and derails not requiring securing, the soundness of the strap is not in question. However, if the track owner requires that the stand be secured by lock or keeper, a weld displaying cracks will call into question the soundness of the latch mechanism and 213 defect code 0135F, *throw lever* (potentially) operable with switch-lock or keeper in place, should be cited without recommending a violation. If the track owner fails to aggressively address and correct the potential defect on the subject types of switch stands, consider recommending a violation to Chief Counsel.

49 CFR 218.105(b) requires that all hand operated main track switches are to be locked. An ineffective or worn latch or hasp can allow the throw lever of the switch to be operated with the lock in place. There are several different types and models of hand operated switches in use; Inspectors should inspect each latching mechanism to for wear and possible operation of the throw lever with the lock in place. The inspection should include stepping on the latch and observation of the clearance between the throw lever and the opening created when the latch is depressed with lock in place. Inspectors should not attempt to raise the operating lever and request the accompanying railroad representative to lift the handle if its operation through the latch appear probable, and it is safe to do so. As shown in figure below, the throw lever is clearly operable with the lock in place.

Many power switches are operable by either power (remotely by control operator or train dispatcher) or by hand, frequently called dual control switches. Inspection of this type of switch machine is similar to the typical hand operated switch stand. Most have two levers, one to remove the switch machine from power operation, and one that acts as the throw lever. The latches should be inspected for the possibility of the power lever or throw lever being operated with the lock in place. (See the following two figures)

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

Guidance: Examine condition of switch position indicator and note any unnecessary obstruction to its visibility. This requirement does not mandate that every switch have a position indicator but merely requires such devices to be clearly visible when installed on a switch stand.

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

Guidance: The rule does not provide for specific dimensions for determining when switch points are "unusually chipped or worn." The accident/incident database indicates that worn or broken switch points are the largest single cause of derailments within the general category of "Frogs, Switches, and Appliances." However, most of these derailments are related also to other causal factors such as wheel flange condition, truck stiffness, and train-handling characteristics. Therefore, qualified individuals must use their experience to determine when switch points are "unusually chipped or worn."

135(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.

Guidance: This paragraph provides an exemption for this item of specialized track work, primarily used in pavement or street railroads, which, by design, does not conform to the maximum gage limits prescribed for Class 1 and excepted track. This type of special work is fabricated from "girder rail," which includes a tram (flangeway) rolled into the rail section. A "mate" is similar to a frog but located on the side of the switch that is equivalent to a straight stock rail. The switch, when in the open or curved position, guides wheels past the mate on the turnout (curved) side in a manner similar to a frog guardrail.

Guidance, General. In addition to considering the above criteria, inspectors must perform the following when inspecting switches:

- Check alinement, gage, and surface.
- Examine condition as to the wear of switch points and stock rails.

- See that all bolts, nuts, cotter pins, and other fastenings are in place, in good condition, and are properly tightened;
- See that switch points fit snugly against the rail when the switch is thrown in either position. Request that the railroad representative operate switches to test for lost motion and/or loose connections.
- If applicable, examine the rod and fastenings that connect the switch point to the switch circuit controller to ensure they are in place and in good condition.
- Examine the condition and support of spring and power-switch machines and hand-thrown switch stands, including automatic or safety switch stands. Switch stand and machine fastenings to the head block ties must be tight to avoid any movement or play.
- Examine switch-lock and keeper.
- Examine condition of switch position indicator and note any unnecessary obstruction to its visibility.
- Examine the heel block, its fastenings, and bars; or, in the absence of a heel block, examine the floating heel of the switch point.
- Examine the seating of stock rails in the switch plates to ensure that the outer tread of a wheel cannot engage the gage side of these rails and that chairs or braces do not cant these rails in. This defect is particularly a problem for travel in the direction from the frog to the switch (trailing movement). Grease lines or slight groves running at a slight angle on the tread of a stock rail can provide inspectors with clues about the wheel/rail interface. These marks can be found in the area where the wheel tread transitions from the switch rail to the stock rail. When found, inspectors should closely examine the gage side of the stock rail to make sure the outer edge of wheel treads are not contacting the gage side of the stock rail.
- Examine the gage plates and switch rods.

§ 213.137 Frogs

137(a) The flangeway depth measured from a plane across the wheel-bearing area of a frog on Class 1 track may not be less than 1⅜ inches, or less than 1½ inches on Classes 2 through 5 track.

Guidance: The Association of American Railroads (AAR) Field Manual of Interchange Rules states that a wheel is condemnable when the flange height is "1½ inches or more above the approximate center line of the tread." The AREMA Portfolio of Trackwork Plans, Point and Flangeway Dimensions, provides a designed flangeway depth of at least 1⅞ inches. Therefore, the amount of clearance between a worn wheel with a high flange and the bottom of a new frog's flangeway may be as little as three-eighths inch. At higher speeds, if a worn frog has a flangeway less than 1½ inches, the wheel flange could "bottom out" in the flangeway and result in severe damage to the frog.

Section 213.137(a) permits a flangeway depth of 1⅜ inches in Class 1 track. In such a condition, a wheel that is approaching condemning limits might contact the bottom of the flangeway. As such, it is possible to have evidence of wheel flangeway contact on the bottom of the flangeway caused by compliant wheels.

137(b) If a frog point is chipped, broken, or worn more than ⅝ inch down and six inches back, operating speed over that frog may not be more than 10 m.p.h.

Guidance: If a frog point is chipped, broken, or worn more than five-eighths inches down and 6 inches back, a collapse of the point area is possible after repeated wheel impacts. This parameter requires a defect to be more than five-eighths inches down from the original profile to a location 6 inches back toward the heel to be considered. For example, a frog point that is seven-eighths inches below its original profile at the actual frog point and seven-eighths inches below at a position 6 inches back toward the heel of the frog would be a defect.

For a severe condition that would not meet this criteria such as a breakout at a frog point that is only 4 inches in length and greater than five-eighths inches down, inspectors may consider using the 213 defect code 0137E.

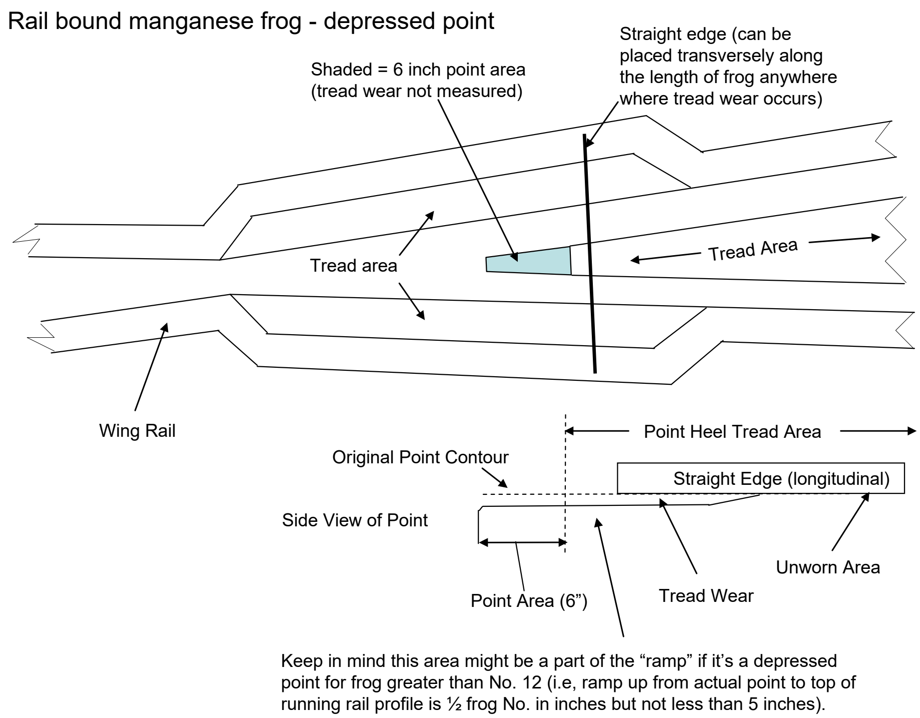
While this condition may not be a defect, it is a method to notify a railroad of a condition that the inspector feels the structural integrity of the frog is in question. Please note that 213 defect code 0137E does not link to a paragraph in the TSS and may only be used as an advisory to the railroad.

Another possible result of a severely worn frog point, especially when coupled with a worn or loose guardrail, is that a railroad wheel may "hit" the point and climb to the wrong side of the frog. Also see figure in paragraph 137(c) below for information about "depressed point" designs that may influence the measurement of a worn or broken frog point.

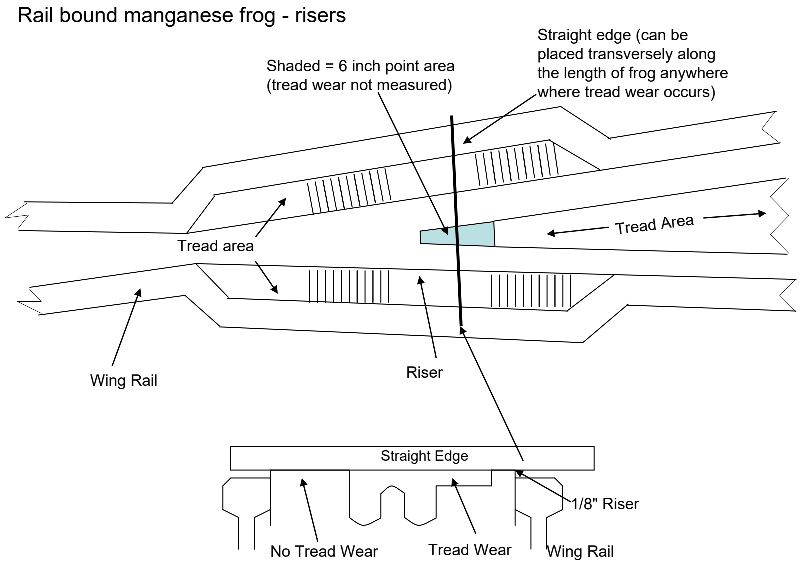
137(c) If the tread portion of a frog casting is worn down more than ⅜ inch below the original contour, operating speed over that frog may not be more than 10 m.p.h.

Guidance: This paragraph specifically refers to the amount of tread wear from the original contour of the casting. The original contour can be determined in a variety of ways depending upon the frog design.

The tread of the frog is considered to be any portion that is contacted by the tread of the wheel except for portion of the frog from the actual point to a position 6 inches back towards the heel [this area is addressed by § 213.137(b)]. As shown in the following figure, the measurements of the portion of the tread further back than the 6 inch position may be taken by placing a straightedge positioned transversely. The following figure shows a rail bound manganese frog design with an actual frog point that is three-sixteenths inch lower than the tread portion. A frog built without manganese insert (e.g., a frog composed of Tee rails called a bolted rigid frog) will have a point with a similar profile. Called a depressed point, the tread will taper up to the top of the rail profile in the direction toward the frog heel in varying distances depending upon the different manufacturing designs and size of frogs, but not less than 5 inches.



An alternate rail bound manganese or solid cast frog design includes a profile whereby the tread portion of the casting adjacent to a frog point is manufactured to a plane one-eighth inch above the top of the rail profile (wing wheel riser). See following figure. These design characteristics need to be considered when measuring tread wear as discussed below.



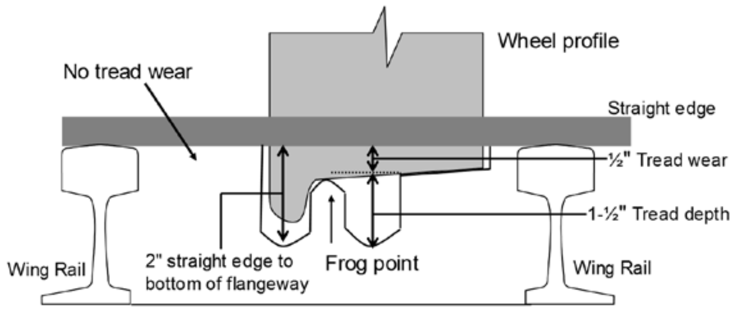
When measuring tread wear, the distance from the bottom of the straight edge to the worn tread at the riser is measured. Various types of gauges, such as a folding leaf gauge with different degrees of taper, or a wedge-type gauge, may obtain this measurement. Tape measures are also frequently used to measure tread wear.

There is a wide variety of new frog designs being developed and used in the industry that may require different measuring techiques or tools and must be given consideration; one example is the conformal frog. The design of the conformal frog casting through the original tread and point area is tapered to the same angle (1:20 ratio) as the tread of the wheel to reduce impact load and smooth wheel transition. The wing or transition portion of the casting of a conformal frog is raised and extends above the wrap or wing rail of the frog. Measuring the amount of wear on a conformal requires use of a special “straight edge” to properly measure tread, point, and flangeway depth due to the “conformal” design. Use of a standard straight edge on a conformal frog may result in improper wear limit measurement.

If the tread is worn more than three-eighths of an inch, the corresponding flangeway depth may also be reaching critical limits. Since the manganese insert is typically designed to be about 2 inches thick at the wall of the flangeway and about 1⅜ inches or less at the bottom of the flangeway, wear in this condemning range could result in structural failure of the frog.

Frogs frequently exhibit small spalling (pitting) in the tread. Usually, this type of spalling is not hazardous. Measurements of tread wear should be made over a length that is worn down due to abrasion or plastic flow of metal not at the bottom of small spalls. However, if the depression is of sufficient size to permit the tread of a wheel to follow that depression, tread wear should be measured at the depression.

To measure flangeway depth, place a straight edge across the frog at the area of concern. Measure the space between the underside of the straight edge to the bottom of the flangeway and the space between the underside of the straight edge and the tread. As shown in the following figure, subtract the tread value from the flangeway value to obtain the actual flangeway depth.

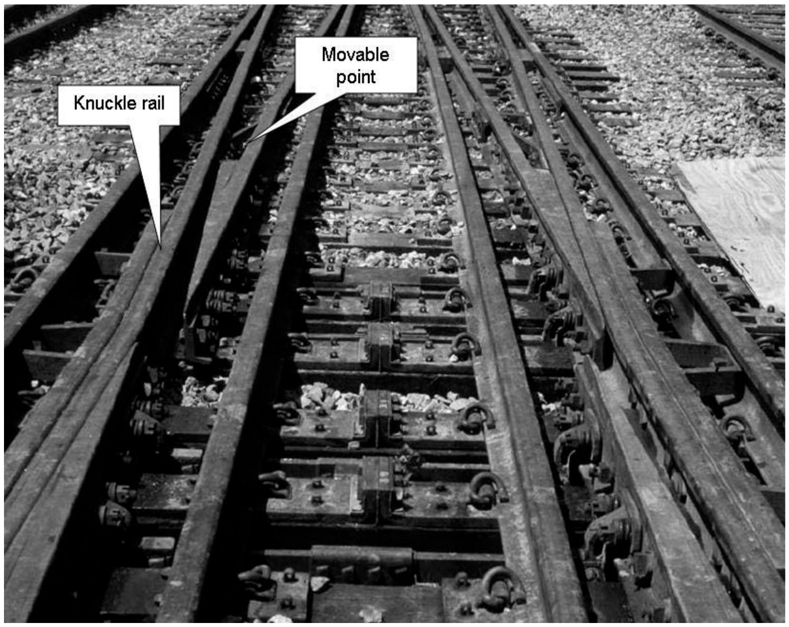


When a railroad wheel approaches the frog in the facing direction, the weight of the wheel is supported on the tread of the frog opposite the point until the wheel reaches the transition point, about 6 inches back from the actual point. At this location, the weight is transferred to the frog point.

137(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.

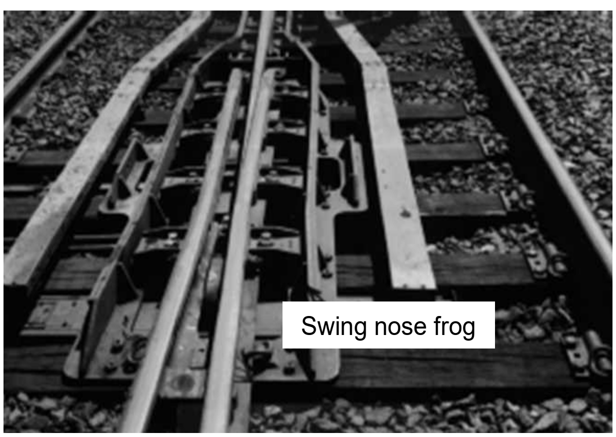
Guidance: This paragraph provides an exemption for an item of specialized track work that by design does not conform to the minimum flangeway depth requirements prescribed in paragraph (a) of this section. Called a flange-bearing frog, this technology is under consideration as a method of reducing impact loads at frogs. This design is a new concept for track above yard speeds but has been used extensively in light rail transit trackwork.

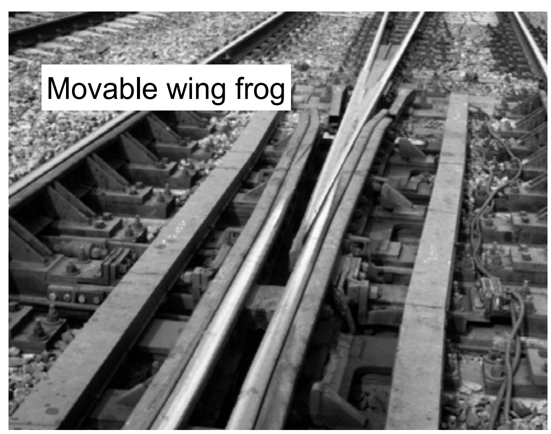
There are a number of frog designs in use throughout the industry and the most common types are rail bound manganese and bolted rigid (stiff). The special attributes of spring frogs are covered under § 213.139. Conventional moveable point frogs are found at flat angle track crossings and slip switches (see the figure below). This type of movable point frog is similar to a switch because of its movable points that fit against a knuckle rail, which is like a stock rail.



Conventional Moveable Point Frogs

In recent decades, new technology movable frogs have been introduced in the Nation and there are two types—"swing nose" (the left figure below) and movable wing (the right figure below). Conventional movable point frogs and swing nose frogs are virtual switches; therefore there are no guardrails. As such, it is appropriate to use the applicable elements of § 213.135 (Switches) in an inspection report when encountering defects in these movable point frogs. For example, a movable point that does not fit its knuckle rail properly would be covered under § 213.135(b) (each switch point shall fit its stock rail properly).





The movable wing rail type frog is similar to a spring frog but both wing rails are moved remotely in synchronization with the switch points. It is appropriate to use the applicable elements of § 213.139 (Spring rail frogs) in an inspection report when encountering defects. Like above, when using any of the 139 series defect codes it is necessary to include 213 defect code 0133A15 – Turnout or track crossing fastenings not intact or maintained.

The following are the key elements to consider when inspecting new technology frogs:

- Bolting or fastener designs that fasten the movable point frog to concrete or timber switch ties are considered fasteners in the same manner as cut spikes. Fastenings are discussed under § 213.127 of this manual. Bolts that connect movable frog components together are considered frog bolts and must be addressed by using 213 defect code 0133A12, Loose or missing frog bolts.
- Of paramount importance is a proper fit of the vee point rails against the wing rails on movable frogs. Inspectors must use their judgment to determine if the point fits the wing rail properly to allow wheels to pass the frog point. Movements of the wing rail must not adversely affect the fit of the frog point to the wing rail. When an inspector encounters a condition on a movable frog which should be addressed on the inspection report and no existing code is available for that condition, 213 defect code 0137E will be acceptable with a full description of the condition in the inspection report.
- Unlike rail bound manganese frogs, the running surface of most, if not all, movable frogs are made of hardened rail. Inspectors must be aware that this rail may contain defects that require remedial action under § 213.113. Asymmetrical rails found in some switch points and frogs must be closely examined during inspections, as this appears to be a potential weak spot where a crack or break could occur.
- When performing inspections, FRA inspectors should discuss any concerns about an advanced turnout with appropriate railroad personnel. Inspectors should consult with the regional track specialist to resolve any questions about the safety of these installations.

General Guidance: The various types of frogs available for specific applications include bolted rigid, solid manganese, self-guarded, railbound manganese, spring rail, movable point, cast, or swing nose. On railbound manganese frogs, the normal wear pattern is in the manganese insert.

An inspector, in addition to measurements described in the TSS, should see that a frog is supported throughout on well tamped and sound ties.

The requirements for flangeway depth in paragraph (a) and the requirements for tread wear in paragraph (c) also apply to crossing frogs. Since the designed flangeway depth is also 1⅞ inches, the safety concerns are the same, as excessive wear on the tread portion could result in a wheel flange striking the bottom of the flangeway and causing structural damage to the frog.

Inspectors must evaluate cracks or breaks in frog castings or rail defects in the non-running portion of wing rails in terms of their potential effect on the safe passage of rolling stock. In particular, when making the evaluation:

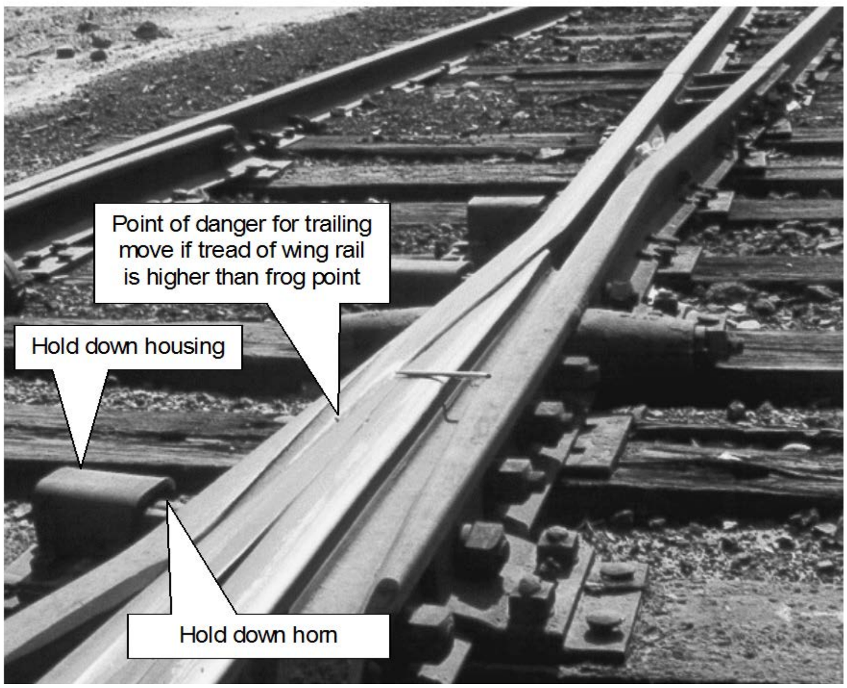
- The inspector should determine if there is a loss or imminent loss of wheel guidance due to a loss of functional integrity.
- The inspector should not consider cracks or breaks in a manganese frog casting that do not affect the safe passage of rolling stock to be a defective condition. If a severe crack, or a series of cracks, creates a condition where the breaking out of a piece of the casting is imminent, the use of 213 defect code 0137E should be considered. Cracks or wear that develop into a loss of functional integrity should be addressed by using 213 defect code 0137B or 0137C, which govern worn frog points and castings.

- Rail defects in the non-running portion of wing rails should be addressed by using 213 defect code 0137E.

§ 213.139 Spring rail frogs

139(a) The outer edge of a wheel tread shall not contact the gage side of a spring wing rail.

Guidance: : Inspectors must closely examine every spring rail frog encountered during an inspection. While spring rail frogs have been successfully used for many years, their unique design requires special maintenance attention to avoid derailment hazards to trailing point train movements on the main track. If a spring wing rail is higher than the top running surface of frog at the transition area, a wheel during a trailing move may push the spring wing rail open causing rail roll out or wide gage. Hollow or false flange wheels are more prone to cause this occurrence.



A beginning sign of outer edge wheel tread contact will appear as gouging on the gage corner of the wing rail behind the point of frog at the transition point similar to the stock rail/switch point configuration. While some spring frogs have a “relief” groove built into the frog for this purpose, inspectors must be acutely aware of any signs of the gage side of a spring wing rail being struck by the outer edge of wheel treads. Wheel gouging must not be confused with channeling in the spring wing rail that is incorporated at the time of manufacture to accommodate wheel tread transition. Vertical deflection at the toe of frog (213.139(b)) and hold-down housing clearance (213.139(e)) must be assessed when gage face wheel contact is observed. If the toe is not solidly tamped and excessive horn and housing clearance exists, the wing rail may have vertical motion while wheels are operating on the point rail in a trailing-point movement and the forces on the wing rail will cause the wing rail to move laterally, allowing the wheel to drop in at the throat of the frog.

139(b) The toe of each wing rail shall be solidly tamped and fully and tightly bolted.

Guidance: The toe of each spring rail frog must be solidly supported, and proper hold-down housing clearance must be maintained to avoid excessive vertical movement of the wing rail. The combination of these two conditions can cause outer edge wheel tread contact. The first sign that this is occurring will be gouging on the gage corner of the wing rail behind the point of frog. Wheel gouging must not be confused with channeling in the spring wing rail that is incorporated at the time of manufacture to accommodate wheel tread transition.
If the toe is not solidly tamped and excessive horn and housing clearance exists, the wing rail may have vertical motion operating on the point rail in a trailing-point movement and the forces on the wing rail will cause the wing rail to move laterally, allowing the wheel to drop in at the throat of the frog.

139(c) Each frog with a bolt hole defect or head-web separation shall be replaced.

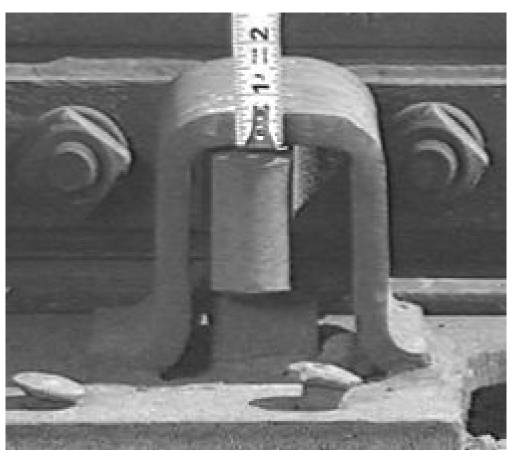
Guidance: Any bolt hole defect or head-web separation in a spring frog of any dimension constitutes a defect. This paragraph does not prescribe a corrective action other than "replacement."

139(d) Each spring shall have compression sufficient to hold the wing rail against the point rail.

Guidance: The intent of the regulation is to ensure the spring holds the wing rail against the point rail. Typically, if a wing rail is up against the point, it is an indication that the spring is holding it as intended. If an inspector finds the wing is not against the point he/she should determine the root cause of the condition. A component such as loose bolt may be obstructing the closure and 213.133A12 should be cited. Without proper anchorage, the horn may bind in the hold-down housing and defect 213.133B should be cited in classes 3-5. If there is a suspicion that there is insufficient compression in the spring, the railroad representative should determine its compliance.

139(e) The clearance between the hold-down housing and the horn shall not be more than ¼ inch.

Guidance: Since the spring wing rail is a movable part of a spring frog, it cannot be fastened down. The hold-down housing and a horn assembly prevents the wing rail from moving up higher than the top of the tread at the transition point. The following figure illustrates the proper method to determine if there is excessive space between the hold-down housing and the horn.



General Guidance: Due to the unique design characteristics of spring frogs, turnouts with this type of appliance require special consideration in regard to guardrails. On the main track side of a turnout, when trains are not "springing" the frog (by design) and operating on an unbroken path, an extra length guardrail assures a proper path for wheelsets.

A guardrail should be of sufficient length to cover the designed hinge length. This keeps wheels off the spring wing rail from the point where this rail is "hinged" through the frog throat and finally to the actual frog point.

While the TSS does not address this design concept, inspectors should be aware of this attribute of spring frogs. If a guardrail is of insufficient length to cover the designed hinge length, any lateral wheel forces can cause significant problems. Specifically, the guardrail and other frog elements will quickly deteriorate, and in extreme circumstances, the wing rail can open while trains are moving through the main track side which can result in an unprotected wide gage. Inspectors should note on their inspection report any guardrail on a spring frog that is not of the proper length or installed in the improper position.

Another special consideration with regard to spring frogs is the longitudinal relationship between the spring wing rail and frog point. If a turnout has insufficient rail anchors to restrain longitudinal movement, the wing rail may not function properly. Evidence that longitudinal movement is occurring may be a gap between the wing rail and the frog point. Inspectors are reminded to refer to § 213.133(b) that requires Classes 3 through 5 track to be equipped with sufficient rail anchoring to restrict longitudinal rail movement. If longitudinal movement is observed because of insufficient anchors on Classes 1 and 2 track, inspectors are encouraged to note this condition and inform the railroad.

Spring frogs are manufactured with a steel base plate. Attached to the base plate are clip plates, which are placed along the fixed side of the frog. The clip plates, which are shaped into a right angle, are attached to the base plate by bolts, welds, or both. Frog bolts are placed through the body of the frog and through the vertical portion of the clip plates and tightened. This holds the body of the frog to the clip plate assembly.

There are no gage holding fasteners along the movable side of the frog as they would interfere with the spring wing rail. Therefore, it can be seen that the frog bolts and clip plate assemblies, acting together, maintain alinement of the spring frog. Care should be taken to ensure that the frog bolts and clip plate bolts are in place and tight (213 defect code 0133A12). Also check clip plates to see if welds are cracked or broken and check clip plates for cracks and breaks at the corner where the plate bends from horizontal to vertical. Where cracks or breaks in clip plates affect the fastening of the frog to the base plate, use defect 213 code 0133A15 (insufficient fasteners).

In recent years, railroads have augmented the design of spring frog installations by the application of improved stops to limit the amount of movement of the spring rail. In addition, some frogs have been retrofitted with welded stops. Most stops are designed to allow the wing to open no more than 1⅞ to 2¼ inches. When stops are properly installed, the risk of trailing point derailments is reduced.

When spring frogs are equipped with the improved features, such as relief grooves and stops, the inspector should evaluate the condition of the components in order to ascertain that the improved features are functioning as intended.

When spring frog defects are found, the defective conditions must be repaired as soon as possible. Combinations of the defects are especially hazardous. The railroad must protect the movements over the frog with a speed restriction until the defects are repaired.

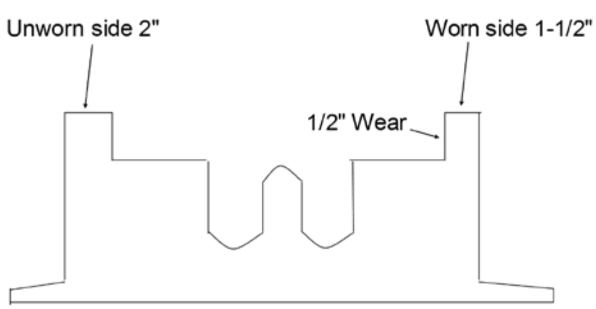
Spring frog defects are considered as non-class-specific defects (see § 213.9); therefore, inspectors must consider the circumstances involved in evaluating the remedial action taken by the railroad when spring frog defects are found. Inspectors should consider all spring frog defects as serious defects that must be repaired as soon as possible. In most circumstances, when it is evident that the outer edge of the wheels are contacting the gage side of the wing rail or a combination of spring frog defects exist, inspectors would expect that the railroad would implement a speed restriction.

Some spring frogs are equipped with retarders that reduce the impact of the wing on the point as the wing closes with each passing wheel in the diverging route. The retarders may hang, causing the wing to remain open. Though the TSS does not address this design concept, inspectors should still be aware of this attribute of spring frogs because it could lead to further degradation of frog components.

§ 213.141 Self-guarded frogs

141(a) The raised guard on a self-guarded frog may not be worn more than ⅜ of an inch.

Guidance: When examining self-guarded frogs, observe the condition of the frog point, and where there is evidence of wear caused by wheel flanges contacting the frog point, take measurements to determine compliance with this section. To determine the amount of wear on a raised guard, measure the thickness at a portion where there is wear. Compare this measurement to a portion where there is no wear and the difference between the two is equivalent to the amount of wear.



141(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.

Guidance: During repairs of a self-guarded frog, it is imperative that the raised guarding face is restored before the actual frog point. This precaution is necessary due to the potential for a wheel flange striking the frog point.

Self-guarded frogs are designed for use in low speed track and their use in tracks where speeds exceed 20 mph can result in excessive lateral forces such as wheels "kicking" or in extreme cases wheels climbing up the raised guard. The TSS does not prohibit the use of self-guarded frogs in any class of track; however, inspectors are encouraged to inform a railroad of the potential for problems that may occur if a self-guarded frog is found in a track where speeds exceed 20 mph.

§ 213.143 Frog guard rails and guard faces; gage

The guard check and guard face gages in frogs must be within the limits prescribed in the following table:

Class of track	*Guard check gage* *The distance between the gage line of a frog to the guard line [1] of its guard rail or guarding face, measured across the track at right angles to the gage line [2], may not be less than*	*Guard face gage* *The distance between guard lines [1], measured across the track at right angles to the gage line[2], may not be more than*
1	*4' 6⅛"*	*4' 5¼"*
2	*4' 6¼"*	*4' 5⅛"*
3 & 4	*4' 6⅜"*	*4' 5⅛"*
5	*4' 6½"*	*4' 5"*

[1]A line along that side of the flangeway which is nearer to the center of the track and at the same elevation as the gage line.

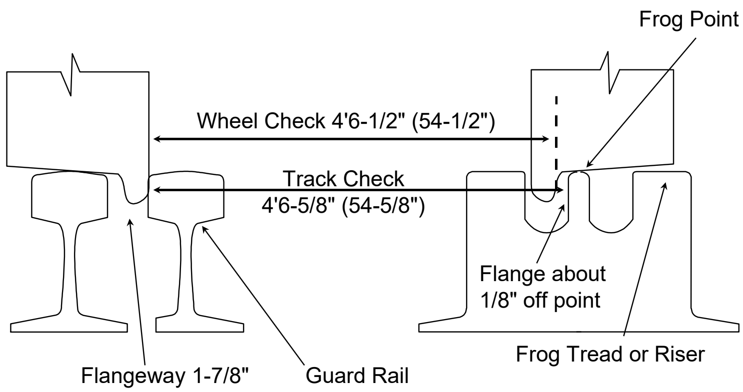
[2]A line ⅝ inch below the top of the centerline of the head of the running rail or corresponding location of the tread portion of the track structure.

Guidance: A guardrail is installed parallel to the running rail opposite a frog to form a flangeway with the rail and to hold wheels of equipment to the proper alinement when passing through the frog.

A guardrail must be maintained in the proper relative position to the frog in order to accomplish its critical intended safety function. Inspectors should examine guardrails carefully to see that they are adequately fastened, and when measuring guardrail gage, fully consider any movement of guardrail or frog under traffic conditions.

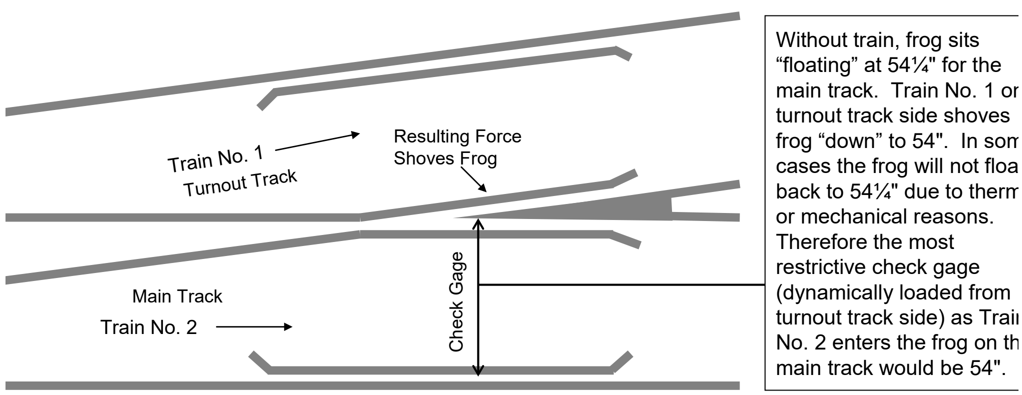
This section clearly specifies allowable tolerances for guard check and guard face gage for various classes of track.

When measuring guard check gage, it is important to consider the path of wheels through the frog because the function of a guardrail is to keep wheel flanges from striking the actual frog point. As reference, standard check gage on a railroad wheel set is approximately 54½ inches (see the following figure for approximate design check gage values). While the TSS minimum guard check gage is less than wheel check gage in lower classes of track, the condition of the actual frog point in relation to the path of wheels through a frog is a good indicator of the effectiveness of a guardrail.



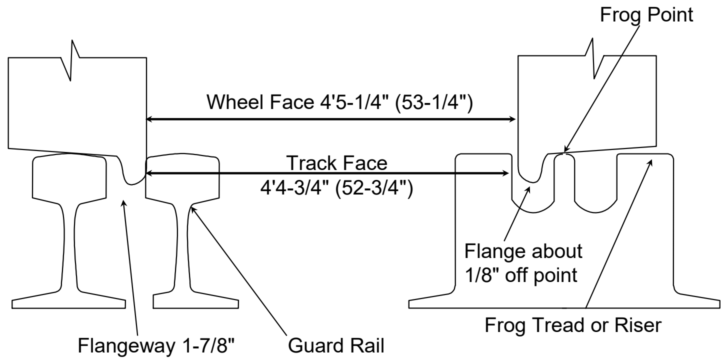
The critical area where guard check gage must be measured is at the actual point of frog. Inspectors must also consider any unusual wear that may exist at the actual frog point and position the track gauge or other measuring device accordingly.

When measuring guard check gage, dynamic lateral movement of the guardrail and/or frog shall be considered. In the case of a frog that is moving laterally under train movement (floating), it is important to consider the most restrictive measurement. Specifically, if measuring guard check gage in a turnout where the frog can move toward the track being measured due to train movement on the other track, that dynamic frog position would be considered. See the figure below.



In severe cases, where a frog is severely floating (moving laterality under load) and there is an accompanying condition (i.e., deteriorated crossties or ineffective fasteners), FRA inspectors should cite the defect or recommend a civil penalty for the accompanying condition (i.e., §§ 213.109 (Crossties) or 213.127 (Rail fastenings)).

Face gage is a dimension that becomes critical when the distance between two opposing guardrails, or a guardrail and a frog wing rail, become larger than the distance between the back of wheelsets. This would occur by improper installation, or a condition such as a severe alinement defect. Normally, face gage would be measured in the same vicinity as check gage. However, inspectors should consider measuring face gage at other points in special trackwork where there may be an indication that wheels are being "pinched." For general reference, the following illustrates approximate design face gage values.

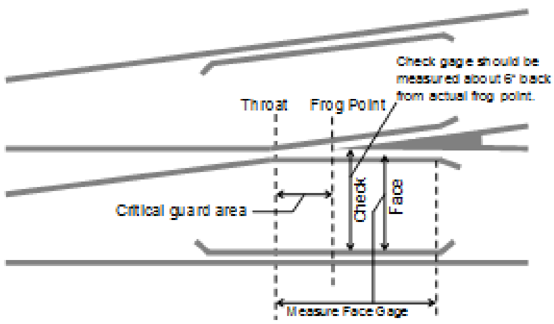


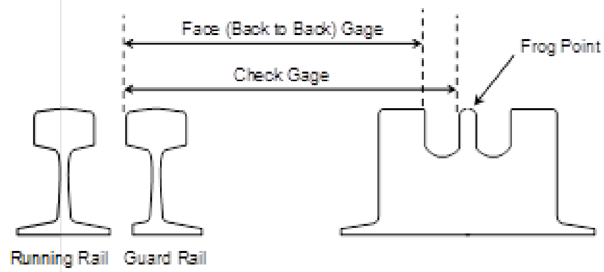
Broken guardrails occur infrequently, since they do not support the vertical wheel loads of passing trains. When evaluating a crack or break in a guardrail, the inspector should be aware that cracks or breaks exist that do not affect the ability of the guardrail to function as intended. If the integrity of the guardrail is affected, the inspector will cite the defect using 213 defect code 0143A3, Cracked or broken guardrail.

There are many different types and designs of frog guardrail designs. Some guardrail plates are recessed to seat the running rail, while others are flat. Some guardrail plates are punched with spike-hole slots; others are not. Other guardrails are bolted to the running rail. On some railroads, it is normal practice not to spike the gage side of the running rail through the guardrail area while some guardrail plates do not have holes punched for this purpose. FRA has no record of serious safety problems that have developed as a result of not spiking the running rail through the guardrail area.

If encountering a problem where the running rail has moved laterally to create an unsafe condition, the inspector should use insufficient fasteners defect code 213.127. Inspectors should discuss unique situations with their regional track specialist.

While not a requirement of the TSS, guardrails have a straight portion that guides wheels through the area from the "throat" to the actual frog point. If inspectors find a guardrail where the straight portion does not encompass this area, inspectors should bring this to the attention of the railroad. The following figure illustrates the proper measurement points to determine check/face gage compliance and shows the proper longitudinal relationship between a guardrail and frog point.


Check gage should be measured about 6" back from actual frog point.
Throat
Frog Point
Critical guard area
Check
Face
Measure Face Gage


Face (Back to Back) Gage
Check Gage
Frog Point
Running Rail
Guard Rail

Subpart E – Track Appliances and Track - Related Devices

§ 213.201 Scope

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

§ 213.205 Derails

205(a) Each derail shall be clearly visible.

Guidance: The TSS requires derails to be clearly visible. Though the TSS does not specify a color derails are to be painted, they must be visible to railroad employees, and a derail dark in color and obscured by vegetation would not be in compliance.

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

Guidance: Inspectors will need to determine the extent of movement due to worn parts or improper adjustment, if any, and determine if such movement renders the derail ineffective.

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

Guidance: Derails are of various designs and may be of the following types: switch point, spring switch point, sliding, hinged, and portable.

Derails can be operated by various means: electrical, hand throw, lever, and mechanical rod from a point other than at the derail. They should be installed to derail rolling stock in a direction away from the track or facility to be protected.

In addition to the requirements of this section, a switch point-type derail must also comply with the requirements of § 213.133 [turnouts generally] and § 213.135 [switches].

205(d) Each derail shall be properly installed for the rail to which it is applied. [This paragraph (d) is applicable September 21, 1999.]

Guidance: Derails must be the proper size for the rail to which it is applied. Derails are manufactured to “sizes” based on the rail section to which they are to be applied and should be installed according to the manufacturer’s instructions. Installation of a derail of incorrect size can make a derail ineffective. Inspectors may use derail manufacturer instructions and specification as a guide to determine if a derail is properly installed (correct size for the rail to which it is applied).

Derails are made by “hand” (right or left) to derail equipment to a specific side of the track. In addition, “universal” derails will derail equipment in either direction. A derail that is installed to derail equipment toward a main track that should otherwise be protected would constitute an improperly installed derail. A “hand” derail placed in the wrong direction would also constitute an improperly installed derail.

Subpart F – Inspection

§ 213.231 Scope

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

§ 213.233 Track inspections

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

> **Guidance:** Recognizing that proper inspection of track is essential to safe maintenance, Subpart F contains the minimum requirements for the frequency and manner of inspecting track. Inspectors should know that a track owner may exceed the TSS in the interest of good practice, but they cannot be less restrictive. FRA's track safety program success is dependent upon the adequacy of the railroad's inspection efforts and subsequent maintenance program. Monitoring and assessing a railroad's track condition, through regular inspections, is integral to our safety success.

233(b) Each inspection shall be made on foot or by riding over the track in a vehicle at a speed that allows the person making the inspection to visually inspect the track structure for compliance with this part. However, mechanical, electrical, and other track inspection devices may be used to supplement visual inspection. If a vehicle is used for visual inspection, the speed of the vehicle may not be more than 5 miles per hour when passing over track crossings and turnouts, otherwise, the inspection vehicle speed shall be at the sole discretion of the Inspector, based on track conditions and inspection requirements. When riding over the track in a vehicle, the inspection will be subject to the following conditions --

(1) One Inspector in a vehicle may inspect up to two tracks at one time provided that the Inspector's visibility remains unobstructed by any cause and that the second track is not centered more than 30 feet from the track upon which the Inspector is riding;

(2) Two Inspectors in one vehicle may inspect up to four tracks at a time provided that the Inspectors' visibility remains unobstructed by any cause and that each track being inspected is centered within 39 feet from the track upon which the Inspectors are riding;

(3) Each main track is actually traversed by the vehicle or inspected on foot at least once every two weeks, and each siding is actually traversed by the vehicle or inspected on foot at least once every month. On high density commuter railroad lines where track time does not permit an on track vehicle inspection, and where track centers are 15 foot or less, the requirements of this paragraph (b)(3) will not apply; and

(4) Track inspection records shall indicate which track(s) are traversed by the vehicle or inspected on foot as outlined in paragraph (b)(3) of this section.

> **Guidance:** This paragraph specifies the number of additional tracks that can be inspected. Depending upon whether one or two qualified railroad inspectors are in the vehicle, and depending upon the distance between adjacent tracks (30 or 39 feet, measured between track centerlines), a track owner's railroad inspectors may inspect multiple tracks (up to four) from hi-rail vehicles. Tracks obstructed from their view by tunnels, differences in ground level, railroad rolling stock, etc., cannot be included in the inspection record. Section 213.233(b)(3) requires each main track to be traversed at least once every 2 weeks, and a

siding traversed at least once every month. Track inspection records, under § 213.241, must indicate which tracks are traversed in accordance with paragraph (b)(3).

233(c) Each track inspection shall be made in accordance with the following schedule:

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

Guidance: A geometry car inspection will not be considered acceptable for meeting the required inspection frequency specified by § 213.233(c), unless a waiver allowing this substitution is in effect.

Section 213.233(c) specifies the minimum frequency at which inspections must be conducted. For purposes under § 213.233(c) and outlined in the frequency schedule, “main track” is defined as “a track, other than an auxiliary track, extending through yards and between stations.” A siding is defined as “an auxiliary track for meeting or passing trains.” Section 213.233(c) also links inspection frequencies to the amount of annual tonnage, presence of passenger trains, and speed according to track class. A railroad’s change in the designation of a track to “other than main track” in its timetable and/or special instructions may not necessarily permit a railroad to reduce track inspection frequency. If the traffic remains essentially the same, the station designations remain, or if the method of operations continue the same, the track will be considered a main track with respect to the TSS. In addition, if any main track type operating rules or procedures are applicable to a track in question, FRA will consider such a track as a main track under the TSS. This would be the case even if the railroad uses the term such as spur, lead, running, etc. to describe the track in question. (Source: Letter dated July 10, 1991, from FRA Associate Administrator for Safety to Union Pacific Railroad.)

Each railroad inspection performed in accordance with the schedule prescribed in paragraph (c) must be made on foot or by riding over the track in a vehicle at a speed that allows the person making the inspections to visually inspect the track structure for compliance. An inspection made from a vehicle driven alongside the track does not constitute an inspection performed at the required frequency. The railroad may make additional inspections using other inspection methods provided that these inspections are not used to comply with frequency requirements prescribed in Section 213.233.
Inspecting after dark is in compliance with the requirements of § 213.233, Track inspections, as long as the railroad inspector is capable of detecting defects. As an example, inspections

are routinely made in tunnels with limited or no lighting, and maintenance requirements may require inspections after daylight hours. Appropriate artificial lighting is required for an inspector to conduct a valid inspection.

When FRA inspectors are conducting inspections from a hi-rail vehicle, only the track occupied will be recorded on the F 6180.96 form [hi-rail main track (MTH) or hi-rail yard track (YTH)]. When conducting a walking inspection, multiple tracks may be inspected and counted as units on the F6180.96 form. It is recognized that walking inspections reveal more defective conditions than hi-rail inspections. Therefore, FRA inspectors may include multiple tracks while conducting walking inspections. Inspectors will use good judgment in ensuring a high-quality inspection while conducting walking inspections.

For the purposes of the application of inspection intervals, a week is defined as a period of 7 days, Sunday through Saturday. This is the accepted standard definition and emphasized here to avoid confusion when the railroad changes the starting and ending days of a week from inspector to inspector or from territory to territory. Classes 1 through 3 track require a weekly inspection with at least 3 calendar days interval between inspections, or before use, if the track is used less than once a week; or twice weekly with at least 1 calendar-day interval between inspections, if the track carries passenger trains, or more than 10 million gross tons of traffic, during the preceding calendar year.

When a railroad operates seasonal or irregular passenger service, it is expected that the twice weekly inspection will be conducted during those periods. A railroad will be considered to be in compliance if the twice weekly inspection occurs the week before and the week or weeks that the passenger trains are operated. If a one-time infrequent or seasonal passenger train movement occurs only on one day of a week, the twice weekly inspection the prior week and one* inspection the week of the movement is adequate.

*If the scheduled passenger train is to operate on one day only, at an interval during the week that does not allow for the two required inspections prior to that movement, then the one inspection for the week must occur before the movement.

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

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

Guidance: To ensure that railroads are providing proper inspections at the required frequency, inspectors must periodically examine the railroad's inspection records (noting record keeping type defects under § 213.241 only). By reviewing the track owner's inspection procedures and records, or through personal observations, inspectors will determine the number of tracks being inspected, the number of railroad inspectors performing inspections, the specific tracks inspected, and whether the railroad inspector actually traversed the track by vehicle or on foot. As specified in this section of the TSS, the track owner must assure all tracks are inspected in accordance with the prescribed schedule. Failure of the owner to comply with this schedule may constitute a violation.

If a track owner's qualified person, designated under § 213.7, finds a deviation from the TSS and fails to immediately initiate proper remedial action, the failure may constitute a violation.

FRA track inspections do not constitute a required track inspection under the TSS. FRA inspections assess a railroad's compliance with Part 213. Inspectors will review a track owner's inspection records to learn if these records reflect the actual conditions of the track structure under train operations.

Turnouts and track crossings visually inspected from a vehicle must be accomplished at a speed not exceeding 5 mph. A vehicle's speed will be at the sole discretion of the operator and is based upon track conditions, inspection requirements, operating rules, and other circumstances that may vary from day to day and location to location. Nothing in the TSS precludes an inspection from a train or engine as long as the overall effectiveness of the inspection is not compromised and the person is able to visually inspect the track structure for compliance with this part. However, examining track while simultaneously operating a locomotive shall not be considered as an inspection under the TSS. The person must have the ability to stop movements to make a close examination of any possible track defect.

Deviations found under § 213.233 are those observed in the field as opposed to the § 213.241 recordkeeping requirements. Inspectors may also monitor other railroad records, such as a dispatcher's or control operator's record of track authorities conveyed and speed restrictions placed, to confirm that inspections were made and proper remedial actions were taken.

Classes 1 through 3 track require a weekly inspection with at least three calendar days interval between inspections, or before use, if the track is used less than once a week; or twice weekly with at least 1 calendar-day interval between inspections if the track carries passenger trains or more than 10 million gross tons of traffic during the preceding calendar year.

§ 213.234 Automated Inspection of Track Constructed with concrete Crossties

General Guidance: This section —effective on July 1, 2012— requires the automated inspection of track constructed with concrete crossties. Automated inspection technology is available to perform essential tasks necessary to supplement visual inspection, quantify performance-based specifications to guarantee safe car behavior, and provide objective confidence and ensure safe train operations. Automated inspections also provide a level of safety superior to that of manual inspection methods by better analyzing overall weak points in track geometry and structural components. The computer systems in automated inspection systems can accurately detect geometry deviations from the Track Safety Standards and can analyze areas that are often hard to examine manually. Railroads benefit from automated inspection technology by having improved defect detection capabilities, suffering fewer track-related derailments, and improving overall track maintenance.

Automated inspection technology is used in Track Geometry Measurement Systems (TGMS), Gage Restraint Measurement Systems (GRMS), and Vehicle/Track Interaction (VTI) performance measurement systems. TGMS identifies single or multiple noncompliant track geometry conditions. GRMS aids in locating good or poor performing track strength locations. VTI performance measurement systems indicate both acceleration and wheel forces that, when exceeding established thresholds, often cause damage to track components and rail equipment, as well as affect passenger ride quality. These automated systems can easily identify and measure track geometry, but they do not identify what causes them.

Automated technologies may be combined in the same or different geometry car platforms or vehicles, and require vehicle/track measurements to be made by truck frame accelerometers, car body accelerometers, or by instrumented wheel sets to measure wheel/rail forces, ensuring performance limits are not exceeded. Moreover, rail seat deterioration (RSD), can be very difficult and time consuming for inspectors to detect manually unless the rail and fastener assembly is removed. Automated inspection vehicles have proven effective in indicating RSD and can inspect much more rapidly and accurately than a visual track inspection. However, indications of RSD must be field-verified by inspectors taking accurate measurements to sustantiate the recorded measurement system.

234(a) General. Except for track described in paragraph (c) of this section, the provisions in this section are applicable on and after July 1, 2012. In addition to the track inspection required under § 213.233, for Class 3 main track constructed with concrete crossties over which regularly scheduled passenger service trains operate, and for Class 4 and 5 main track constructed with concrete crossties, automated inspection technology shall be used as indicated in paragraph (b) of this section, as a supplement to visual inspection, by Class I railroads (including Amtrak), Class II railroads, other intercity passenger railroads, and commuter railroads or small governmental jurisdictions that serve populations greater than 50,000. Automated inspection shall identify and report exceptions to conditions described in § 213.109(d)(4).

Guidance: This paragraph specifies that automated inspection technology is to be used to supplement visual inspection by Class I railroads including Amtrak, Class II railroads, other intercity passenger railroads, and commuter railroads or small governmental jurisdictions that serve populations greater than 50,000, on track constructed of concrete crossties for Class 3 main track over which regularly scheduled passenger service trains operate, and for all Class 4 and 5 main track constructed with concrete crossties. Also, the rule requires that automated inspections identify and report concrete crosstie deterioration or abrasion prohibited by § 213.109(d)(4). The purpose of the automated inspection is to measure for RSD. As previously discussed, RSD is the failure of the concrete surface between the rail and crossties. § 213.109(d)(4) requires that the crosstie must not be “deteriorated or abraded at any point under the rail seat to a depth of ½ inch or more.” The depth includes the loss of rail pad material.

This paragraph explicitly states, that the requirements for automated track inspections do not become applicable until July 1, 2012.

Inspectors may use a step-gauge or caliper to verify the automated measurement of RSD and ensure proper rail seat depth compliance.

234(b) Frequency of automated inspections. Automated inspections shall be conducted at the following frequencies:

(1) If annual tonnage on Class 4 and 5 main track and Class 3 main track with regularly scheduled passenger service, exceeds 40 million gross tons (mgt) annually, at least twice each calendar year, with no less than 160 days between inspections.

(2) If annual tonnage on Class 4 and 5 main track and Class 3 main track with regularly scheduled passenger service is equal to or less than 40 mgt annually, at least once each calendar year.

(3) On Class 3, 4, and 5 main track with exclusively passenger service, either an automated

inspection or walking inspection must be conducted once per calendar year.

(4) Track not inspected in accordance with paragraph (b)(1) or (b)(2) of this section because of train operation interruption shall be reinspected within 45 days of the resumption of train operations by a walking or automated inspection. If this inspection is conducted as a walking inspection, the next inspection shall be an automated inspection as prescribed in this paragraph.

Guidance: Frequency of automated inspections states the frequencies at which track constructed of concrete crossties shall be inspected by automated means. An automated inspection must be conducted twice each calendar year, with no less than 160 days between inspections, if the annual tonnage on Class 4 and 5 main track and Class 3 main track with regularly scheduled passenger service exceeds 40 million gross tons. An automated inspection must be conducted at least once each calendar year if annual tonnage on Class 4 and 5 main track and Class 3 track with regularly scheduled passenger service equals or is less than 40 mgt annually.

Additionally, the regulation requires that either an automated or walking inspection be conducted once per calendar year on Class 3, 4 and 5 main track with exclusively passenger service. Track not inspected in accordance with paragraph (b)(1) or (b)(2) of this section because of train operation interruption must be reinspected within 45 days of the resumption of train operations by a walking or automated inspection. If this inspection is conducted as a walking inspection, the rule requires that the next scheduled inspection be an automated inspection. The rule provides sufficient flexibility to permit a track owner to schedule the inspections to allow for foreseeable operational conditions such as a standing train or failed equipment and still be able to conduct the required one or two inspections within a calendar year.

234(c) Nonapplication. Sections of tangent track 600 feet or less constructed of concrete crossties, including, but not limited to, isolated track segments, experimental or test track segments, highway-rail crossings, and wayside detectors, are excluded from the requirements of this section.

Guidance: NONAPPLICATION excludes from the required automated inspections sections of tangent track of 600 feet or less constructed of concrete crossties, including, but not limited to, isolated track segments, experimental or test track segments, highway-rail crossings, and wayside detectors. These exclusions are specified because FRA recognizes the economic burden caused by requiring automated inspections to be made on short isolated locations constructed of concrete crossties that may be difficult to measure without removal of additional material, such as grade crossing planking.

234(d) Performance standard for automated inspection measurement system. The automated inspection measurement system must be capable of indicating and processing rail seat deterioration requirements that specify the following:

(1) An accuracy, to within 1/8 of an inch;

(2) A distance-based sampling interval, which shall not exceed five feet; and

(3) Calibration procedures and parameters assigned to the system, which assure that indicated and recorded values accurately represent rail seat deterioration.

Guidance: PERFORMANCE STANDARD FOR AUTOMATED INSPECTION MEASUREMENT SYSTEM requires that an automated inspection measurement system be capable of indicating and processing RSD requirements which specify the following: (1) an accuracy, to within 1/8 of an inch; (2) a distance-based sampling interval not exceeding five feet; and (3) calibration procedures and parameters assigned to the system, which assure that recorded values accurately represent RSD. RSD is indicated as a result of interpolations and calculations from rail cant measurements. The rail cant measurements provide an indication to the designated § 213.7 person that the location should be field-verified.

The design and practicality of all automated and autonomous geometry measurement systems is a supplement to visual inspection efforts toward identifying locations of greatest derailment risk. It is FRA's objective and policy that on-the-ground visual verification must be done by inspectors to validate not only RSD, but also all track structure and geometry conditions discovered by automated means. While other automated inspection technologies may exist, the belief is FRA's Rail Profile Measurement System (RPMS) is currently the best-developed technology to indicate (measure) RSD. The RPMS determines RSD by measuring rail cant angle in tenths of a degree. It is often difficult to measure rail cant in the field with hand measurement tools because of the small dimension, e.g., 1-degree rail cant angle equates to ⅛-inch depth between the rail seat and the rail. Typically the RPMS instrumentation onboard FRA geometry cars are set to notify an advisory 'alarm' exception when the angle exceeds 4 degrees of negative (outward) and positive (inward) rail cant.

FRA's current fleet of automated inspection systems provides a reliable method of determining RSD. However, to allow for future advances in technology, FRA does not mandate that a track owner's automated system 'measure' the rail cant angle to determine RSD. FRA also recognizes that detecting rail cant alone will not necessarily demonstrate all possible locations of RSD. For example, FRA geometry cars will not find areas of RSD that are due to compression forces from loads onto the crosstie. However, FRA geometry cars will locate RSD due to rail cant in curve and tangent track, which are the hardest areas to detect manually when the rail is obstructed.

234(e) Exception reports to be produced by system; duty to field-verify exceptions. The automated inspection measurement system shall produce an exception report containing a systematic listing of all exceptions to § 213.109(d)(4), identified so that an appropriate person(s) designated as fully qualified under § 213.7 can field-verify each exception.

(1) Exception reports must be provided to or be made available to all persons designated as fully qualified under § 213.7 and whose territories are subject to the requirements of § 213.234.

(2) Each exception must be located and field verified no later than 48 hours after the automated inspection.

(3) All field-verified exceptions are subject to all the requirements of this part.

(4) Exception reports must note areas identified between ⅜ of an inch and ½ of an inch as an "alert."

Guidance: EXCEPTION REPORTS TO BE PRODUCED BY SYSTEM; DUTY TO FIELD-VERIFY EXCEPTIONS requires that the automated inspection measurement system produce an exception report containing a systematic listing of all exceptions to § 213.109(d)(4), identified so that appropriate persons designated as fully qualified under § 213.7, either a supervisor under § 213.7(a) or a track inspector under § 213.7(b), can field-verify each exception. A designated qualified inspector must receive any noncompliant rail seat deterioration reports, whether the reports are made accessible to or are physically handed to the person designated under § 213.7, for field verification and repairs purposes. This paragraph also requires that each exception be located and field-verified no later than 48 hours after the automated inspection, and that all field-verified exceptions are subject to all the requirements of Part 213. Inspectors should ensure that exceptions between three-eighths of an inch and one-half of an inch are reported as an 'alert.' Automated inspection exceptions equal to or greater than one-half inch would require field-verification by a qualified person under § 213.7. This is not only to ensure that the exception report accurately reflects the conditions of the track, but also to ensure that a qualified person can take appropriate remedial action in a timely manner.

234(f) Recordkeeping requirements. The track owner shall maintain and make available to FRA a record of the inspection data and the exception record for the track inspected in accordance with this paragraph for a minimum of two years. The exception reports must include the following:

(1) Date and location of limits of the inspection;

(2) Type and location of each exception;

(3) Results of field verification; and

(4) Remedial action if required.

Guidance: RECORDKEEPING REQUIREMENTS contains a requirement that the track owner maintain a record of the inspection data and the exception record for the track inspected in accordance with this section for a minimum of 2 years. The record must include the date and location of limits for the inspection, type and location of each exception, the results of field verification, and any remedial action if required. The location identification must be provided either by milepost or by some other objective means, such as by the location description provided by the Global Positioning System. This new regulation is intended to require the track owner to keep a good record of the conditions of track constructed of concrete crossties and, through such records, FRA track inspectors will have a greater ability to gain access to and accurately assess the railroad's compliance history.

234(g) Procedures for integrity of data. The track owner shall institute the necessary procedures for maintaining the integrity of the data collected by the measurement system. At a minimum, the track owner shall do the following:

(1) Maintain and make available to FRA documented calibration procedures of the measurement system that at a minimum, specify an instrument verification procedure that ensures correlation between measurements made on the ground and those recorded by the instrumentation; and

(2) Maintain each instrument used for determining compliance with this section such that it accurately provides an indication of the depth of rail seat deterioration in accordance with paragraph (d)(1) of this section.

Guidance: PROCEDURES FOR INTEGRITY OF DATA requires that the track owner institute the necessary procedures for maintaining the integrity of the data collected by the measurement system. The track owner must maintain and make available to FRA documented calibration procedures of the measurement system that, at a minimum, specifies an instrument verification procedure that will ensure correlation between measurements made on the ground and those recorded by the instrumentation. Also, the track owner must maintain each instrument used for determining compliance with this section. The purpose of this paragraph is to ensure that the equipment that the track owner is using to comply with the regulations accurately detects what it is designed to detect. In lieu of rail cant angle reference, track owners can use alternative means of technology in their automated inspections to indicate RSD.

234(h) Training. The track owner shall provide annual training in handling rail seat deterioration exceptions to all persons designated as fully qualified under § 213.7 and whose territories are subject to the requirements of § 213.234. At a minimum, the training shall address the following:

(1) Interpretation and handling of the exception reports generated by the automated inspection measurement system;

(2) Locating and verifying exceptions in the field and required remedial action; and

(3) Recordkeeping requirements.

Guidance: TRAINING requires that the track owner provide annual training in handling RSD exceptions to all persons designated as fully qualified under § 213.7 and whose territories are subject to the requirements of § 213.234. At a minimum, the annual training required by this paragraph shall address interpretation and handling of the exception reports generated by the automated inspection measurement system, locating and verifying exceptions in the field and required remedial action, and recordkeeping requirements. The objective is to ensure that all persons required to comply with the regulations are properly trained.

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

235(a) Except as provided in paragraph (c) of this section, each switch, turnout, track crossing, and moveable bridge lift rail assembly of other transition device shall be inspected on foot at least monthly.

Guidance: Paragraph (a) prescribes the frequency and method of inspection for switches, turnouts, track crossings, and moveable bridge lift rail assemblies or other transition devices by a track owner's qualified persons. By examining records and conducting field investigations, FRA inspectors can confirm the track owner's on foot inspection of each switch, turnout, track crossing, and moveable lift bridge rail assembly at least monthly.

235(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 three month period.

Guidance: Each switch, in Classes 3 through 5 track, which is held in normal or reverse position by only one connecting rod is required to be operated (thrown) in all its positions during one track inspection by the track owner in every 3-month period. An example of a switch that has more than one connecting rod is a switch that also has a lock rod. A rod connecting a switch to a switch circuit controller (point detector) is not considered to be a rod that holds a switch in position. This requirement is designed to emphasize the importance of these nonredundant mechanisms. Thorough inspection is best accomplished by operating the switch mechanism to allow for a comprehensive inspection of these components. inspectors should observe the various switch components, determine their functional design, and assess missing components that are integral to safe operation. If the proper operation of the points is in doubt, inspectors should use the appropriate codes under § 213.133. The phrase “all positions” is intended to cover slip and lap (three-way) switches.

235(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.

Guidance: “Lift rails” have unique properties and functions. This discussion will focus on cast manganese alloy types of lift rail assemblies that provide a transition between a fixed span and a movable span on lift bridges, swing bridges, and bascules. Lift rails are made of three pieces for swing bridges: a section on the fixed span, a section on the movable span, and the rocker.

Analogous to a rail in some respects, a manganese lift rail provides a running surface and it is also similar to a rail joint in that it joins rails at the ends of bridge spans. It is made of manganese alloy, and it has the appearance of a frog.

Manganese lift rails have tapered sections to reduce shock. The design provides for the transfer of wheels to take place on one span, rather than between spans. Track and bridge maintenance personnel familiar with manganese steel lift rails point out that cracks generally progress slowly.

Railroad maintenance officials advocate proper maintenance to prevent or reduce cracking of manganese lift rails. Because there is deformation of manganese over time, they recommend that metal flow be ground at the wheel contact point to reduce or prevent cracks. Railroad maintenance personnel also emphasize that the bridge itself can aggravate wear and deterioration of manganese steel lift rails when the bridge needs to be adjusted or repaired. The condition of the bridge ties, for example, is an important factor in the maintenance of these of such assemblies.

Policies regarding speeds on manganese lift rails are set by each railroad. Some railroads require a 25 mph maximum speed on all lift rails regardless of condition. Further reductions of train speeds should be placed when the lift rails deteriorate to prohibitive levels. In deciding to place a speed restriction or remove a lift rail from service, railroads consider a wide range of factors including the amount of traffic, bridge condition, and the condition of the lift rail itself.

In summary:

- When evaluating the safety of a manganese lift rail assembly, inspectors must consider that cracks in manganese casting are known to propagate slowly. Although cracks are known to propagate slowly, they can be more hazardous under certain bridge conditions, such as a deteriorated deck. Inspectors are cautioned against citing § 213.113 (Defective rails) to describe cracks in the manganese casting running surface of the manganese lift rail appliance.

- Specific concerns about the safety of a manganese steel lift rails must be immediately brought to the attention of an appropriate railroad manager and discussed with the regional track specialist.

General Guidance: Inspections conducted from a vehicle are not considered sufficient to determine compliance. Therefore, each switch; turnout; track crossing; and lift rail assembly, or other transition device on moveable bridges, will be inspected by a walking inspection before FRA inspectors can consider a unit (activity) inspected, as outlined in Chapter 2 of this manual.

§ 213.237 Inspection of rail

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

Guidance: The inspection frequency requirements stated in this paragraph consider both the passage of time and the accumulated tonnage since the last inspection. Several methods are employed by railroads to estimate tonnage, but they are only estimates and cannot be considered as precisely accurate. In addition, scheduling of rail detection cars is influenced by many factors such as the availability of equipment if the service is contracted, equipment failures or various other scheduling problems, which may arise.

For Class 3 track, over which only freight operations are conducted, the date of the most recent inspection will define the beginning of a new inspection cycle, and before the expiration of time or tonnage limits, whichever is longer, an inspection for internal rail defects must be conducted. For Classes 4 and 5 track, and Class 3 track over which passenger trains operate, the date of the most recent inspection will define the beginning of a new inspection cycle, and before the expiration of time or tonnage limits, whichever is shorter, an inspection for internal rail defects must be conducted.

Language in § 213.237(a) refers to § 213.233 (Track inspection) indicating that many rail, defects, as well as conditions caused by wear or damage, cannot be visually discovered. These require an internal search by a detector car or other specialized detection equipment.

Some railroads have elected to perform more internal rail inspections than required under the TSS, with intervals between tests typically ranging from 20 to 30 million gross tons or between 20 and 30 days. These typical intervals define a good baseline for generally accepted maintenance practices, and the industry’s rail quality managers consider these limits as points of departure for adjustment of test schedules to account for the effects of specific track characteristics, maintenance, traffic, and weather.

The annual test requirement for Classes 4 and 5 track and Class 3 track over which passenger trains operate is based on risk factors associated with freight train speeds and passenger train operations.

Selecting an appropriate frequency of rail testing is a complex task involving many different factors which include, but are not limited to, temperature differential, curvature, residual stresses, rail sections, cumulative tonnage, and past rail test results. Taking into consideration all of the above factors, FRA's research suggests that 40 million gross tons is the maximum tonnage that should be hauled between rail tests and still allow a safe window of opportunity for detection of an internal rail flaw before it propagates in size to a service failure. Furthermore, FRA's Accident/Incident data points to a need for inclusion of all Class 3 trackage in a railroad's rail testing program. The requirement states that Class 3 track, over which passenger trains do not operate, should be tested once a year or once every 30 million gross tons, whichever is longer.

237(b) Inspection equipment shall be capable of detecting defects between joint bars, in the area enclosed by joint bars.

Guidance: The equipment used must be capable of detecting defects in the joint area as well as in the body of the rail. Two separate systems may be used to meet this requirement provided that each is used before the expiration of the time or tonnage limits as required by this section.

237(c) Each defective rail shall be marked with a highly visible marking on both sides of the web and base.

Guidance: Each defective rail must be marked with a highly visible marking on both sides of the web and base to prevent reuse of the rail. A defect's identity and control numbers are not required on the web and base, but may be used by a railroad for inventory purposes. Inspectors should be aware that rail with certain defects, such as a bolt hole crack, may have the defective portion "cropped" and the remaining portion placed back in service. The track owner may remove defect markings from the nondefective portion of such rail.

*237(d) If the person assigned to operate the rail defect detection equipment being used determines that, due to rail surface conditions, a valid search for internal defects could not be made over a particular length of track, the test on that particular length of track cannot be considered as a search for internal defects under §213.237(a). ** (This paragraph (d) is not retroactive to tests performed prior to September 21, 1998).*

Guidance: This paragraph and paragraph (e) address a situation where a valid search for internal rail defects could not be made because of rail surface conditions. Several types of technologies are presently employed to continuously search for internal rail defects, some with varying means of displaying and monitoring search signals. A continuous search is intended to mean an uninterrupted search by whatever technology is being used, so that there are no segments of rail that are not tested. If the test is interrupted (e.g., as a result of rail surface conditions that inhibit the transmission or return of the signal) then the test over that segment of rail is not valid because it was not continuous. Therefore, a non-test is not defined in absolute technical terms. Rather, the provision leaves this determination to the rail test equipment operator who is uniquely qualified on that equipment. Paragraph (d) is not retroactive to tests performed prior to September 21, 1998.

237(e) If a valid search for internal defects cannot be conducted for reasons described in paragraph (d) of this section, the track owner shall, before the expiration of time or tonnage limits;

(1) Conduct a valid search for internal defects;

(2) Reduce operating speed to a maximum of 25 miles per hour until such time as a valid search for internal defects can be made; or

(3) Remove the rail from service.

Guidance: This paragraph specifies the three options available to a railroad following a non-test due to rail surface conditions. These options must be exercised prior to the expiration of time or tonnage limits specified in the paragraph (a) of this section. If doubts exist concerning a defective rail's disposition, inspectors should review the track owner's records, under § 213.241(c). When conducting a records inspection, inspectors will determine that the requirements of §§ 213.113(a)(2) and 213.237(e) are in compliance and have determined that valid inspections have occurred. The expiration of time and tonnage must be determined before any compliance action is taken.

Broken rails continue to be one of the leading causes of train accidents. Inspectors should examine records to ensure railroad internal rail inspection frequency compliance, and should be alert during track inspections to any rail that is marked as defective. During accident investigations where a broken rail is a factor, inspectors should provide complete information on type of defects, results of last rail inspection, type of inspection equipment used, track usage since last inspection, and accumulated tonnage on that rail. See the guidance under § 213.237(d) for a discussion of the situation where a valid search for internal rail defects could not be made because of rail surface conditions.

§ 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.

Guidance: This section is general in nature, because it is not practical to specify all the conditions that could trigger a special inspection or the specific manner and timing. This section is not meant to imply that train operations must necessarily stop until the special inspection is made. However, all special inspections should be conducted for the primary purpose of determining whether the track structure is safe for the continued operation of trains. Inspectors are directed to review the significant impacts to railroad operations in regard to storms as discussed in any applicable safety advisory.

Because a number of train derailments have been caused by unexpected track damage from moving water in the past, FRA deemed it appropriate to issue Safety Advisory 97-1, which recommends procedures that reflect effective industry practices for special track inspections. The procedures consist of:

1. Prompt notification to dispatchers of expected bad weather.
2. Limits on train speed on all track subject to flood damage, following the issuance of a flash flood warning, until a special inspection can be performed.
3. Identification of bridges carrying Class 4 or higher track that are vulnerable to flooding and over which passenger trains operate.
4. Availability of information about each bridge, such as identifying marks, for those who may be called to perform a special inspection.
5. Training programs and refresher training for those who perform special inspections.

6. Availability of a bridge maintenance or engineering employee to evaluate the railroad track inspector's findings.

Although the advisory contains a sample list of sudden events that routinely occur in nature, this provision is not limited to only the occurrences listed or to only natural disasters. Section 213.239 addresses the need to inspect after "other occurrences," which include such natural phenomena as temperature extremes, as well as unexpected events that are human-caused (e.g., a vehicle that falls on the tracks from an overhead bridge, a water main break that floods a track roadbed, or terrorist activity that damages track). This interpretation is not new; FRA has always viewed this section to encompass sudden events of all kinds that affect the safety and integrity of track.

Inspectors should determine the procedures that have been established by the railroad to comply with § 213.239, mindful that advisory procedures are not mandatory. Procedures should include the method employed by the railroad to receive information on severe weather (e.g., who receives the information and what is done with that information). When the railroad is notified of a possible track-damaging occurrence, a special inspection must be made. A track owner may designate any official to be responsible for making a determination on whether a special inspection, under § 213.239, is required. The designation is not limited to any certain craft, but the official must be trained and qualified to assure a proper inspection was conducted. The TSS do not require railroads to keep written records of special inspections, and so FRA inspectors will not have any such records to determine railroad compliance with this section. As a result, FRA inspectors should look to other sources (e.g., train dispatcher hi-rail occupancy records) to determine compliance.

§ 213.241 Inspection records

241(a) Each owner of track to which this part applies shall keep a record of each inspection required to be performed on that track under this subpart.

Guidance: Each track owner is required to keep a record of each inspection according to the requirements under §§ 213.4, 213.119, 213.233, and 213.235. Each inspection report under these sections must be prepared on the day of inspection and signed by the person making the inspection.

The track owner may develop any form that meets the requirements of the TSS. If the owner requires inspections at more frequent intervals than specified by § 213.233(c), then the only requirement is to prepare and maintain an inspection record to comply with the minimum inspection frequency. This section is explicit concerning the required information contained in the inspection records. They must specify the track inspected [including the provisions under § 213.233(b)(3)], date of inspection, location and nature of any defect, and the remedial action taken by the person making the inspection. Railroad inspection reports are required to reflect the actual conditions, as they exist in the track structure. The railroad inspector must include the specific measurement of the track parameter, whenever appropriate, when describing the nature of the defect per § 213.241(b). For example: "wide gage exceeds allowable for Class 4 track - 58 inches - track slow ordered to 10 m.p.h." When defects are discovered, the track owner's inspectors and immediately initiate remedial action, in accordance with § 213.5. If a speed restriction is used as remedial action, the reduced speed should be shown in the inspection records.

Railroad track inspectors are required to list all deviations from the TSS on their inspection record. FRA inspectors should review railroad inspection records to determine if the reported data accurately reflects the track conditions, as they exist in the field. Railroad inspectors are not limited to recording deviations from the TSS (e.g., railroad maintenance items). FRA inspectors should compare the defects they find with the railroad inspectors reports to determine the level of compliance with the railroad's inspection program. If multiple tracks are being inspected, the records must designate the track(s) traversed, and any tracks not inspected due to visibility obstruction or excessive distance as required under § 213.233.

When two qualified persons inspect multiple tracks in accordance with § 213.233(b), one report or two reports may be optionally prepared. If one report is used, the report must include a notation such as signature, initials, or printed name of the second inspector.

Rail inspection records must be maintained by the track owner for at least 2 years after the inspection and for 1 year after the last remedial action is taken. The record must specify the location and nature of any rail defects found through internal inspection, and the remedial action taken and the date thereof. This record may consist of log sheets combined with a standard rail defect and change out report, computer records, or other data kept by the track owner and containing all the required information.

The rail inspection records must specify the locations of any rail that, due to rail surface conditions, prohibit the railroad from conducting a valid search for internal defects at the required frequency. If a valid search cannot be conducted before the time or tonnage frequency expires, the remedial action and date of remedial action must be recorded on the inspection records.

241(b) Each record of an inspection under §§ 213.4, 213.119, 213.233, and 213.235 shall be prepared on the day the inspection is made and signed by the person making the inspection. Records shall specify the track inspected, date of inspection, location and nature of any deviation from the requirements of this part, and the remedial action taken by the person making the inspection. The owner shall designate the location(s) where each original record shall be maintained for at least one year after the inspection covered by the record. The owner shall also designate one location, within 100 miles of each state in which they conduct operations, where copies of record which apply to those operations are either maintained or can be viewed following 10 days notice by the Federal Railroad Administration.

Guidance: FRA has added § 213.119 to the list of sections in paragraph (b), thereby requiring that inspections of joints made pursuant to § 213.119 comply with the inspection record requirements found in § 213.241(b).

In reviewing compliance with this section, inspectors should determine if the track owner is properly recording the location and date when each switch that is held in position only by the operating mechanism and a connecting rod are operated in every three month period [(§ 213.235(c)]. In addition, the record should reflect when each siding was actually traversed by a vehicle or on foot at the required frequency [§ 213.233(c)].

The regulation allows railroads to designate a location within 100 miles of each state (designated locations) where inspectors can view records. Inspectors are required to give 10 days advance notice before conducting the record keeping inspection of designated locations. The regulation does not require the railroads to maintain the records at these designated locations, only to be able to provide viewing of them at the locations within 10 days after notification. The TSS stipulates locations within 100 miles of each state, rather than locations in each state, to accommodate those railroads whose operations may cross a state's line by only a few miles. In those cases, the railroad could designate a location in a neighboring state, provided the location is within 100 miles of that state's border. Records must be kept for at least one year after the inspection covered by the report. It is appropriate for the inspector to expect all records will be available for inspection up to the date of notification.

241(c) Rail inspection records shall specify the date of inspection, the location and nature of any internal defects found, the remedial action taken and the date thereof, and the location of any intervals of track not tested per §213.237(d). The owner shall retain a rail inspection record for at least two years after the inspection and for one year after remedial action is taken.

Guidance: This paragraph requires a track owner to record any locations where a proper rail inspection cannot be performed because of rail surface conditions. Section § 213.237(d), specifies that if rail surface conditions prohibit the railroad from conducting a proper search for rail defects, a test of that rail does not fulfill the requirements of § 213.237(a) which requires a search for internal defects at specific intervals. Subsection (c) requires a record keeping of those instances.

241(d) Each owner required to keep inspection records under this section shall make those records available for inspection and copying by the Federal Railroad Administration.

241(e) For purposes of compliance with the requirements of this section, an owner of track may maintain and transfer records through electronic transmission, storage, and retrieval provided that;

(1) The electronic system be designed so that the integrity of each record is maintained through appropriate levels of security such as recognition of an electronic signature, or other means, which uniquely identify the initiating person as the author of that record. No two persons shall have the same electronic identity;

(2) The electronic storage of each record shall be initiated by the person making the inspection within 24 hours following the completion of that inspection;

(3) The electronic system shall ensure that each record cannot be modified in any way, or replaced, once the record is transmitted and stored;

(4) Any amendment to a record shall be electronically stored apart from the record which it amends. Each amendment to a record shall be uniquely identified as to the person making the amendment;

(5) The electronic system shall provide for the maintenance of inspection records as originally submitted without corruption or loss of data;

(6) Paper copies of electronic records and amendments to those records, that may be necessary to document compliance with this part shall be made available for inspection and copying by the Federal Railroad Administration at the locations specified in paragraph (b) of this section; and

(7) Track inspection records shall be kept available to persons who performed the inspections and to persons performing subsequent inspections.

Guidance: This paragraph contains requirements for maintaining and retrieving electronic records of track inspections. This allows each railroad to design its own electronic system as long as the system meets the specified criteria to safeguard the integrity and authenticity of each record. The provision also requires that railroads make available paper copies of electronic records, when needed by the FRA inspector or by railroad track inspectors.

A track owner may elect to maintain and transfer records through electronic transmission, storage, and retrieval procedures. Each record must have sufficient security to maintain the integrity of the record. Levels of security must identify the person making the inspection as the author of the record. No two individuals will have or share the same electronic signature or identity. If individuals use an electronic signature or identity other than their own, violations or personal liability action should be considered for all parties involved. The integrity of electronic inspection record systems is an extremely sensitive issue. Should the system integrity be compromised, an inspector should immediately contact the appropriate regional track specialist. Should the regional track specialist be unavailable the inspector will notify the appropriate Regional Administrator. Headquarters Track Division will also be notified.

The system must ensure that no record can be replaced, deleted, or modified in any way, once the record has been transmitted and stored. Each amendment to a record shall be stored separately from the record it amends. Each amendment must identify the person making the amendment and have sufficient security to maintain the integrity of the amendment.

For electronic records, inspection records must be completed the day of the inspection either on computer or temporarily on paper. The electronic record must then be uploaded to the permanent electronic storage system where the record will be maintained for one year. The uploading of each inspection record must be completed within 24 hours following the completion of the inspection.

An advantage of an electronic system is the associated reduction in paperwork. Therefore, inspectors must rely on viewing records on a terminal or monitor screen whenever it is made available for viewing by the railroad. Although printouts of records must be made available to FRA inspectors, inspectors are discouraged from requesting paper copies of electronic records unless necessary to document noncompliance. A paper copy of an electronic record may be marked “original” and included in the documentation necessary for a violation report when recommending civil penalties.

The railroad inspection records will be furnished upon request at the location specified by the railroad as required in paragraph (b) of this section. A paper copy of any electronic inspection record or amendment will be made available to the railroad inspector or any subsequent railroad inspectors performing inspections of the same territory upon request.

Appendix

Appendix A – Superelevation in Inches/Speed MPH

Curve	Table A1 – Elevation Inches – Three Inches Unbalance												
Degree	0	½	1	1½	2	2½	3	3½	4	4½	5	5½	6
0º30'	93	100	107	113	120	125	131	136	141	146	151	156	160
0º40'	80	87	93	98	103	109	113	118	122	127	131	135	139
0º50'	72	78	83	88	93	97	101	106	110	113	117	121	124
1º00'	66	71	76	80	85	89	93	96	100	104	107	110	113
1º15'	59	63	68	72	76	79	83	86	89	93	96	99	101
1º30'	54	58	62	66	69	72	76	79	82	85	87	90	93
1º45'	50	54	57	61	64	67	70	73	76	78	81	83	86
2º00'	46	50	54	57	60	63	66	68	71	73	76	78	80
2º15'	44	47	50	54	56	59	62	64	67	69	71	74	76
2º30'	41	45	48	51	54	56	59	61	63	66	68	70	72
2º45'	40	43	46	48	51	54	56	58	60	62	65	66	68
3º00'	38	41	44	46	49	51	54	56	58	60	62	64	66
3º15'	36	39	42	45	47	49	51	54	56	57	59	61	63
3º30'	35	38	40	43	45	47	50	52	54	55	57	59	61
3º45'	34	37	39	41	44	46	48	50	52	54	55	57	59
4º00'	33	35	38	40	42	44	46	48	50	52	54	55	57
4º30'	31	33	36	38	40	42	44	45	47	49	50	52	54
5º00'	29	32	34	36	38	40	41	43	45	46	48	49	51
5º30'	28	30	32	34	36	38	40	41	43	44	46	47	48
6º00'	27	29	31	33	35	36	38	39	41	42	44	45	46
6º30'	26	28	30	31	33	35	36	38	39	41	42	43	45
7º00'	25	27	29	30	32	34	35	36	38	39	40	42	43
8º00'	23	25	27	28	30	31	33	34	35	37	38	39	40
9º00'	22	24	25	27	28	30	31	32	33	35	36	37	38
10º00'	21	22	24	25	27	28	29	31	32	33	34	35	36
11º00'	20	21	23	24	26	27	28	29	30	31	32	33	34
12º00'	19	20	22	23	24	26	27	28	29	30	31	32	33

Curve Degree	Table A2 - Elevation Inches – Four Inches Unbalance												
	0	½	1	1½	2	2½	3	3½	4	4½	5	5½	6
0º30'	107	113	120	125	131	136	141	146	151	156	160	165	169
0º40'	93	98	104	109	113	118	122	127	131	135	139	143	146
0º50'	83	88	93	97	101	106	110	113	117	121	124	128	131
1º00'	76	80	85	89	93	96	100	104	107	110	113	116	120
1º15'	68	72	76	79	83	86	89	93	96	99	101	104	107
1º30'	62	65	69	72	76	79	82	85	87	90	93	95	98
1º45'	57	61	64	67	70	73	76	78	81	83	86	88	90
2º00'	53	57	60	63	65	68	71	73	76	78	80	82	85
2º15'	50	53	56	59	62	64	67	69	71	73	76	78	80
2º30'	48	51	53	56	59	61	63	65	68	70	72	74	76
2º45'	46	48	51	53	56	58	60	62	64	66	68	70	72
3º00'	44	46	49	51	53	56	58	60	62	64	65	67	69
3º15'	42	44	47	49	51	53	55	57	59	61	63	65	66
3º30'	40	43	45	47	49	52	53	55	57	59	61	62	64
3º45'	39	41	44	46	48	50	52	53	55	57	59	60	62
4º00'	38	40	42	44	46	48	50	52	53	55	57	58	60
4º30'	36	38	40	42	44	45	47	49	50	52	53	55	56
5º00'	34	36	38	40	41	43	45	46	48	49	51	52	53
5º30'	32	34	36	38	39	41	43	44	46	47	48	50	51
6º00'	31	33	35	36	38	39	41	42	44	45	46	48	49
6º30'	30	31	33	35	36	38	39	41	42	43	44	46	47
7º00'	29	30	32	34	35	36	38	39	40	42	43	44	45
8º00'	27	28	30	31	33	34	35	37	38	39	40	41	42
9º00'	25	27	28	30	31	32	33	35	36	37	38	39	40
10º00'	24	25	27	28	29	30	32	33	34	35	36	37	38
11º00'	23	24	25	27	28	29	30	31	32	33	34	35	36
12º00'	22	23	24	26	27	28	29	30	31	32	33	34	35

Appendix B – Defect Codes

Note:

1) All codes correspond to the rule text. For example, 0004E1 corresponds to 213.4(e)(1) and 0109B1i corresponds to 213.109(b)(1)(i).
2) For penalty schedule, please refer 49 CFR Part 213.
3) Defect code descriptions are not exact regulatory language. They are subject to change as needed.

Code	Description
0004A	Excepted track segment not identified in appropriate record.
0004B	Excepted track segment located within 30 feet of an adjacent track subject to simultaneous operation at speeds in excess of 10 mph.
0004C	Excepted track not inspected in accordance with 213.233(c) and 213.235 as specified for class 1 track.
0004D	Train speed exceeds 10 mph on excepted track.
0004E1	Occupied passenger train operated on excepted track.
0004E2	Freight train operated on excepted track with more than five cars required to be placarded in accordance with 49 CFR part 172.
0004E3	Train with a car required to be placarded by 49 CFR Part 172 operated over excepted track within 100 feet of a bridge or in a public street or highway.
0004F	Failure to notify fra of removal of trackage from excepted status.
0005A	Failure of owner to either bring track into compliance, halt operations, or operate subject to the conditions of this part.
0007A2	Failure of track owner to have persons demonstrate required knowledge, ability to detect deviations and prescribe remedial action, inspection.
0007A3	Failure of person to have written authorization for restoration and renewal.

0007B	Failure of track owner to use qualified persons to inspect track.
0007B2	Failure of track owner to have persons demonstrate required knowledge, ability to detect deviations and prescribe remedial action, restoration and renewal.
0007B3	Failure of person to have written authorization for inspection.
0007C	Failure of track owner to use qualified persons to inspect, restore or renew CWR.
0007C2	Failure to complete comprehensive CWR training course.
0007C3	Failure of track owner to have persons demonstrate required knowledge, ability to detect deviations, CWR.
0007C4	Failure of person to have written authorization to inspect, restore or renew CWR.
0007D	Failure of track owner to use not fully qualified persons to pass trains over broken rails or pull aparts.
0007D2	Train speed exceeds 10 mph over broken rails or pull aparts.
0007D3	Person not watching or prepared to stop train movements over broken rails or pull aparts.
0007D4	Failure to promptly notify and dispatch person(s) fully qualified under 213.7 to the location of the broken rail or pull apart.
0007E	Failure of track owner to properly maintain written records of designation and basis for each designation.
0009B1	Failure to restore other than excepted track to compliance with class 1 stds. Within 30 days after a person designated under 213.7(a) has determined that operations may safely continue over defect(s) not meeting class 1 or excepted track standards.
0009B2	Failure of track owner to enforce, over class 1 defects, the limiting conditions imposed by person designated under 213.7(a).
0011	Proper qualified supervision not provided at work site during work hours when track is being restored or renewed under traffic conditions.
0013	Failure to add dynamic movement to static measurement
0033A1	Drainage or water-carrying facility not maintained.

0033A2	Drainage or water-carrying facility obstructed by debris.
0033A3	Drainage or water-carrying facility collapsed.
0033A4	Drainage or water-carrying facility obstructed by vegetation.
0033A5	Drainage or water-carrying facility obstructed by silting.
0033A6	Drainage or water-carrying facility deteriorated to allow subgrade saturation.
0033A7	Uncontrolled water undercutting track structure or embankment.
0037A	Combustible vegetation around track-carrying structures.
0037B1	Vegetation obstructs visibility of railroad signs and fixed signals.
0037B2	Vegetation obstructs visibility of grade crossing warning signs and signals by the traveling public.
0037C1	Vegetation interferes with railroad employees performing normal trackside duties.
0037C2	Vegetation obstructs passing of day and night signals by railroad employees.
0037C3	Excessive vegetation in toepaths and around switches that interferes with employees performing normal trackside duties.
0037D	Vegetation prevents proper functioning of signal and/or communication lines.
0037E1	Excessive vegetation at train order office, depot, interlocking plant, a carman's building, etc., prevents employees on duty from visually inspecting moving equipment when their duties so require.
0037E2	Excessive vegetation at train meeting points prevents proper inspection by railroad employees of moving equipment.
0037E3	Vegetation brushing sides of rolling stock that prevents employees from visually inspecting moving equipment from their normal duty stations.
0053A	Gage measurement improper
0053B1	Gage dimension on tangent track exceeds allowable.

0053B2	Gage dimension on tangent track.is less than allowable
0053B3	Gage dimension on curved track exceeds allowable
0053B4	Gage dimension on curved track.is less than allowable
0053B5	Gage dimension for excepted track.exceeds allowable
0055A1	Alinement deviation of tangent track for a 62-foot chord exceeds allowable
0055A2	Alinement deviation of curved track for a 62-foot chord exceeds allowable.
0055A3	Alinement deviation of curved in class 3-5 track for a 31-foot chord exceeds allowable.
0057A1	Maximum crosslevel on a curve in class 1 and 2 track exceeds allowable.
0057A2	Maximum crosslevel on curve in class 3-5 track exceeds allowable.
0057B1	Operating speed exceeds allowable for 3-inches of unbalance, based on curvature and elevation.
0057C1	Operating speed exceeds allowable for 4-inches of unbalance, based on curvature and elevation.
0057D	Operating speed exceeds allowable for a fra approved unbalance based on curvature and elevation for contiguous high speed track exceeds allowable.
0059A	Where fixed physical conditions are not considered, operating speed based on curvature and actual minimum elevation in a curve exceeds allowable
0059B	Improper elevation runoff in a spiral exceeds allowable
0063A1	Runoff in any 31-feet of rail at end of raise exceeds allowable.
0063A10	Crosslevel differences in all of six or more consecutive pairs of staggered joints in class 2-5 track exceeds allowable.
0063A2	Deviation from uniform profile on either rail exceeds allowable.
0063A3	Deviation from zero crosslevel at any point on tangent track exceeds allowable

0063A4	Reverse crosslevel on curve track exceeds allowable
0063A5	Difference in crosslevel (warp) between any two points less than 62-feet apart on tangent track exceeds allowable.
0063A6	Difference in crosslevel (warp) between any two points less than 62-feet apart on curve track between spirals exceeds allowable.
0063A7	Difference in crosslevel (warp) between any two points less than 62-feet apart on spiral track exceeds allowable.
0063A8	Variation in crosslevel per 31-feet on a physically restricted length spiral exceeds allowable.
0063A9	Where elevation at any point in curve track equals or exceeds six inches, the difference in crosslevel within 62-feet between that point and a point with greater elevation exceeds allowable
0103A	Fouled or insufficient ballast failing to transmit and distribute loading
0103B	Fouled or insufficient ballast failing to restrain the track laterally, longitudinally or vertically.
0103C	Fouled ballast failing to provide adequate drainage for the track.
0103D	Fouled or insufficient ballast failing to maintain proper geometry.
0109A	Crossties made of unsound material
0109B1i	39-foot segment of track does not have sufficient number of crossties to provide effective support to hold gage within limits prescribed in part 213.53(b).
0109B1ii	39-foot segment of track does not have sufficient number of crossties to provide effective support that will maintain surface within the limits prescribed by part 213.63.
0109B1iii	39-foot segment of track does not have sufficient number of crossties to provide effective support that will maintain alinement within the limits prescribed by part 213.55.
0109B2	Crossties not effectively distributed to support a 39-foot segment of track.
0109B3	No effective support ties within the prescribed distance from a joint.

0109B4	Failure to maintain the minimum number of crossties per fra track class for each 39-foot segment of track as indicated in table in this section.
0109C1	Crossties, other than concrete, that meet the minimum requirements of part 213.109 (b)(4),are broken through.
0109C2	Crossties, other than concrete, that meet the minimum requirements of part 213.109 (b)(4), are split or otherwise impaired to the extent the crosstie will allow the ballast to work through, or it will not hold spikes or rail fasteners.
0109C3	Crossties, other than concrete, that meet the minimum requirements of part 213.109 (b)(4), are so deteriorated that the crosstie plate or base of the rail can move laterally 1/2-inch relative to the crosstie.
0109C4	Crossties, other than concrete, that meet the minimum requirements of part 213.109 (b)(4), are cut by the crosstie plate through more than 40 percent of a crosstie's thickness.
0110A	Failure to maintain and operate GRMS within minimum design requirements over designated GRMS line segments
0110A1	Failure to notify fra at least 30 days prior to the designation of a GRMS line segment
0110A2	Failure to notify fra at least 10 days prior to the removal of a line segment from GRMS designation
0110B1	Failure to provide required information identifying a GRMS line segment
0110C	Failure to provide sufficient technical data to establish compliance with minimum GRMS design requirements
0110G	Failure of GRMS to provide analog trace of specified parameters
0110H	Failure of GRMS to provide exception report listing of specified parameters
0110I	Failure to provide exception report listing to par. 213.7 individual prior to next inspection required under par. 213.333
0110J1i	Failure to maintain and make available documented calibration procedures on GRMS vehicle
0110J1ii	Failure to initiate a daily instrument verification procedure
0110J2	Failure to maintain PTLF accuracy within five-percent of 4,000 reading
0110K	Failure to meet training requirements.

0110L	Failure to initiate required remedial action for exceptions listed on GRMS record of lateral restraint
0110M1i	Gage widening exceeds allowable measured with PTLF
0110M5	Failure to provide functional PTLF to par. 213.7 individual whose territory is subject to requirements of par. 213.110
0110M6	Failure to restore contact between rail and lateral rail restraint components
0110N	Failure to keep GRMS records as required
0110O	Failure to conduct GRMS inspections at required frequency
0113A	Operation continued over defective rail without required remedial action.
0113B	Rail defect originating from bond wire attachment [where a defect results from a bond wire attachment, fra inspectors must cite this defect code and also include a description of the applicable rail defect as described in §213.113]
0113B1	Transverse fissure
0113B10	Ordinary break
0113B11	Damaged rail
0113B12	Flattened rail
0113B13	Bolt-hole crack
0113B14	Broken or defective weld
0113B15	Head web separation
0113B2	Compound fissure
0113B3	Horizontal split head
0113B4	Vertical split head

0113B5	Split web
0113B6	Piped rail
0113B7	Broken base
0113B8	Detail fracture
0113B9	Engine burn fracture
0115A1	Rail-end mismatch on tread of rail exceeds allowable.
0115A2	Rail-end mismatch on tread of rail exceeds allowable (CWR).
0115A3	Rail-end mismatch on gage side of rail exceeds allowable.
0115A4	Rail-end mismatch on gage side of rail exceeds allowable (CWR).
0118A1	Failure of track owner to develop and implement written CWR procedures.
0118A2	Failure to comply with written CWR procedures.
0118A3	Failure of track owner to develop a training program for the implementation of their written CWR procedures.
0118C	Failure of track owner to comply with existing CWR plan.
0118E1	Failure of track owner to file a revised CWR plan with associate administrator of safety/chief operating officer within 30 days of revision.
0118E2	Failure of track owner to re-submit a conforming plan within 30 days of receipt of final submission decision.
0119A	Failure to comply with written CWR procedures - installation and adjustment
0119B	Failure to comply with written CWR procedures - anchoring or fastening requirements
0119C	Failure to comply with written CWR procedures - joint installation and maintenance procedures
0119D	Failure to comply with written CWR procedures - maintaining desired rail installation temperature range

0119E	Failure to comply with written CWR procedures - curved track
0119F	Failure to comply with written CWR procedures - train speed
0119G	Failure to comply with written CWR procedures - physical track inspections
0119H	Failure to comply with written CWR procedures - CWR joint inspection
0119I	Failure to comply with written CWR procedures - training
0119J	Failure to comply with written CWR procedures - recordkeeping
0119K	Car procedures and revisions not available at job site or maintained in one manual
0121A1	Rail joint not of structurally sound design and dimension (jointed track)
0121A2	Rail joint not of structurally sound design and dimension (CWR).
0121B1	Cracked or broken joint bar in classes 3 through 5 track (other than center-break) (jointed track)
0121B2	Cracked or broken joint bar in classes 3 through 5 track (other than centerbreak) (CWR)
0121B3	Cracked or broken insulated joint bar in classes 3 through 5 track (other than centerbreak) (CWR).
0121B4	Worn joint bar allows excessive vertical movement of rail in joint in classes 3 through 5 track (jointed track)
0121B5	Worn joint bar allows excessive vertical movement of rail in joint in classes 3 through 5 track (CWR).
0121C1	Center cracked or broken joint bar (jointed track)
0121C2	Center cracked or broken joint bar (cwr).
0121C3	Center cracked or broken insulated joint bar (cwr)
0121D1	Less than 2 bolts per rail at each joint for conventional jointed rail in classes 2 through 5 track.
0121D2	Less than 1 bolt per rail at each joint for conventional jointed rail in class 1 track.
0121E	Less than 2 bolts per rail at any joint in continuous welded rail.

0121F1	Loose joint bars (jointed track)
0121F2	Loose joint bars (cwr).
0121G1	Torch-cut or burned-bolt hole in rail in classes 2 through 5 track (jointed track)
0121G2	Torch-cut or burned-bolt hole in rail in classes 2 through 5 track (cwr).
0121H1	Joint bar reconfigured by torch cutting in classes 3 through 5 track (jointed track)
0121H2	Joint bar reconfigured by torch cutting in classes 3 through 5 track (cwr).
0122Ai	Torch cut rail applied in class 3 through 5 track for other than emergency.
0122Aii	Failure to remove torch cut rails within specified time frame.
0122B1	Failure to remove non-inventoried torch cut rail within 30 days of discovery.
0122B2	Train speed exceeds allowable over non-inventoried torch cut rail.
0123A	Insufficient tie plates in class 3 through 5 track.
0123B	Object between base of rail and the bearing surface of the tie plate causing concentrated load.
0127A	Failure of fastening components to effectively maintain gage within the limits described in part 213.53(b)
0127A2	Insufficient fasteners in a track segment.
0127A3	Insufficient fasteners at rail joint.
0127B	Failure of applied rail anchors to provide effective longitudinal restraint
0127C	Failure of fastener placement at insulated joints from performing as intended, or the crosstie does not effectively support the rail
0133A1	Loose, worn, or missing switch clips.
0133A10	Missing switch, frog, or guard rail plates.

0133A11	Loose or missing switch point stops.
0133A12	Loose, worn, or missing frog bolts.
0133A13	Loose, worn, or missing guard rail bolts.
0133A14	Loose, worn or missing guard rail clamps, wedge, separator block, end block, or other components.
0133A15	Turnout or track crossing fastenings not intact or maintained.
0133A16	Obstruction between switch point and stock rail.
0133A17	Obstruction in flangeway of frog.
0133A18	Obstruction in flangeway of guard rail.
0133A2	Loose, worn, or missing clip bolts (transit, side jaw, eccentric, vertical).
0133A3	Loose, worn, or defective connecting rod.
0133A4	Loose, worn, or defective connecting rod fastening.
0133A5	Loose, worn, or defective switch rod.
0133A6	Loose, worn, or missing switch rod bolts.
0133A7	Worn or missing cotter pins.
0133A8	Loose or missing rigid rail braces.
0133A9	Loose or missing adjustable rail braces.
0133B	Insufficient anchorage to restrain rail movement.
0133C	Flangeway less than 1 1/2 inches wide.
0135A1	Stock rail not securely seated in switch plates.
0135A2	Stock rail canted by overtightening rail braces.

0135B1	Improper fit between switch point and stock rail.
0135B2	Excessive lateral or vertical movement of switch point.
0135B3	Lateral or vertical movement of a stock rail adversely affecting the fit of the switch point to the stock rail.
0135C	Outer edge of wheel contacting gage side of stock rail.
0135D	Heel of switch insecure.
0135E1	Switch stand or switch machine insecure or operable with excessive lost motion.
0135E2	Connecting rod insecure or operable with excessive lost motion.
0135F	Throw lever operable with switch lock or keeper in place.
0135G	Switch position indicator not clearly visible.
0135H1	Unusually chipped or worn switch point.
0135H2	Improper switch closure due to metal flow.
0135I	Use of tongue and plain mate where speeds exceed class one.
0137A	Insufficient flangeway depth.
0137B	Frog point chipped, broken, or worn in excess of allowable.
0137C	Tread portion of frog worn in excess of allowable.
0137D	Use of flange bearing frog where speed exceeds that permitted by class 1.
0137E	Severe frog condition not otherwise provided. (advisory only cannot be used solely to recommend violation)
0139A	Outer edge of wheel contacting side of spring wing rail.
0139B	Toe of wing rail not fully bolted and tight.
0139B1	Ties under or wing rail not solidly tamped.

0139C1	Bolt-hole defect in spring frog.
0139C2	Head and web separation in spring frog.
0139D	Insufficient compression in spring to hold wing rail against point rail.
0139E	Excessive clearance between hold-down housing and horn.
0141A	Raised guard worn excessively.
0141B	Frog point rebuilt before restoring guarding face.
0143A1	Guard check gage less than allowable.
0143A2	Guard face gage exceeds allowable.
0143A3	Cracked or broken guard rail.
0205A	Derail not clearly visible.
0205B	Derail operable when locked.
0205C1	Loose, worn, or defective parts of derail.
0205C2	Insecure derail or stand
0205D1	Improper size derail.
0205D2	Improperly installed derail.
0233A	Track inspected by other than qualified designated individual.
0233B	Track being inspected at excessive speed.
0233B1	One inspector inspecting more than two tracks or inspecting tracks with centers greater than allowable.
0233B2	Two inspectors inspecting more than four tracks or inspecting tracks with centers greater than allowable.
0233B3i	Main track not traversed within the required frequency.

0233B3ii	Siding track not traversed within the required frequency.
0233C	Failure to inspect at required frequency.
0233D	Failure to initiate remedial action for deviations found.
0234B1	Failure to inspect at required frequency on class 4 and 5 main track and class 3 main track with regularly scheduled passenger service, exceeding 40 million gross tons annually, at least twice each calendar year, with no less than 160 days between inspect
0234B2	Failure to inspect at required frequency on class 4 and 5 main track and class 3 main track with regularly scheduled passenger service equal to or less than 40 million gross tons annually, at least once per calendar year.
0234B3	Failure to inspect at required frequency on class 3, 4, and 5 main track with exclusively passenger service, either an automated inspection or walking inspection once per calendar year.
0234B4	Failure to inspect at required frequency in accordance with paragraph (b)(1) or (b)(2) of this section because of train operation interruption.
0234C	Sections of tangent track greater than 600 feet constructed of concrete crossties, not inspected
0234D1	Automated inspection measurement system incapable of measuring and processing rail seat deterioration.
0234E	Failure of automated inspection measurement system to produce an exception report.
0234F	Failure to maintain and make available to fra a record of the inspection data and exception record for the track inspected.
0234G	Failure to maintain proper procedures for data integrity.
0234H	Failure to provide annual rail seat deterioration training.
0235A1	Failure to inspect turnouts at required frequency.
0235A2	Failure to inspect track crossings at required frequency.
0235A3	Failure to inspect lift rail assemblies or other transition devices on moveable bridges at required frequency.

0235B	Failure to operate specified switches in classes 3 through 5.
0235C	Switch, turnout, track crossing or transition device used less than once a month and not inspected on foot before use
0235C1	Track used less than once a month not inspected on foot before use
0237A	Failure to inspect rail for internal defects at required frequency.
0237B	Failure of equipment to inspect rail at joints.
0237C	Defective rail not marked properly.
0237E	Improper action taken after expiration limits of previous internal rail defect search.
0239A	Failure to conduct special inspections when required.
0241A	Failure to keep records as required.
0241B1	Failure of inspector to complete report the day of the inspection.
0241B2	Failure of inspector to sign report.
0241B3	Failure to indicate the nature of deviation.
0241B4	Failure of inspector to provide required information.
0241B5	Failure to record required periodic or follow-up cwr joint inspection
0241C	Failure of rail inspection record to provide required information.
0241D	Failure to make records available for copying and inspection.
0241E1	Electronic system does not maintain the integrity of each record.
0241E2	Electronic storage not initiated within 24 hours.
0241E3	Electronic system allows record or amendments to be modified.

0241E4	Electronic amendments not stored separately from record.
0241E4i	Person making electronic amendment not identified.
0241E5	Electronic system corrupts or losses data.
0241E6	Paper copies of records not made available for inspection and copying.
0241E7	Inspection reports not available to inspector or subsequent inspectors.

Appendix C – Rail Mill Branding and Key Dimensions

Weight	Type	Rail Mill/Branding Designations														
		U.S. Steel	Bethlehem	Illinois	Old Illinois	Carnegie	Tennessee	Lackawanna	Midvale	Colorado	Inland	Cambria	MD/PA	Dominion	Algoma	Sydney
70	ARA-A			7020		7020	7020	7031								
70	ARA-B		174	7030		7030	7030	7032								
70	ASCE	7040	70AS	7040	7010	7040	7040	700	532	701			237			
70	Bangor Aroostook		70-BA					703					97			
70	Chicago & Alton				7002											
70	Pennsylvania			7033	7005	7033	7033		504				57			
72	CP Sandberg															
72	Chicago NW	7250	72NP	7250	7201	7250	7250		581							
72	Spokane							722								
74	MD/PA												146			
75	ASCE	7540	75AS	7540	7506	7540	7540	750	529	753			214			
75	Boston & Maine		92					752					92			
75	Lackawanna		75-C					753								
75	Int. Great Northern			7551		7551	7551									
75	Miscellaneous															
75	Missouri Pacific	7550	75MP	7550	7512	7550	7550	754	528							
75	Nat. Ry. Mexico		128													
75	NYC. (Dudley)															
75	MD/PA												87			
75	Seaboard (Dudley)		75DY	7522		7522	7522						221			
75	Union Pacific		75-B	7523	7513	7523	7523			754			249			
75	Union Pacific	7524	75SP	7524		7524	7524			757						
76	MD/PA												216			
78	Great Northern				77501			775								
78	Old Colony		78-OC										98			
79	MD/PA												76			
80	Frictionless		79.5-C													
80	ARA-A	8020	80-RA	8020		8020	8020	8031		801						
80	ARA-B	8030	80-RB	8030		8030	8030	8032	569	802						
80	ASCE	8040	80AS	8040		8040	8040	800	530	800	8040		251			
80	Canadian Northern		804	8010		8010	8010	804								
80	DUDLEY	8022	80DY	8022		8022	8022						220			

Weight	Type	Rail Mill/Branding Designations														
		U.S. Steel	Bethlehem	Illinois	Old Illinois	Carnegie	Tennessee	Lackawanna	Midvale	Colorado	Inland	Cambria	MD/PA	Dominion	Algoma	Sydney
80	Frictionless		80-MC-F													
80	Great Northern				8009			802								
80	Hocking Valley								540							
80	New York Central		220	8022	8008	8022	8022	801	543							
85	Asce	8540	85AS	8540	8504	8540	8540	850	531	851	8540		235			
85	C.B. & Q.	8543	85-CB	8543	8506	8543	8543	855		852						
85	Canadian Pacific	8524	85CP	8524		8524	8524	856			8524			8501	113	
85	Head Free – CP													8504	137	
85	Denver & RG									850						
85	D. & R.G. / C & S									853						
85	Great Northern		854	8553	8509	8553	8553	854								
85	Missouri Pacific	8550	853	8550	8507	8550	8550									
85	N.Y.C. & Stl. / Kcs		85-NK	8521		8521	8521	8531			8521					
85	Pennsylvania	8531	85PS	8531	8530	8531	8531	8530	559		8531					
85	Pennsylvania		85-PR	8533	8503	8533	8533	852	500				67			
85	Seaboard (Dudley)		85DY	8522		8522	8522	851					261			
85	Soo Line	8520		8520		8520	8520									
85	Western Pacific															
90	ARA-A	9020	90RA	9020		9020	9020	9031	563	902	9020					
90	ARA-B	9030	90RB	9030		9030	9030	9032	561	905	9030					
90	ASCE	9040	90AS	9040	9002	9040	9040	900	535		9040		245			
90	A.T. & SF	9021	90SF	9021		9021	9021	9033		903	9021					
90	Chicago NW	9035	90OM	9035		9035	9035	904								
90	Denver Rio Grande									906						
90	Frictionless			9039		9039	9039									
90	Frictionless			9029		9029	9029									
90	Great Northern	9024	90GH	9024		9024	9024			908	9024					
90	Great Northern			9036		9036										
90	Great Northern		90-GN	9034	9010	9034	9034	9030	560	904						
90	Head Free - R.A.	9027	90RA-T	9027		9027	9027			TC1013						
90	Interborough R. T.	9050	90RT	9050		9050	9050	902					77			
90	Lehigh Valley															
90	N.Y.C. (Dudley)		90DY					901								
90	Union Pacific	9023		9023	9003	9023	9023			901						

Weight	Type	Rail Mill/Branding Designations														
		U.S. Steel	Bethlehem	Illinois	Old Illinois	Carnegie	Tennessee	Lackawanna	Midvale	Colorado	Inland	Cambria	MD/PA	Dominion	Algoma	Sydney
91	Lackawanna		91- DL	9133		9133	9133	911								
92	Frictionless		304													
93	Frictionless		93-NH-F					932								
95	ASCE							950					267			
95	Boston & Albany															
95	W & H Ry. (Dudley)		95-DY					951								
97	Frictionless		97-CO-F													
98	Frictionless		98-PS-F													
100	ARA-A	10020	100RA	10020		10020	10020	10031	565	1003	10020					
100	ARA-B	10030	100RB	10030		10030	10030	10032	564	1002	10030					
100	AREA	10025	100RE	10025		10025	10025			10025	10025					
100	ASCED	10040	100 AS	10040	10001	10040	10040	1000	536				247			
100	Canadian Pacific															100CP-RE
100	Chicago NW	10035	100-OM	10035		10035	10035	1006			10035					
100	Elgin Joliet & East.			10050		10050	10050									
100	Great Northern	10036	100GN	10036		10036	10036	1008								
100	Head Free - R.A.		100RA-T											10004	136	
100	Head Free - R.E.		100RE-T													
100	Interborough R. T.	10005	100RT	10005		10005	10005	1005								
100	N.Y., N.H. & H.	10034	100NH	10034	10004	10034	10034	1002					100			
100	New York Central		100-DY	10022	10003	10022	10022	1001								
100	Pennsylvania	10031	100PS	10031		10031	10031	10030	558		10031					
100	Pennsylvania	10033	100PR	10033	10002	10033	10033	1003	520				96			
100	Reading	10032	100RG	10032		10032	10032	1007								
100	R.W. Hunt.															
101	Lackawanna	10133	101DL	10133		10133	10133	10130								
105	Lackawanna	10533	105DL	10533		10533	10533	1052								
105	Dudley	10524	105DY	10524		10524	10524				10524					
105	New York Central		105-B	10522		10522	10522	1051								
106	Miscellaneous.									1060						
107	N.Y., N.H. & H.	10734	107NH	10734		10734	10734	1072								
110	AREA	11025	110RE	11025		11025	11025			1100	11025					
110	ASCE												268			
110	C.T.A.	11050														

Weight	Type	Rail Mill/Branding Designations														
		U.S. Steel	Bethlehem	Illinois	Old Illinois	Carnegie	Tennessee	Lackawanna	Midvale	Colorado	Inland	Cambria	MD/PA	Dominion	Algoma	Sydney
110	Great Northern	11036	110GN	11036		11036	11036				11036					
110	Head Free - AREA	11027	110RE-T	11027		11027	11027				11027					
110	Lehigh Valley	11033	110LV	11033		11033	11033									
112	AREA	11228	112RE	11228		11228	11228			1121	11228					
112	Head Free – R.E.	11227	112RE-T	11227		11227	11227				11227HF					
112	CB & Q – TR	11229		11229		11229	11229			1122						
113	Head Free – SP	11327	113RE-T	11327		11327	11327			1130						
115	AREA	11525	115RE	11525		11525	11525			1150	11525					
115	D.R.G.W.									1155						
115	Dudley	11522/23	115DY	11523		11523	11523									
115	Miscellaneous.															
118	Lackawanna		118DL-M													
119	Area	11937								1190	11937					
120	Area			12025		12025	12025									
120	Mfg. Std.		120-MS													
120	New York Central		120-DY					1201								
122	CB (B&O)		122-CB													
125	Pennsylvania		308	12531		12531	12531	12530	584							
126	Frictionless		125.5-PSF													
127	Dudley	12723	127DYM								12723					
127	New York Central		127-DY	12722		12722	12722				12722					
129	CB & Q – TR	12929		12929		12929	12929				12929					
130	AREA	13025	130RE	13025		13025	13025			1300	13025					
130	Head Free – P.S.		130PS-T													
130	Head Free – R.E.	13027	130RE-T	13027		13027	13027				13027			13001	138	
130	Phil. & Reading		130RG													
130	Pennsylvania	13031	130PS	13031		13031	13031	13030	589	1302	13031					
131	Area	13128	131RE	13128		13128	13128			1311	13128					
131	Head Free – R.E.	13127														
132	Area	13225	132RE	13225		13225	13225			1321	13225					
132	Head Free – S.P.	13227	132RE-T	13227		13227	13227			1320						
133	Area	13331	133RE	13331		13331	13331			1330	13331					
135	Central of NJ		135CR													
136	AREA	13637	136RE							1360						

Weight	Type	Rail Mill/Branding Designations														
		U.S. Steel	Bethlehem	Illinois	Old Illinois	Carnegie	Tennessee	Lackawanna	Midvale	Colorado	Inland	Cambria	MD/PA	Dominion	Algoma	Sydney
136	Lehigh Valley	13633	136LV	13633		13633	13633									
136	Lehigh Valley		136-LV													
136	Lehigh Valley		136-LV-M													
136	New York Central		136NYC													
140	AREA/PS	14031	140RE	14031		14031	14031									
141	AREA		141RE													
152	Pennsylvania	15222	152PS	15224		15224	15224									
155	Pennsylvania	15531	155PS	15531		15531	15531									

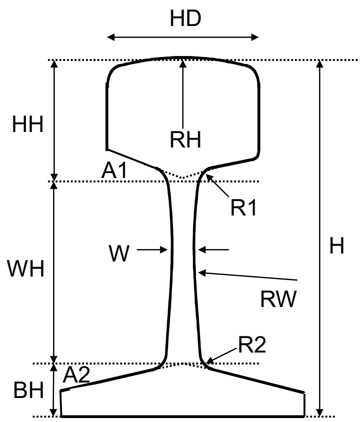
		Key Rail Dimensions											
		Rail Height	Head Width	Web Thickness	Head Height	Web Height Fishing	Base Height	Head Radius	Web Radius	Top Fillet Radius	Bottom Fillet Radius	Head Bottom Angle	Base Angle
Weight	Type	H	HD	W	HH	WH	BH	RH	RW	R1	R2	A1	A2
70	ARA-A	4 ¾	2 3/8	1/2	1 11/32	2 1/2	29/32	14	14	0.375	0.375	1 to 4	1 to 4
70	ARA-B	4 35/64	2 3/8	33/64	1 23/64	2 17/64	59/64	12	12	0.3125	0.3125	13 deg.	13 deg.
70	ASCE	4 5/8	2 7/16	33/64	1 11/32	2 15/32	13/16	12	12	0.25	0.25	13 deg.	13 deg.
70	Bangor Aroostook	4 ¾	2 7/16	1/2	1 13/32	2 19/32	3/4	12	12	0.25	0.25	12 deg.	12 deg.
70	Chicago & Alton	4 3/8	2 23/64	35/64	1 45/64	1 59/64	3/4					12 deg.	12 deg.
70	Pennsylvania	4 ½	2 7/16	1/2	1 19/32	2 1/8	25/32	10	8	0.25	0.25	13 deg.	13 deg.
72	CP (Sandberg)	4 15/16	2 1/4	1/2	1 5/8	2 25/64	59/64	6	VERT.	0.375	0.375	15 deg.	15 deg.
72	Chicago NW	4 ¾	2 3/8	9/16	1 13/32	2 1/2	27/32					14 deg.	14 deg.
72	Spokane Int'l. Ry.	4 45/64	2 7/16	33/64	1 27/64	2 15/32	13/16	12	12	0.25	0.25	13 deg.	13 deg.
74	MD/PA	4 11/16	2 7/16	9/16	1 3/4	2 3/16	3/4	15	15	0.3125	0.3125	17 deg.	13 deg.
75	ASCE	4 13/16	2 15/32	17/32	1 27/64	2 35/64	27/32	12	12	0.25	0.25	13 deg.	13 deg.
75	Boston & Maine	5	2 1/2	9/16	1 7/16	2 47/64	53/64	12	STR.	0.25	0.25	13 deg.	13 deg.
75	Lackawanna	4 11/16	2 1/2	1/2	1 43/64	2 13/64	13/16	10.5	10	0.3125	0.3125	18 deg.	12° 45'
75	Int. & Grt. Nor	4 ¾	2 1/2	9/16	1 7/16	2 15/32	27/32					13 deg.	13 deg.
75	Miscellaneous	4 ¾	2 1/2	1/2	1 27/32	2 1/8	25/32					13 deg.	13 deg.
75	Missouri Pacific	4 ¾	2 9/16	9/16	1 7/16	2 15/32	27/32	12	30	0.25	0.25	13 deg.	13 deg.
75	Nat. Ry. Mex.	5	2 3/4	1/2	1 3/8	2 7/8	3/4					12 deg.	12 deg.
75	N.Y.C. (Dudley)	5	2 5/8	17/32	1 3/8	2 3/4	7/8	14	14	0.5	0.3125	14 deg.	14 deg.
75	MD/PA	4 3/4	2 1/2	9/16	1 1/2	2 7/16	13/16	12	VERT.	0.25	0.25	13 deg.	13 deg.
75	Seaboard (Dudley)	5	2 9/16	1/2	1 3/8	2 3/4	7/8	14	14	0.5	0.3125	14 deg.	14 deg.
75	Union Pacific	5	2 9/16	33/64	1 3/8	2 13/16	13/16	12	12	0.25	0.25	13 deg.	13 deg.
75	Union Pacific	4 15/16	2 7/16	33/64	1 3/8	2 5/8	15/16	14	14	0.375	0.375	1 to 4	1 to 4
76	MD/PA	4 3/4	2 1/2	1/2	1 11/16	2 1/4	13/16	20	VERT.	0.3125	0.3125	14° 30'	12 deg.
78	Great Northern	5	2 3/8	5/8	1 11/16	2 1/2	13/16					14 deg.	14 deg.
78	Old Colony	4 3/4	2 1/2	17/32	1 3/4	2 7/32	25/32	12	12	0.4375	0.4375	14 deg.	12° 15'
79	MD/PA	4 3/4	2 5/8	5/8	1 5/8	2 11/32	25/32	12	9	0.25	0.25	13 deg.	13 deg.
80	Frictionless	5 3/16	1 15/16	9/16	2 1/32	2 9/32	7/8					13 deg.	13 deg.
80	ARA-A	5 1/8	2 1/2	33/64	1 7/16	2 23/32	31/32	14	14	0.375	0.375	1 to 4	1 to 4
80	ARA-B	4 15/16	2 7/16	35/64	1 15/32	2 15/32	1	12	12	0.3125	0.3125	13 deg.	13 deg.
80	ASCE	5	2 1/2	35/64	1 1/2	2 5/8	7/8	12	12	0.25	0.25	13 deg.	13 deg.
80	Canadian Northern	5	2 9/16	35/64	1 13/32	2 11/16	29/32					13 deg.	13 deg.
80	Dudley	5 1/8	2 21/32	17/32	1 1/2	2 3/4	7/8	14	14	0.5	0.3125	1 to 4	1 to 4
80	Frictionless	5 3/16	1 15/16	9/16	2 1/32	2 9/32	7/8					13 deg.	13 deg.
80	Great Northern	5	2 13/32	5/8	1 5/8	2 1/2	7/8					14 deg.	14 deg.
80	Hocking Valley	5	2 31/64	29/64	1 3/4	2 25/64	7/8					13 deg.	13 deg.

		Key Rail Dimensions											
		Rail Height	Head Width	Web Thickness	Head Height	Web Height Fishing	Base Height	Head Radius	Web Radius	Top Fillet Radius	Bottom Fillet Radius	Head Bottom Angle	Base Angle
Weight	Type	H	HD	W	HH	WH	BH	RH	RW	R1	R2	A1	A2
80	New York Central	5 1/8	2 21/32	17/32	1 1/2	2 3/4	7/8	14	14	0.5	0.3125	1 to 4	1 to 4
85	ASCE	5 3/16	2 9/16	9/16	1 35/64	2 3/4	57/64	12	12	0.25	0.25	13 deg.	13 deg.
85	C.B. & Q.	5 3/16	2 21/32	9/16	1 35/64	2 3/4	57/64					13 deg.	13 deg.
85	Canadian Pacific	5 1/8	2 1/2	9/16	1 7/16	2 11/16	1	8	8	0.375	0.375	1 to 4	1 to 4
85	Head Free – CP	5 1/4	2 29/64	9/16	1 9/16	2 11/16	1	8	8	0.375	0.375	1 to 4	1 to 4
85	Denver & RG	5 1/4	2 1/2	9/16	1 3/4	2 5/8	7/8					13 deg.	13 deg.
85	D. & R.G. / C & S	5 3/8	2 1/2	9/16	1 15/32	2 29/32	1					1 to 4	1 to 4
85	Great Northern	5	2 21/32	21/32	1 19/32	2 1/2	29/32					14 deg.	14 deg.
85	Missouri Pacific	5 7/32	2 15/32	19/32	1 3/4	2 39/64	55/64					13 deg.	13 deg.
85	N.Y.C. & Stl. / Kcs	5 3/8	2 17/32	17/32	1 29/64	2 15/16	63/64	14	14	0.375	0.375	1 to 4	1 to 4
85	Pennsylvania	5 1/8	2 1/2	17/32	1 21/32	2 15/32	1	10	10	0.25	0.25	15 deg.	13 deg.
85	Pennsylvania	5	2 9/16	17/32	1 3/4	2 3/8	7/8	10	8	0.25	0.25	13 deg.	13 deg.
85	Seaboard (Dudley)	5 1/4	2 11/16	17/32	1 5/8	2 3/4	7/8	14	14	0.5	0.3125	1 to 4	1 to 4
85	Soo Line	5 3/8	2 1/2	9/16	1 15/32	2 29/32	1					14° 2' 11"	14° 2' 11"
85	Western Pacific	5 1/4	2 1/2	9/16	1 3/4	2 5/8	7/8	10	VERT.	0.3125	0.3125	13 deg.	13 deg.
90	ARA-A	5 5/8	2 9/16	9/16	1 15/32	3 5/32	1	14	14	0.375	0.375	1 to 4	1 to 4
90	ARA-B	5 17/64	2 9/16	9/16	1 39/64	2 5/8	1 1/32	12	12	0.3125	0.3125	13 deg.	13 deg.
90	ASCE	5 3/8	2 5/8	9/16	1 19/32	2 55/64	59/64	12	12	0.25	0.25	13 deg.	13 deg.
90	AT & SF	5 5/8	2 9/16	9/16	1 15/32	3 5/32	1					1 to 4	1 to 4
90	Chicago NW	5 17/32	2 1/2	1/2	1 17/32	2 31/32	1 1/32	12	12	0.3125	0.3125	13 deg.	13 deg.
90	Denver & RG	5 1/2	2 9/16	9/16	1 5/8	2 7/8	1					14 deg.	14 deg.
90	Frictionless	5 5/8	2 1/4	9/16	2	2 5/8	1					13 deg.	13 deg.
90	Frictionless	6 3/32	1 59/64	9/16	1 15/16	3 5/32	1					1 to 4	1 to 4
90	Great Northern	5 3/8	2 5/8	9/16	1 15/32	2 7/8	1 1/32	12	14	0.4375	0.625	13 deg.	13 deg.
90	Great Northern	5 3/8	2 5/8	19/32	1 15/32	2 7/8	1 1/32					13 deg.	13 deg.
90	Great Northern	5 3/8	2 5/8	5/8	1 1/2	2 7/8	1	14	14	0.375	0.375	13 deg.	13 deg.
90	Head Free - R.A.	5 25/32	2 31/64	9/16	1 5/8	3 5/32	1	14	14	0.375		1 to 4; U = 54°	1 to 4
90	Interborough R.T.	5	2 7/8	11/16	1 25/32	2 11/32	7/8	12	9	0.25	0.25	13 deg.	13 deg.
90	Lehigh Valley	5	2 3/4	5/8	1 53/64	2 15/64	15/16	12	9	0.25	0.25	14 deg.	14 deg.
90	N.Y.C. (Dudley)	5 1/2	2 21/32	9/16	1 1/2	3 1/32	31/32	14	14	0.5	1	1 to 4	1 to 4
90	Union Pacific	5 3/4	2 3/4	17/32	1 1/2	3 3/8	7/8					13 deg.	13 deg.
91	Lackawanna	5 1/4	2 5/8	5/8	1 41/64	2 11/16	59/64	10	8	0.25	0.25	13 deg.	13 deg.
92	Frictionless	5 7/16	1 15/16	5/8	2 3/32	2 5/16	1 1/32					13 deg.	13 deg.
93	Frictionless	6 1/8	2 1/8	19/32	1 13/16	3 3/8	15/16					13 deg.	13 deg.
95	ASCE	5 9/16	2 11/16	9/16	1 41/64	2 63/64	15/16	12	12	0.25	0.25	13 deg.	13 deg.

		Key Rail Dimensions											
		Rail Height	Head Width	Web Thickness	Head Height	Web Height Fishing	Base Height	Head Radius	Web Radius	Top Fillet Radius	Bottom Fillet Radius	Head Bottom Angle	Base Angle
Weight	Type	H	HD	W	HH	WH	BH	RH	RW	R1	R2	A1	A2
95	Boston & Albany	5 1/32	3	5/8	1 9/16	2 15/32	1	14	14	0.5	0.3125	14 deg.	14 deg.
95	W & H Ry. (Dudley)	5 1/32	3	5/8	1 9/16	2 15/32	1	14	14	0.5	0.3125	1 to 4	1 to 4
97	Frictionless	5 7/8	2 1/4	9/16	1 15/16	2 55/64	1 5/64					13 deg.	13 deg.
98	Frictionless	5 27/32	2 1/2	9/16	1 31/32	2 25/32	1 3/32					15 deg.	13 deg.
100	ARA-A	6	2 3/4	9/16	1 9/16	3 3/8	1 1/16	14	14	0.375	0.375	1 to 4	1 to 4
100	ARA-B	5 41/64	2 21/32	9/16	1 45/64	2 55/64	1 5/64	12	12	0.3125	0.3125	13 deg.	13 deg.
100	AREA	6	2 11/16	9/16	1 21/32	3 9/32	1 1/16	14	14	0.375	0.625	1 to 4	1 to 4
100	ASCE	5 3/4	2 3/4	9/16	1 45/64	3 5/64	31/32	12	12	0.25	0.25	13 deg.	13 deg.
100	Canadian Pacific	6 1/16	2 11/16	9/16	1 23/32	3 9/32	1 1/16	14	14	0.375	0.625	1 to 4	1 to 4
100	Chicago NW	5 45/64	2 9/16	9/16	1 39/64	2 61/64	1 9/64	12	12	0.3125	0.3125	13 deg.	13 deg.
100	Elgin Joliet & East.	5 9/16	2 21/32	9/16	1 37/64	2 51/64	1 3/16					1 to 4	1 to 4
100	Great Northern	5 3/4	2 3/4	9/16	1 5/8	3	1 1/8					1 to 4	1 to 4
100	Head Free - R.A.	6 5/32	2 11/16	9/16	1 23/32	3 3/8	1 1/16	14	14	0.375		1 to 4; U = 49°	1 to 4
100	Head Free - R.E.	6 1/16	2 39/64	9/16	1 23/32	3 9/32	1 1/16					1 to 4; U = 57°	1 to 4
100	Interborough R. T.	5 3/4	2 7/8	9/16	1 45/64	3 5/64	31/32	12	12	0.25	0.25	13 deg.	13 deg.
100	N.Y., N.H. & H.	6	2 3/4	19/32	1 23/32	3 11/32	15/16	12	12	0.25	0.25	13 deg.	13 deg.
100	New York Central	6	3	19/32	1 5/8	3 13/32	31/32	14	14	0.5	0.3125	1 to 4	1 to 4
100	Pennsylvania	5 11/16	2 43/64	9/16	1 13/16	2 25/32	1 3/32	10	10	0.3125	0.3125	15 deg.	13 deg.
100	Pennsylvania	5 1/2	2 13/16	5/8	1 7/8	2 11/16	15/16	10	8	0.25	0.25	13 deg.	13 deg.
100	Reading	5 5/8	2 21/32	9/16	1 45/64	2 55/64	1 1/16	12	12	0.3125	0.3125	13 deg.	13 deg.
100	R.W. Hunt.	6	2 9/16	9/16	1 19/32	3 21/64	1 5/64	12	12	0.375	0.375	14 deg.	14 deg.
101	Lackawanna	5 7/16	2 3/4	5/8	1 23/32	2 11/16	1 1/32	10	8	0.25	0.25	13 deg.	13 deg.
105	Lackawanna	6	2 3/4	5/8	1 23/32	3 1/4	1 1/32	10	8	0.25	0.25	13 deg.	13 deg.
105	Dudley	6	3	5/8	1 5/8	3 13/32	31/32	14	14	0.5	0.75	1 to 4	1 to 4
105	New York Central	6	3	5/8	1 5/8	3 13/32	31/32	14	14	0.5	1	1 to 4	1 to 4
106	Misc.	6 3/16	2 21/32	19/32	1 3/4	3 3/8	1 1/16					1 to 4	1 to 4
107	N.Y., N.H. & H.	6 1/8	2 3/4	19/32	1 23/32	3 11/32	1 1/16	12	12	0.25	0.25	13 deg.	13 deg.
110	AREA	6 1/4	2 25/32	19/32	1 23/32	3 13/32	1 1/8	14	14	0.375	0.625	1 to 4	1 to 4
110	ASCE	6 1/8	2 7/8	37/64	1 25/32	3 11/32	1	12	12	0.25	0.25	13 deg.	13 deg.
110	C.T.A.	7	2 3/4	9/16	1 7/8	4 5/16	13/16					14 deg.	9 deg.
110	Great Northern	6 1/2	2 3/4	19/32	1 5/8	3 3/4	1 1/8	14	14	0.5	0.625	1 to 4	1 to 4
110	Head Free - AREA	6 7/16	2 11/16	19/32	1 29/32	3 13/32	1 1/8	14	14	0.375		1 to 4; U = 55° 30'	1 to 4
110	Lehigh Valley	6	2 7/8	19/32	1 7/8	3 1/16	1 1/16					1 to 4	1 to 4
112	AREA	6 5/8	2 23/32	19/32	1 11/16	3 13/16	1 1/8	24	10 & 23	0.375	0.625	1 to 4	1 to 4
112	Head Free - R.E.	6 3/4	2 11/16	19/32	1 13/16	3 13/16	1 1/8	14	10 & 23	0.375		1 to 4; U = 58°	1 to 4

		Key Rail Dimensions											
		Rail Height	Head Width	Web Thickness	Head Height	Web Height Fishing	Base Height	Head Radius	Web Radius	Top Fillet Radius	Bottom Fillet Radius	Head Bottom Angle	Base Angle
Weight	Type	H	HD	W	HH	WH	BH	RH	RW	R1	R2	A1	A2
112	CB & Q – TR	6 3/4	2 1/2	5/8	1 3/4	3 7/8	1 1/8					1 to 4; U = 77° 45'	1 to 4
113	Head Free – SP	6 13/16	2 11/16	19/32	1 7/8	3 13/16	1 1/8	14	10 & 23	0.375		1 to 4; U = 58°	1 to 4
115	AREA	6 5/8	2 23/32	5/8	1 11/16	3 13/16	1 1/8	10	3 & 14	0.75	0.75	1 to 4	1 to 4
115	D.R.G.W.	6 5/8	2 23/32	3/4	1 11/16	3 13/16	1 1/8					13 deg.	13 deg.
115	Dudley	6 1/2	3	5/8	1 11/16	3 3/4	1 1/16	14	14	0.5	0.75	1 to 4	1 to 4
115	Miscellaneous	6	2 15/16	21/32	1 7/8	3 1/16	1 1/16					1 to 4	1 to 4
118	Lackawanna	6 1/2	2 7/8	5/8	1 29/32	3 1/2	1 3/32					13 deg.	13 deg.
119	AREA	6 13/16	2 21/32	5/8	1 7/8	3 13/16	1 1/8	14	3 & 14	0.75	0.75	1 to 4	1 to 4
120	AREA	6 1/2	2 7/8	5/8	1 25/32	3 17/32	1 3/16					1 to 4	1 to 4
120	Mfg. Std.	6 1/4	2 7/8	5/8	1 29/32	3 5/32	1 3/16	12	12	0.375	0.375	14 deg.	14 deg.
120	New York Central	7	3	21/32	1 5/8	4 5/16	1 1/16	14	20	0.5	1	1 to 4	1 to 4
122	CB (B&O)	6 25/32	2 15/16	21/32	1 15/16	3 39/64	1 15/64	10	3 & 14	0.75	0.75	1 to 2 3/4	1 to 2 3/4, 1 to 13.7
125	Pennsylvania	6 1/2	3	21/32	1 7/8	3 13/32	1 7/32	12	16	0.5	0.75	18 deg.	14 deg.
126	Frictionless	7	1 13/16	11/16	2 3/8	3 13/32	1 7/32					18 deg.	14 deg.
127	Dudley	7	3	21/32	1 11/16	4 5/32	1 5/32					1 to 4	1 to 4
127	New York Central	7	3	21/32	1 11/16	4 5/32	1 5/32	14	18	0.5	0.75	1 to 4	1 to 4
129	CB & Q – TR	7 5/16	2 5/8	21/32	1 27/32	4 9/32	1 3/16					1 to 4	1 to 4
130	AREA	6 3/4	2 15/16	21/32	1 27/32	3 11/16	1 7/32	14	14	0.5	0.75	1 to 4	1 to 4
130	Head Free - P.S.	6 13/16	3	21/32	2 3/16	3 3/8	1 7/32					18°; U = 58° 30'	14 deg.
130	Head Free - R.E.	6 13/16	2 27/32	21/32	2 1/32	3 11/16	1 7/32	14	14	0.5		1 to 4; U = 61°	1 to 4
130	Phil. & Reading	6 27/32	2 15/16	21/32	1 15/16	3 11/16	1 7/32					1 to 4	1 to 4
130	Pennsylvania	6 5/8	3	11/16	2	3 13/32	1 7/32	12	16	0.5	0.75	18 deg.	14 deg.
131	AREA	7 1/8	3	21/32	1 3/4	4 3/16	1 3/16	24	10 & 23	0.5	0.75	1 to 4	1 to 4
131	Head Free - R.E.	7 1/4	2 31/32	21/32	1 7/8	4 3/16	1 3/16	14	10 & 23	0.5		1 to 4; U = 60° 30'	1 to 4
132	AREA	7 1/8	3	21/32	1 3/4	4 3/16	1 3/16	10	8 & 16	3/4 & 5/16	0.875	1 to 4	1 to 4
132	Head Free – S.P.	7 5/16	2 31/32	21/32	1 15/16	4 3/16	1 3/16	14	10 & 23	0.5		1 to 4; U = 60° 30'	1 to 4
133	AREA	7 1/16	3	11/16	1 15/16	3 15/16	1 3/16	10	8 & 16	3/4 & 7/16	0.75	1 to 3	1 to 4.011
135	Central of NJ	6 1/2	3 5/32	3/4	2	3 9/32	1 7/32					14 deg.	14 deg.
136	AREA	7 5/16	2 15/16	11/16	1 15/16	4 3/16	1 3/16	14	8 & 20	3/4 & 5/16	0.75	1 to 4	1 to 4
136	Lehigh Valley	7	2 15/16	21/32	1 7/8	3 7/8	1 1/4					1 to 4	1 to 4
136	Lehigh Valley	7 3/8	2 15/16	11/16	1 25/32	4 3/8	1 7/32					1 to 4	1 to 4
136	Lehigh Valley	7	2 15/16	11/16	1 7/8	3 7/8	1 1/4					1 to 4	1 to 4
136	New York Central	7 9/32	2 15/16	11/16	1 7/8	4 5/32							
140	AREA/PS	7 5/16	3	3/4	2 1/16	4 1/16	1 3/16	10	8 & 27	3/4 & 7/16	0.75	1 to 3	1 to 4
141	AREA	7 7/16	3 1/16	11/16	2 5/32	4 3/32	1 3/16		19 31/32	¾	3/4	18.4 deg.	14 deg.

		Key Rail Dimensions											
		Rail Height	Head Width	Web Thickness	Head Height	Web Height Fishing	Base Height	Head Radius	Web Radius	Top Fillet Radius	Bottom Fillet Radius	Head Bottom Angle	Base Angle
Weight	Type	H	HD	W	HH	WH	BH	RH	RW	R1	R2	A1	A2
152	Pennsylvania	8	3	11/16	1 27/32	4 7/8	1 9/32	24	6&30	0.5	0.75	14 deg.	14 deg.
155	Pennsylvania	8	3	3/4	2 1/16	4 21/32	1 9/32					18° 26' 10"	14 deg.



Appendix D – Use of portable track-loading fixture (PTLF) in non-GRMS territory

Note – The use of the PTLF for compliance purposes outside GRMS territory has been temporality suspended.

Appendix E – CWR Joint Bar Fracture Report

(For Reference Purposes Only – Please use the official form available at: http://safetydata.fra.dot.gov/CWR/.)

CWR JOINT BAR FRACTURE REPORT	***TYPE OF INSPECTION*** ☐ PERIODIC JOINT INSPECTION (213.119[h][6][i]) ☐ TRACK INSPECTION (213.233) ☐ TURNOUT INSPECTION (213.235) ☐ OTHER (discovered during other than required inspection)

RAILROAD:	SUBDIVISION:		MILEPOST:
DATE FOUND: ____/____ 20____	ANNUAL MGT:	TRACK #:	TRACK CLASS:

☐ TANGENT	☐ CURVE ____ degrees ☐ IN SPIRAL	☐ LOW/INNER RAIL ☐ HIGH/OUTER RAIL	RAIL SECTION(S):______ / ______

ANNUAL JOINT INSPECTION FREQUENCY FOR THIS SEGMENT ☐ 1x ☐ 2x ☐ 3x ☐ 4x ☐ OTHER: ____________	DATE OF LAST JOINT INSPECTION: ____/____/20____

BAR TYPE (check all that apply)	☐ STANDARD ☐ INSULATED ☐ COMPROMISE NUMBER OF HOLES: ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8

FIELD SIDE BAR	***GAGE SIDE BAR***
BROKEN THROUGH Check location of break: ☐ CENTER ☐ INNER BOLT HOLE ☐ OTHER	**BROKEN THROUGH** Check location of break: ☐ CENTER ☐ INNER BOLT HOLE ☐ OTHER
CRACKED Check location(s) and record length(s): ☐ TOP CENTER ________ inches ☐ BOTTOM CENTER ________ inches ☐ INNER BOLT HOLE ________ inches ☐ OTHER BOLT HOLE ________ inches ☐ OTHER (describe) ________ inches	**CRACKED** Check location(s) and record length(s): ☐ TOP CENTER ________ inches ☐ BOTTOM CENTER ________ inches ☐ INNER BOLT HOLE ________ inches ☐ OTHER BOLT HOLE ________ inches ☐ OTHER (describe) ________ inches

GAP BETWEEN RAIL ENDS _______ INCHES
RAIL END BATTER OR RAMP (Figures 1 and 2)
☐ NORTH or ☐ EAST RAIL END _______ INCHES HIGH _______ INCHES LONG
☐ SOUTH or ☐ WEST RAIL END _______ INCHES HIGH _______ INCHES LONG
TREAD MISMATCH _______ INCHES (Figure 3)
JOINT VERTICAL MOVEMENT _______ INCHES

<u>IF JOINT IN CURVE or SPIRAL:</u>
GAGE RAMP (Figure 4) _______ INCHES OUT _______ INCHES LONG
GAGE MISMATCH (Figure 5) _______ INCHES
JOINT LATERAL MOVEMENT _______ INCHES

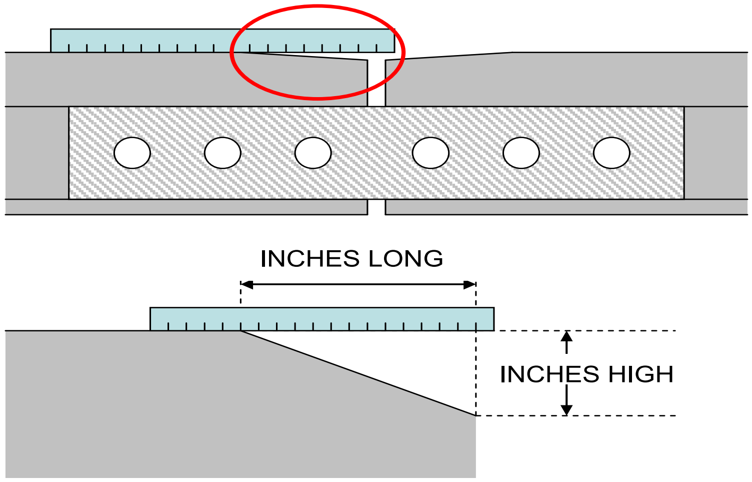
OTHER COMMENTS:

FRACTURE REPORT INSTRUCTIONS

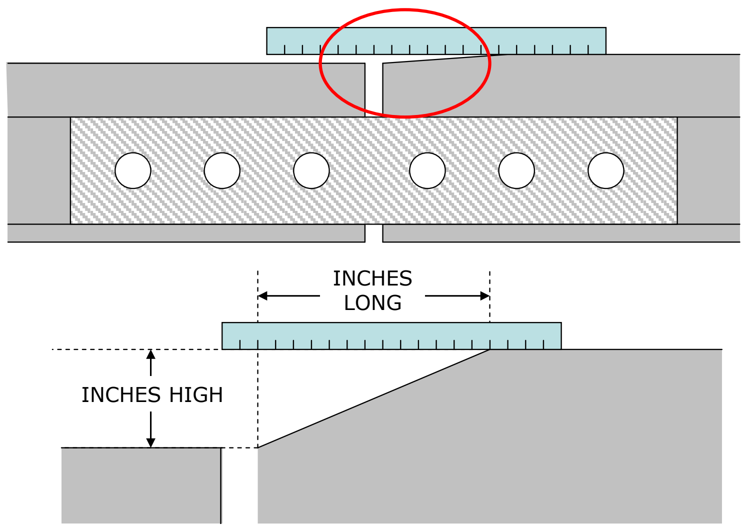
TYPE OF INSPECTION – Indicate the type of inspection being performed when fracture was found. At least one (1) box in group must be checked.
RAILROAD – FRA railroad reporting code, (*e.g.* CSX or NS). Four (4) character alpha.
SUBDIVISION – Railroad's subdivision or district. If none enter "system". Fourteen (14) character alphanumeric.[2]
MILEPOST – Railroad's designated milepost at the location of the fracture. 7.2 character alphanumeric, *e.g.*, ABC1234.56.[1]
DATE FOUND – Date the fracture was found. Eight (8) character numeric, MMDDYYYY.
ANNUAL MGT – Million Gross Tons (from previous year) for the specific track with the fracture. 4.1 numeric, *e.g.*, 123.4 (allowable range 0 to 999.9 inclusive).
TRACK CLASS – FRA Class for track with the fracture. One (1) character numeric, *e.g.*, 3 (allowable range 2 - 6 inclusive).
TANGENT/CURVE/SPIRAL/INNER/OUTER – Indicate whether fracture found on tangent, curve (include degree of curvature) or spiral and if inner or outer rail, if applicable. If tangent, check TANGENT. Otherwise check CURVE or SPIRAL and INNER or OUTER. If curve checked, curvature entered as 2.1 numeric, *e.g.* 2.5.
RAIL SECTION – Indicate each rail section comprising the joint, (*e.g.* for a standard bar, enter 136 or for a compromise bar, enter 132/115).
ANNUAL JOINT INSPECTION FREQUENCY – Number of times per year that walking joint bar inspection is performed. Two (2) character numeric, *e.g.* 3 (allowable range 1 – 12 inclusive).
DATE OF LAST JOINT BAR INSPECTION – Date the last walking joint bar inspection was performed. Eight (8) character numeric, MMDDYYYY.
BAR TYPE/HOLES – Indicate bar type: standard, insulated, or compromise bar and number of holes. Two (2) boxes (one in each group) must be checked.
BROKEN THROUGH – For each bar, field and gage, check appropriate box if broken completely through and indicate the location of the break (through center, through inner bolt hole or other location). For each bar, field and gage, there is no requirement to check any box(es) – neither bar is broken through.
CRACKED – For each bar, field and gage, indicate the crack location(s) and corresponding length(s). For each bar, field and gage, any number of boxes may be checked. If box is checked, crack length is 3.1 numeric, *e.g.*, 2.5. If OTHER is checked, text description can be 64 (128) character alpha-numeric.
GAP BETWEEN RAIL ENDS – Measure and record the distance between the rail ends. If joint is pulled apart or separated, estimate the gap prior to separation. 5.2 numeric, *e.g.* 10.25.
RAIL END BATTER OR RAMP - Measure and record the ***height and length of the batter or ramp for each rail end*** and record even if found to be zero. See Figures 1 and 2 for method of measurement. Check appropriate boxes (one each of NORTH or EAST and one each of SOUTH or WEST) and enter batter ramp as four (4) 4.2 numeric, *e.g.*, 1.25.

[2] This format has been pre-established in FRA's RISPC system for its safety inspectors.

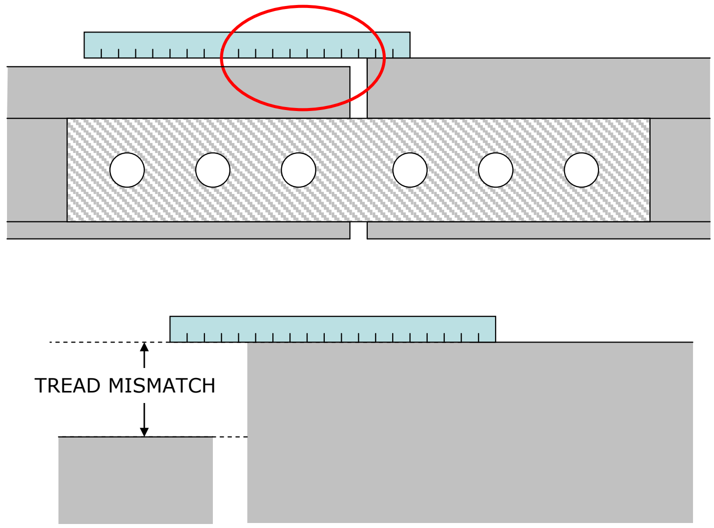
TREAD MISMATCH – Measure and record the tread mismatch. See Figure 3 for method of measurement. 4.2 numeric, *e.g.*, 1.25.
JOINT VERTICAL MOVEMENT – Record the vertical movement of the rail joint (not track surface) according to 213.13. 4.2 numeric, *e.g.*, 1.25.
GAGE RAMP – In curves only, measure and record the gage ramp distance out and length. See Figure 4 for method of measurement. Two (2) 4.2 numeric, *e.g.*, 1.25.
GAGE MISMATCH – In curves only, measure and record the gage mismatch. See Figure 5 for method of measurement. 4.2 numeric, *e.g.*, 1.25.
JOINT LATERAL MOVEMENT – In curves only, record the lateral movement of the rail joint (not gage) according to 213.13. 4.2 numeric, *e.g.*, 1.25.
OTHER COMMENTS: - Other comments, including any other factors or conditions that may have contributed to the fracture of the bar(s). 256 character alphanumeric.



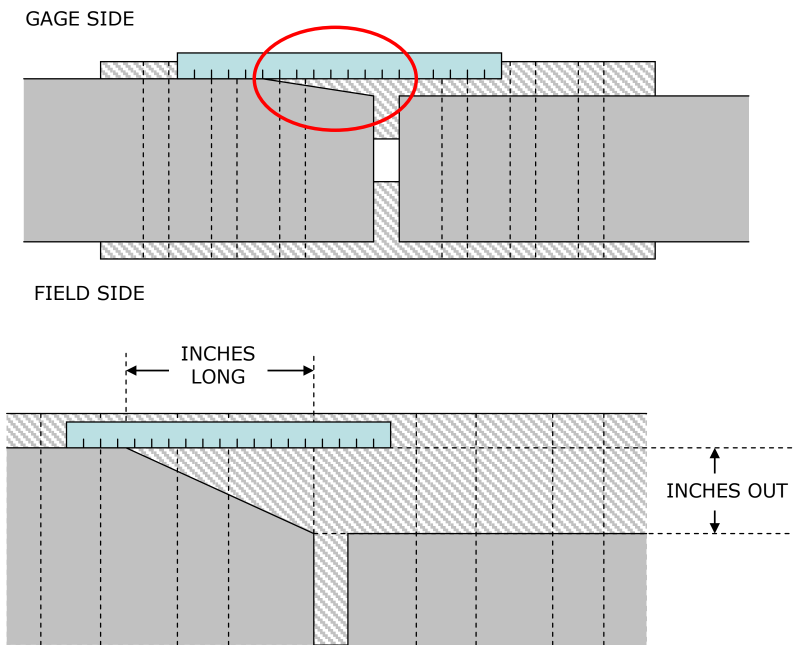
CWR Joint Bar Fracture Report - Figure 1
Method for measuring RAIL END BATTER.
Measurement to be made on each rail end.
(NOT TO SCALE)



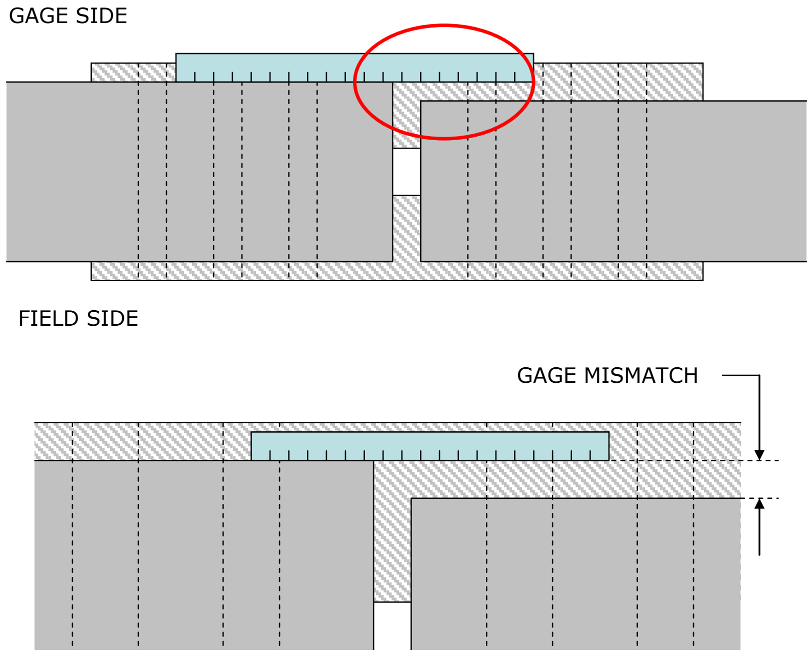
CWR Joint Bar Fracture Report - Figure 2.
Method for measuring RAIL END RAMP.
(NOT TO SCALE)



CWR Joint Bar Fracture Report - Figure 3
Method for measuring TREAD MISMATCH.
(NOT TO SCALE)



CWR Joint Bar Fracture Report - Figure 4
Method for measuring GAGE RAMP.
(NOT TO SCALE)



CWR Joint Bar Fracture Report - Figure 5.
Method for measuring GAGE MISMATCH.
(NOT TO SCALE)

Federal Railroad Administration

Track and Rail and Infrastructure Integrity Compliance Manual

Volume II Track Safety Standards
Chapter 2 Track Safety Standards
Classes 6 through 9

January 2014

Text in italic font of this manual is regulatory language, whereas indented paragraphs provide field guidance for FRA inspectors. Indented paragraphs are not to be construed as regulatory language in any manner.

CHAPTER 2
TRACK SAFETY STANDARDS CLASSES 6 THROUGH 9

Subpart G

§ 213.301 Scope of subpart

This subpart applies to all track used for the operation of trains at a speed greater than 90 mph for passenger equipment and greater than 80 mph for freight equipment.

Guidance: Subpart G applies to track required to support the passage of passenger and freight equipment in specific speed ranges higher than those permitted over Class 5 track. For those speeds above Class 5, the track and the vehicles operated on the track must be considered as an integral system. This subpart does not apply to technologies such as magnetic levitation that do not use flanged wheel equipment. Subpart G begins at a speed greater than 90 mph for qualified passenger equipment and a speed greater than 80 mph for qualified freight equipment.

The safety requirements for high-speed track classes are contained in Subpart G of the Track Safety Standards (TSS) which covers track classes 6 through 9. As are the standards for the lower track classes, the rules prescribed herein are minimum requirements for safety and the high-speed railroad is encouraged and expected to maintain higher standards.

This subpart is intended to function as “standalone” regulations governing any track belonging to one of these higher track classes. In other words, the track owner needs to refer only to Subpart G for compliance with the TSS for track over which railroads operate trains at the speeds associated with the high-speed track classes. However, if that same track does not meet the requirements in Subpart G at any time, the other subparts (A through F) apply.

These requirements constitute only one of several components comprising a regulatory program permitting trains to travel at high speeds. FRA may also address high-speed issues in regulations outside of Part 213, such as emergency preparedness, wheel conditions, braking systems, and grade crossings. The TSS are an integral part of that larger regulatory scheme.

This Subpart provides the necessary information for FRA and State personnel to properly interpret and enforce the TSS for the higher track classes. It is not to be construed as a modification, alteration, or revision of the TSS as published.

The inspector should refer to this manual as often as necessary to understand the intent of any particular standard. The requirements prescribed in this part apply to specific track and vehicle/track interaction conditions. As in the lower classes, a combination of track conditions, none of which individually amounts to a deviation from the requirements in this part, may require remedial action to provide for safe operations over that track.

The high-speed TSS is based on the fundamental principle that vehicles in the high-speed regime must demonstrate that they will not exceed minimum vehicle/track performance safety limits when operating on specified track. Specific requirements are included for the qualification of persons engaged in the inspection and maintenance of high-speed track, high-speed track geometry, track structure, and both automated and visual inspections.

The high-speed standards address conditions that exist alone and combinations of track and vehicle/track interaction, which, while individually not in violation of any standard, could nonetheless present a hazard to the safe movement of trains. As in the inspection of the lower classes, if the inspector should encounter a rare event the inspector should bring the condition to the attention of the accompanying railroad official, explain the hazard of such a condition and encourage its rapid removal. Where the inspector is unable, using professional experience, to convince the railroad to initiate some action, the inspector should apply to the regional track specialist for assistance. It is unlikely to find railroad resistance in the removal of recognized safety hazards.

§ 213.303 Responsibility for compliance

303(a) Any owner of track to which this subpart applies who knows or has notice that the track does not comply with the requirements of this subpart, shall --

(1) Bring the track into compliance; or
(2) Halt operations over that track.

Guidance: This paragraph describes the action that must be taken by the track owner once the owner knows that the track is not in compliance with the TSS. The track owner must:

(1) Bring the track into compliance by either repairing the defects or imposing an appropriate speed restriction; or

(2) Remove the track from service.

Only two response options are available under this paragraph. Track owners who know or have notice of noncompliance with this subpart may either bring the track into compliance with the subpart or halt operations over that track. This paragraph does not offer the railroad the option of operating under this subpart with the supervision of a qualified person, as in the standards for track classes 1 through 5. Such an option would permit too much potential for human error. Under this subpart, if a track does not comply with the requirements of its class, it must be repaired immediately or train speeds must be reduced to the maximum speed for the track class with which the track complies. It may be necessary on occasion for the track owner to reduce the class of track to Class 5 or below. When this occurs, the requirements for the lower classes (1–5) will apply.

303(b) If an owner of track to which this subpart applies assigns responsibility for the track to another person (by lease or otherwise), notification of the assignment shall be provided to the appropriate FRA Regional Office at least 30 days in advance of the assignment. The notification may be made by any party to that assignment, but shall be in writing and include the following --

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

(2) The name and address of the person to whom responsibility is assigned (assignee);

(3) A statement of the exact relationship between the track owner and the assignee;

(4) A precise identification of the track;

(5) A statement as to the competence and ability of the assignee to carry out the duties of the track owner under this subpart;

(6) A statement signed by the assignee acknowledging the assignment to that person of responsibility for purposes of compliance with this subpart.

Guidance: This paragraph also provides that the party responsible for compliance can be someone other than the actual owner.

This paragraph requires a track owner to notify FRA, through the appropriate regional office, when the responsibility for compliance with this part is assigned. Notification must contain the specific information required in this paragraph and shall be made 30 days prior to the assignment of the responsibility.

Inspectors must determine the responsible party when recommending civil penalties for noncompliance and alert Chief Counsel when violation reports involve parties other than the track owner.

For class specific defects, it is explicitly apparent to the track owner that they have the option of reclassifying the track to a lower class to bring the track into compliance. For example, § 213.351, Rail Joints, states that "if a joint bar is cracked, broken, or because of wear allows vertical movement of either rail when all bolts are tight, it must be replaced." Obviously, one of the remedial actions available to the carrier would be to place a speed restriction and reclassify the track to Class 1 or 2. For other defects in the standards, specific classes or remedial actions are not printed in the appropriate section.

Track owners often have questions regarding the remedial actions available when inspectors discover and record turnout defects such as missing or loose frog bolts. The carrier will not find the required remedial action in § 213.353. Because turnouts are designed with certain redundancies, some maintenance personnel suggest that loose or missing components should not always be considered defects unless they present an immediate hazard. However, it is also recognized that these conditions will only deteriorate if left un-repaired.

One loose frog bolt out of several would seldom constitute an immediate hazard, provided that the frog was otherwise secure. On the other hand, a missing cotter pin in a critical location such as in a connecting rod could have serious consequences.

Consider the example of loose or missing rail braces. One or two loose braces are usually not considered to be an immediate hazard, provided that the other braces are in acceptable functional condition to support the stock rail. On the other hand, several consecutively loose braces, especially in the higher track classes, could be much more serious.

Intermittent patches of vegetation that brush the sides of rolling stock may not be an immediate hazard, but more severe vegetation might have the potential of contributing to the injury of an employee who is riding on the side of a car or looking out locomotive cab windows.

As the above examples illustrate, non-class specific defects must be considered in the context of the specific circumstances involved. The existence of a non-class specific defect under one set of circumstances may not be serious while the identical condition under other circumstances may constitute a serious safety concern.

Although some non-class specific defects may not present an immediate hazard, these conditions will only degrade under train traffic. Therefore, it is important for carrier and FRA inspectors to record these defects so that they will not be left un-repaired. In summary:

(1) FRA inspectors should record all noncomplying conditions, including non-class specific defects such as loose or missing frog bolts or switch braces. Care must be taken to conduct a thorough inspection, recording the location, type and size of each defect discovered.

(2) FRA inspectors should evaluate the remedial action taken by the carrier. If an inspector becomes aware that the remedial action, or lack thereof, for a non-class specific defect is not sufficient based on the circumstances, the inspector should seek a more appropriate action from the carrier. For a non-class specific defect which is an imminent hazard such as a missing nut on a connecting rod, the inspector should immediately inquire as to the remedial action planned by the carrier.

(3) If the railroad does not institute an appropriate remedial action, the inspector should consider recommending a violation. If the railroad has been advised that a violation has been recommended and has not initiated appropriate remedial action, the inspector should be prepared to issue a Special Notice for Repairs, under the guidelines described in Chapter 4 of the this manual.

(4) In the case of a non-class specific defect that did not pose an immediate hazard when the defect was recorded, and the inspector discovers that no action was taken within a reasonable time frame after the carrier had knowledge of the defect, the inspector should consider the enforcement options described in item 3 above. In any case, if no appropriate action was taken within a 30-day period, the inspector should consider the enforcement tools outlined above.

(5) When a railroad inspector discovers a non-class specific defect, as with all defects, the railroad inspector must initiate immediate action in accordance with § 213.365(d). The remedial action taken by the railroad inspector must be recorded in accordance with § 213.369(b). For non-class specific defects, the record must show a reasonable explanation of the action taken. For example, "repaired before next train" would be appropriate for serious conditions. On the other hand, a notation for a defect such as vegetation that indicates the vegetation is scheduled to be cut by a weed mower by a specific date within 30 days may be appropriate. The 30-day period represents only a maximum period that FRA would expect that <u>all</u> non-class specific defects are repaired or other appropriate action taken and is not intended to create a 30-day "grace period" for all defects.

(6) A non-class specific defect may not pose an immediate hazard for one train movement, but the condition may deteriorate to become a hazard to following trains. It is reasonable to expect that conditions such as loose or missing frog bolts or braces are repaired as quickly as possible. However, a qualified railroad representative under § 213.305 may determine that the condition is not an immediate hazard and decide to call for assistance to make the repairs, or the representative may decide to end the inspection, retrieve the necessary repair materials, and return later to make the repairs. In some cases, the representative may determine that a speed restriction is appropriate.

303(c) The Administrator may hold the track owner or the assignee or both responsible for compliance with this subpart and subject to the penalties under § 213.15.

Guidance: FRA may hold responsible any party contracted by the track owner to ensure compliance with this part. FRA may hold the track owner, the assignee, or both responsible.

§ 213.305 Designation of qualified individuals; general qualifications

Each track owner to which this subpart applies shall designate qualified individuals responsible for the maintenance and inspection of track in compliance with the safety requirements prescribed in this subpart. Each individual, including a contractor or an employee of a contractor who is not a railroad employee, designated to:

Guidance: Work on or about a track structure supporting qualified high-speed passenger trains demands the employees be fully aware of the need to perform work properly. This section specifies that the requirements for a person to be qualified under subpart G concern those portions of this subpart necessary for the performance of that person's duties. This section continues to require that a person designated under it has the knowledge, understanding, and ability necessary to supervise the restoration and renewal of subpart G track, or to perform inspections of subpart G track, or both, for which he or she is responsible.

305(a) Supervise restorations and renewals of track shall meet the following minimum requirements:

(1) At least;

(i) Five years of responsible supervisory experience in railroad track maintenance in track class 4 or higher and the successful completion of a course offered by the employer or by a college level engineering program, supplemented by special on the job training emphasizing the techniques to be employed in the supervision, restoration, and renewal of high-speed track; or

(ii) A combination of at least one year of responsible supervisory experience in track maintenance in Class 4 or higher and the successful completion of a minimum of 80 hours of specialized training in the maintenance of high-speed track provided by the employer or by a college level engineering program, supplemented by special on the job training provided by the employer with emphasis on the maintenance of high-speed track; or

(iii) A combination of at least two years of experience in track maintenance in track class 4 or higher and the successful completion of a minimum of 120 hours of specialized training in the maintenance of high-speed track provided by the employer or by a college level engineering program supplemented by special on the job training provided by the employer with emphasis on the maintenance of high-speed track.

(2) Demonstrate to the track owner that the individual:

(i) Knows and understands the requirements of this subpart that apply to the restoration and renewal of the track for which he or she is responsible;

(ii) Can detect deviations from those requirements; and

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

(3) Be authorized in writing by the track owner to prescribe remedial actions to correct or safely compensate for deviations from the requirements of this subpart and successful completion of a recorded examination on this subpart as part of the qualification process.

305(b) Inspecting track for defects shall meet the following minimum qualifications:

(1) At least:

(i) Five years of responsible experience inspecting track in Class 4 or above and the successful completion of a course offered by the employer or by a college level engineering program, supplemented by special on the job training emphasizing the techniques to be employed in the inspection of high-speed track; or

(ii) A combination of at least one year of responsible experience in track inspection in Class 4 or above and the successful completion of a minimum of 80 hours of specialized training in the inspection of high-speed track provided by the employer or by a college level engineering program, supplemented by special on the job training provided by the employer with emphasis on the inspection of high-speed track; or

(iii) A combination of at least two years of experience in track maintenance in Class 4 or above and the successful completion of a minimum of 120 hours of specialized training in the inspection of high-speed track provided by the employer or from a college level engineering program, supplemented by special on the job training provided by the employer with emphasis on the inspection of high-speed track.

(2) Demonstrate to the track owner that the individual:

(i) Knows and understands the requirements of this subpart that apply to the inspection of the track for which he or she is responsible;

(ii) Can detect deviations from those requirements; and

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

(3) Be authorized in writing by the track owner to prescribe remedial actions to correct or safely compensate for deviations from the requirements in this subpart and successful completion of a recorded examination on this subpart as part of the qualification process.

Guidance: Paragraph (a) concerns qualifications of designated personnel who supervises restorations and renewals of track and paragraph (b) concerns qualifications of designated personnel who inspect track for defects. Note that these paragraphs specify more stringent requirements than their counterparts for Class 1 through to 5 track (213.7(a) and (b)).

Paragraphs (a)(2)(i) and (b)(2)(i) specifically clarify that the requirements for a person to be qualified under this section concern the portions of Part 213 necessary for the person to perform his/her duties. The person is not required to know or understand specific requirements of this part not necessary to fulfill his or her duties. For example, track foremen and inspectors may not be required to know or understand vehicle qualification and testing requirements for high cant deficiency operations in track Classes 6 to 9 in fulfilling their duties.

Under paragraph (a), a person may be qualified to perform restorations and renewals under this subpart in three ways. First, the person may combine 5 or more years of supervisory experience in track maintenance for Class 4 or higher and the successful completion of a course offered by the employer or by a college level engineering program, supplemented by special on-the-job training. Second, a person may be qualified by a combination of at least 1 year of supervisory experience in track maintenance of Class 4 or higher, 80 hours of specialized training or in a college level program, supplemented with on-the-job training. Under the third option, a railroad employee with at least 2 years of experience in maintenance of high-speed track can achieve qualification status by completing 120 hours of specialized training in maintenance of high-speed track, provided by the employer or by a college level engineering program, supplemented by special on-the-job training. For the third option, all or part of the experience required may be non-supervisory.

Similarly, under paragraph (b), a person may be qualified to perform track inspections in Classes 6, 7, 8 and 9 by attaining 5 or more years of experience in inspection in track class 4 or higher and by completing a course taught by the employer or by a college level engineering program, supplemented by special on-the-job training. Or, the person may be qualified by attaining a combination of at least 1 year of experience in track inspection in Class 4 and higher and by successfully completing 80 hours of specialized training in the inspection of high-speed track provided by the employer or by a college level engineering program, supplemented with on-the-job training. Finally, a person may be qualified by attaining 2 years of experience in track maintenance in Class 4 and above and by successfully completing 120 hours of specialized training in the inspection of high-speed track provided by the employer or by a college level engineering program, supplemented by special on-the-job training provided by the employer with emphasis on the inspection of high-speed track. For the third option, all or part of the experience required may be non-supervisory. The third option is primarily intended to provide a way for employees with 2 years of experience in the maintenance of high-speed track to gain the necessary training to be qualified to inspect track.

305(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 in accordance with the written procedures established by the track owner shall have:

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

(2) Successfully completed a training course of at least eight hours duration specifically developed for the application of written CWR procedures issued by the track owner; and

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

(i) Knows and understands the requirements of those written CWR procedures;

(ii) Can detect deviations from those requirements; and

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

(4) Written authorization from the track owner to prescribe remedial actions to correct or safely compensate for deviations from the requirements in those procedures and successful completion of a recorded examination on those procedures as part of the qualification process. The recorded examination may be written, or it may be a computer file with the results of an interactive training course.

Guidance: This paragraph specifies requirements for qualifications of persons charged with maintaining and inspecting CWR. Training of employees in CWR procedures is essential for high-speed operations. Each person inspecting and maintaining CWR must understand how CWR behaves and how to prevent track buckles and other adverse track reactions to thermal and dynamic loading.

As CWR track has characteristics inherently different than those of traditional jointed rail, track owners are required to designate which individuals are specifically qualified to inspect or supervise the installation, adjustment, and maintenance of CWR. In addition to the qualifications that an individual must have under either paragraph (a) or (b), an individual designated under paragraph (c) must have completed a CWR training course and be well-versed in the maintenance of CWR track as detailed in the track owner's CWR plan. The comprehensive nature of the training course is more important than its duration; therefore, the railroad employee must successfully complete an in depth initial training course of the track owner's written CWR procedures and continue subsequent periodic re-training thereafter, pursuant to the training program required by § 213.343(g). In addition, all individuals qualified on CWR for train operations must successfully complete a recorded examination on the track owner's CWR procedures. This recorded examination may be, for example, a traditional written examination, an electronic file of a computerized interactive training course that concludes with an examination, or a record of a supervisor's oral testing of the employee's knowledge through practical field application. Due to the language of the regulation, track owners have flexibility to test an individual's knowledge to one of the previously stated methods. However, it should be noted that the results of the examination must be recorded so that FRA may inspect the basis for the qualification of an individual under paragraph (c).

305(d) Persons not fully qualified to supervise certain renewals and inspect track as outlined in paragraphs (a), (b) and (c) of this section, but with at least one year of maintenance of way or signal experience, may pass trains over broken rails and pull-aparts provided that –

(1) The track owner determines the person to be qualified and, as part of doing so, trains, examines, and re-examines the person periodically within two years after each prior examination on the following topics as they relate to the safe passage of trains over broken rails or pull-aparts: rail defect identification, crosstie condition, track surface and alinement, gage restraint, rail end mismatch, joint bars, and maximum distance between rail ends over which trains may be allowed to pass. The sole purpose of the examination is to ascertain the person's ability to effectively apply these requirements and the examination may not be used to disqualify the person from other duties. A minimum of four hours training is adequate for initial training;

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

(3) The person shall watch all movements over the broken rail or pull-apart and be prepared to stop the train if necessary; and

(4) Person(s) fully qualified under § 213.305 of this subpart are notified and dispatched to the location as soon as practicable for the purpose of authorizing movements and effectuating temporary or permanent repairs.

Guidance: Paragraph (d) allows employees to be qualified for the specific purpose of authorizing train movements over broken rails or pull-aparts. This section requires the employees to have at least 1 year of maintenance of way or signal experience and a minimum of four hours of training and examination on requirements related to the safe passage of trains over broken rails and pull-aparts. The purpose of the examination is to ascertain the person's ability to effectively apply these requirements. A railroad may use the examination to determine whether or not a person should be allowed to authorize train movements over broken rails or pull-aparts.

The maximum speed over broken rails and pull-aparts shall not exceed 10 mph. However, movement authorized by a person qualified under this subsection may further restrict speed, if warranted, by the particular circumstances. The person qualified under this paragraph must be present at the site and able to instantly communicate with the train crew so that the movement can be stopped immediately, if necessary.

Fully qualified persons under § 213.305 must be notified and dispatched to the location promptly to assume responsibility for authorizing train movements and effecting repairs. The word "promptly" is meant to provide the railroad with some flexibility in the event that there is only one train to pass over the condition prior to the time when a fully qualified person would report for a regular tour of duty, or where a train is due to pass over the condition before a fully qualified person is able to report to the scene. Railroads should not use persons qualified under § 213.305(d) to authorize multiple train movements over such conditions for an extended period of time.

305(e) With respect to designations under paragraphs (a), (b), (c) and (d) of this section, each track owner shall maintain written records of:

(1) Each designation in effect;

(2) The basis for each designation, including but not limited to:

(i) The exact nature of any training courses attended and the dates thereof;

(ii) The manner in which the track owner has determined a successful completion of that training course, including test scores or other qualifying results;

(3) Track inspections made by each individual as required by § 213.369. These records shall be made available for inspection and copying by the Federal Railroad Administration during regular business hours.

Guidance: Inspectors may request of an owner, verification of the experience and qualifications of his supervisory (under paragraph (a)) and track inspection personnel (under paragraph (b)) and those supervisory and track personnel who inspect and maintain CWR (under paragraph (c)) and those qualified to pass trains over broken rails or pull-aparts (under paragraph (d)). Each inspector shall maintain an up-to-date list of the owner's qualified personnel to determine the effectiveness of their inspection or work. The submission of a seniority roster or job awarding bulletin is not to be considered as satisfactory identification of qualified employees or as a basis for their designation. Specific names of individuals should be made available in writing by the owner.

If the inspector is in doubt as to the qualifications of the owner's supervisory or inspection personnel, the inspector should examine the owner's inspection records. The TSS require the retention of required track inspection reports for 1 year at the owner's division office. Should the records consistently fail to reflect the actual track condition, question can be raised as to the competence and/or qualifications of the person(s) establishing the record.

When in doubt as to the qualifications of an owner's supervisors or inspectors, the inspector should discuss the matter with the owner.

Failure of the owner to have and maintain written records designating employees or the basis for each designation is a deviation from the TSS. Incomplete qualification records would also constitute a deviation from the standards. Designated employees include supervisors, inspectors, those supervisors and inspectors qualified on CWR, and those partially qualified to pass trains over broken rails and pull-aparts.

Defect Codes

0305A3	Failure of track owner to provide written authorization to qualified designated individuals to supervise restoration and renewals.
0305B3	Failure of track owner to provide written authorization to qualified designated individuals to inspect track for defects.
0305C4	Failure of track owner to provide written authorization to qualified designated individuals - CWR.
0305D	Failure to use qualified person to pass trains over broken rails or pull aparts.
0305D2	Train speed exceeds 10 m.p.h. over broken rails or pull aparts.
0305D4	Failure to promptly notify and dispatch person fully qualified under 213.7 to the location of the broken rail or pull apart.
0305E	No written record of names of qualified persons to supervise restorations and renewals of track under traffic and/or to inspect track for defects, or to pass trains over broken rails or pull-aparts, or to maintain or inspect CWR.

§ 213.307 Class of track; operating speed limits

307(a) Except as provided in paragraph (b) of this section and §§ 213.329, 213.337(a) and 213.345(c), the following maximum allowable operating speeds apply:

Over track that meets all of the requirements prescribed in this subpart for	***The maximum allowable operating speed for trains[1]***
Class 6 track	*110 m.p.h.*
Class 7 track	*125 m.p.h.*
Class 8 track	*160 m.p.h.[2]*
Class 9 track	*220 m.p.h.[2]*

[1] Freight may be transported at passenger train speeds if the following conditions are met:

(1) The vehicles utilized to carry such freight are of equal dynamic performance and have been qualified in accordance with §213.329 and §213.345.

(2) The load distribution and securement in the freight vehicle will not adversely affect the dynamic performance of the vehicle. The axle loading pattern is uniform and does not exceed the passenger locomotive axle loadings utilized in passenger service, if any, operating at the same maximum speed.

(3) No carrier may accept or transport a hazardous material, as defined at 49 CFR 171.8, except as provided in Column 9A of the Hazardous Materials Table (49 CFR 172.101) for movement in the same train as a passenger-carrying vehicle or in Column 9B of the Table for movement in a train with no passenger-carrying vehicles.

[2] Operating speeds in excess of 125 m.p.h. are authorized by this part only in conjunction with FRA regulatory approval addressing other safety issues presented by the railroad system. For operations on a dedicated right-of-way, FRA's regulatory approval may allow for the use of inspection and maintenance criteria and procedures in the alternative to those contained in this subpart, based upon a showing that at least an equivalent level of safety is provided.

Guidance: The maximum speed for Class 9 track has been raised to 220 m.p.h. from the 1998 rule. This is to address the need for the highest speeds likely to be achieved by the most forward-looking, high-speed rail projects. FRA conducted research and vehicle/track interaction simulations at higher speeds and concluded that Class 9 vehicle/track safety standards can be safely extended up to 220 m.p.h. - the highest speeds proposed to date.

The rule requires the testing and evaluation of equipment for qualification purposes at a speed of 5 m.p.h. above the maximum intended operating speed, in accordance with § 213.345. For example, this will require equipment intended to operate at Class 8 track's maximum speed of 160 m.p.h. to be tested at 165 m.p.h.. The rule makes clear that operating at speeds up to 165 m.p.h. for vehicle qualification purposes under this subpart will be permitted to continue on Class 8 track, subject to the requirements for the planning and safe conduct of such test operations. These test operations are distinct from service operations on Class 8 track that will be limited to a maximum speed of 160 m.p.h..

Footnote 1 provides conditions under which freight may be transported at passenger train speeds. The second clause of footnote 1 references passenger locomotive axle loadings used in passenger service along with the freight. This clause contains the words "if any" after the reference to passenger service, to make clear that there need not be any passenger service on the same line with the freight service.

Footnote 2 has also been revised from the 1998 rule and provides that operating speeds in excess of 125 m.p.h. are authorized by this part only in conjunction with FRA regulatory approval addressing other safety issues presented by the railroad system. This provision recognizes that while high-speed rail operations are subject to FRA regulatory approval, it is no longer necessary to specify that FRA regulatory approval be provided through an RPA as required in the 1998 rule. This footnote also recognizes that high-speed rail operation begins at speeds above 125 m.p.h., consistent with FRA's Tier II Passenger Equipment Safety Standards in 49 CFR part 238.

In addition, Footnote 2 provides that for operations on a dedicated right-of-way, FRA's regulatory approval may allow for the use of inspection and maintenance criteria and procedures in the alternative to those contained in this subpart, based upon a showing that at least an equivalent level of safety is provided. This addition acknowledges the unique system attributes inherent in a dedicate right-of-way operation, allowing for FRA approval of alternative criteria and procedures that are appropriate and safe in such a defined operating environment.

307(b) If a segment of track does not meet all of the requirements for its intended class, it is to be reclassified to the next lower class of track for which it does meet all of the requirements of this subpart. If a segment does not meet all of the requirements for Class 6, the requirements for Classes 1 through 5 apply.

Guidance: As in the lower classes, the high-speed standards classify track solely on the basis of authorized speeds of freight and passenger trains, irrespective of traffic density, axle loads, trailing tonnage, curvature, grades, or rail weight. Tolerances are specified in the TSS for each class of track. A deviation beyond the limiting tolerances requires repair, or reduction of speeds to the appropriate class. If the condition does not meet the requirements for track classes 6 through 9, the owner may reduce the speed to comply with the requirements for Classes 1 through 5.

All equipment, whether used for passenger or freight, must demonstrate the same vehicle/track performance and be qualified on the high-speed track. Hazardous materials, except for limited and small quantities, may not move in bulk on trains operated at high-speeds.

Defect Codes

0307A	Train speed exceeds 200 mph without fra approval.
0307A1	Freight transported at passenger train speeds in unqualified vehicles.
0307A2	Load distribution & securement in the freight vehicle adversely affects the dynamic performance of the vehicle or the axle loading pattern is not uniform & exceeds the passenger locomotive axle loadings in passenger trains at the same maximum speed.
0307A3	Carrier accepted or transported a hazardous material defined in 49 CFR Part 171.8 which is not acceptable for movement.
0307A2i	Trains operated in excess of 150 mph not in conjunction with a rule of particular applicability addressing other safety issues presented by the system.

§ 213.309 Restoration or renewal of track under traffic conditions

309(a) Restoration or renewal of track under traffic conditions is limited to the replacement of worn, broken, or missing components or fastenings that do not affect the safe passage of trains.

309(b) The following activities are expressly prohibited under traffic conditions:

(1) Any work that interrupts rail continuity, e.g., as in joint bar replacement or rail replacement;

(2) Any work that adversely affects the lateral or vertical stability of the track with the exception of spot tamping an isolated condition where not more than 15 lineal feet of track are involved at any one time and the ambient air temperature is not above 95 degrees Fahrenheit; and

(3) Removal and replacement of the rail fastenings on more than one tie at a time within 15 feet.

Guidance: The term “restoration and renewal” in this section does not have the same meaning as in the context of § 213.11, restoration or renewal of track under traffic conditions, in the low speed standards. The essential difference between this section and § 213.11 is that the options for a qualified person to authorize movements over a work area at a speed determined by that person are severely restricted. Under § 213.11, a qualified person may determine that it is safe to permit a train to pass through a work area at any speed up to the permanent speed on the track. Under § 213.309, these options are further limited because of the potential for human error and the speeds involved. Options available in the lower classes, for a designated person to perform general restorations under traffic and set train speeds, are not available under this section. Any restoration under traffic conditions beyond the replacement of worn, broken or missing components or fastenings or minor levels of spot surfacing is prohibited or a speed restriction must be imposed to place the track below Class 6 where the requirements for track classes 1 through 5 apply. The section does not limit any restoration work while the track is “out-of-service” and then restored to service.

This section addresses two elements of concern: 1) that the stability of the track structure is significantly degraded; and 2) that roadway worker safety is compromised.

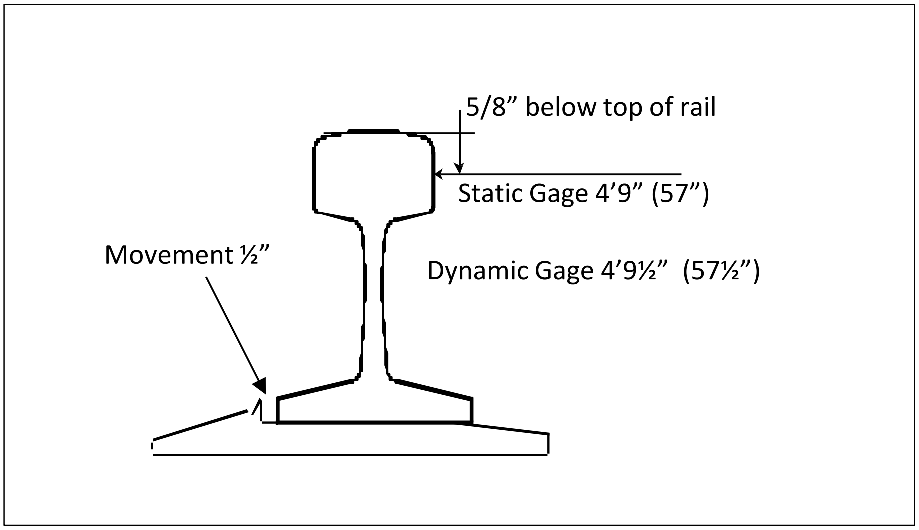
Defect Codes

0309A	Reserved
0309B1	Work performed during a period of restoration and renewal under traffic conditions which interrupts rail continuity.
0309B2	Work performed during a period of restoration and renewal under traffic conditions which adversely affects track stability.
0309B3	Removal and replacement of the rail fastenings on more than one tie at a time within 15 feet during a period of restoration and renewal under traffic conditions.

§ 213.311 Measuring track not under load

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

Guidance: In addition to the static (unloaded) geometry measurements taken, the amount of visually detectable dynamic (loaded) deflection that occurs under train movement must be considered. This includes the amount of vertical or lateral rail deflection occurring between rail base and tie plate, a tie plate and crosstie, from voids between the crosstie and ballast section resulting from elastic compression, or any combinations of the above must be added. Each deflection under the running rails must be measured and properly considered when computing the collective deviations under a load. It is very important that consideration be given to both rails when measuring these deflections. The following figure illustrates this concept in relation to lateral rail movement in a tie plate.



Vertical and lateral deflections may be found at locations such as rail joints and turnout locations with poor wooden crossties and conventional cut-spike fastening conditions; at bridge abutments and over culverts where the subgrade has settled; or where incipient geometry conditions exist. The word "incipient" means "beginning to appear."

§ 213.313 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.

Guidance: This section states that, unless otherwise provided in this part, requirements specified for curved track apply only to track having a curvature greater than 0.25 degree. This definition is intended to apply to all sections where limits for curved track are specified, unless otherwise provided.

For curves with a curvature equal or less than 0.25 degrees, for which requirements for curved track do not apply, the requirements for tangent track will play. However, when determining compliance with cant deficiency and maximum allowable operating speed these curves may still need to be treated as curves.

§ 213.317 Waivers

317(a) Any owner of track to which this subpart applies may petition the Federal Railroad Administrator for a waiver from any or all requirements prescribed in this subpart.

Guidance: Inspectors have no authority to grant waivers from the TSS.

317(b) Each petition for a waiver under this section shall be filed in the manner and contain the information required by §§ 211.7 and 211.9 of this chapter.

Guidance: Per 49 CFR 211.7(b) and 211.45(f), any petition for waiver must be filed by the owner or designated operator with the Docket Clerk, Office of Chief Counsel, in Washington, D.C. The petition can also be filed by a trade association, such as

Association of American Railroads (AAR), on behalf of its members. In addition to this chapter, inspectors should also reference the FRA Office of Railroad Safety's General Manual, Chapter 5 Complaint and Waiver Investigations, for guidance and information regarding waiver procedures.

General Manual, Chapter 5 (page 153) indicates that waiver petitions may also be addressed to a FRA manager or specialist. In the past, most petitions have been addressed to the chairperson of the FRA Railroad Safety Board, a position held by the Associate Administrator for Railroad Safety/Chief Safety Officer, as most waivers are decided by the board.

317(c) If the Administrator finds that a waiver is in the public interest and is consistent with railroad safety, the Administrator may grant the waiver subject to any conditions the Administrator deems necessary. Where a waiver is granted, the Administrator publishes a notice containing the reasons for granting the waiver.

Guidance: Typically, waivers bear the signature of AA/Chief Safety Officer, or his/her delegate. Inspectors should keep updated with any waivers in effect in their assigned territory which are relevant to their job activities.

§ 213.319 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.

Guidance: One of the most essential element of track maintenance is a comprehensive drainage system. Drainage facilities (bridges, trestles or culverts) must be given careful, detailed consideration. Drainage facilities must be examined during inspections. Openings under the track are used to channel and divert water from one side of the roadbed to the other.

The TSS specifies that each drainage structure is maintained and the inspector should observe conditions that would affect the integrity of the structure such as culvert pull-apart or separations, crushing or uneven settlement due to failure of or lack of head walls, coupled with frost action, too steep a gradient, and insufficient support.

Drainage openings must also be inspected and notice given where debris has accumulated to such an extent that expected water flow cannot be accommodated.

Most railroad drainage structures have existed for many years, and if properly maintained and kept free of debris, they are considered to be adequately designed to accommodate expected water flow even though recent high water marks may be slightly above the inlet opening.

Culverts designed with submerged inlets are common. Where questions are raised concerning the adequacy of drainage structures, the track specialist should be consulted.

The inspector must take note of the conditions of:

- Right-of-way ditches;

- Culvert, trestles and bridge inlets;
- Water carrying structures or passageways;
- Outlets or tail ditches;
- Berm ditches;
- Scouring of embankments, piling or piers in channels or at abutments;
- Filling in of passageways from silting, sand wash, or debris.

Inspectors must call to the attention of the track owner any drainage condition deemed hazardous or potentially hazardous to the safety of train operations over the track and subgrade.

Defect Codes

0319	Drainage or water-carrying facility not maintained.
0319	Drainage or water-carrying facility obstructed by debris.
0319	Drainage or water-carrying facility collapsed.
0319	Drainage or water-carrying facility obstructed by vegetation.
0319	Drainage or water-carrying facility obstructed by silting.
0319	Drainage or water-carrying facility deteriorated to allow subgrade saturation.
0319	Uncontrolled water undercutting track structure or embankment.

§ 213.321 Vegetation

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

321(a) Become a fire hazard to track-carrying structures;

321(b)Obstruct visibility of railroad signs and signals:

(1) Along the right of way, and

(2) At highway-rail crossings;

321(c) Interfere with railroad employees performing normal trackside duties;

321(d) Prevent proper functioning of signal and communication lines; or

321(e) Prevent railroad employees from visually inspecting moving equipment from their normal duty stations.

Guidance: Inspectors must be aware that live and dead growth, drift, tumbleweeds, debris, etc., can constitute fire hazards to timber bridges, trestles, wooden box culverts, and other track-carrying structures.

Obstruction of the visibility of railroad signs and signals by vegetation is a deviation from the TSS. Although all signals are important, the visibility of certain signals must be closely observed: i.e., block signals, interlocking signals, speed signs (or other signs affecting the movement of trains), close clearance signs, whistle posts, and mileposts.

Paragraph (b) includes a requirement to clear vegetation from signs and signals along railroad rights-of-way and at highway-rail grade crossings. Because the scope of Part 213 limits vegetation requirements to railroad property, this is not intended to be an attempt to dictate standards for surrounding landowners. This paragraph intends only to cover the clearing of vegetation at highway-rail grade crossings on railroad property to provide adequate visibility to the traveling public of railroad signs and signals. It is not intended to cover or preempt State or local requirements for the clearing of vegetation on railroad rights-of-way at highway-rail grade crossings.

Judgment must be exercised by the inspector in determining whether trackside vegetation will interfere with the railroad employees' performance of normal trackside duties. Weeds covering the track that hinder the ability of an inspector to see track structure components is not necessarily a noncomplying condition.

Before citing the railroad for vegetation interfering with signal or communication lines, the inspector must confirm that the line is active. Occasionally, however, inspectors may observe vegetation in lines that appear to be no longer functioning. Communication between the Track inspector and the FRA Signal and Train Control inspector is necessary if the railroad representative cannot confirm the status of a signal or communication line. When interfering with active lines, vegetation may cause false signal indications and/or disrupt communications that are vital to safe train operations. When there are questions with regard to vegetation and the signal lines, joint inspections by track and signal personnel are encouraged. Violation reports, if necessary, will be executed by the Track inspector with concurrence of the Signal inspector.

Judgment must be exercised by the inspector in determining whether or not vegetation will prevent railroad employees from visually inspecting rolling stock from their normal duty stations.

Defect Codes

0321A	Combustible vegetation around track-carrying structures.
0321B1	Vegetation obstructs visibility of railroad signs and fixed signals.
0321B2	Vegetation obstructs visibility of grade crossing warning signs and signals by the traveling public.
0321C1	Vegetation obstructs passing of day and night signals by railroad employees.
0321C2	Vegetation interferes with railroad employees performing normal trackside duties.
0321C3	Excessive vegetation in toepaths and around switches where employees are performing normal trackside duties.
0321C4	Vegetation brushing sides of rolling stock that prevents employees from visually inspecting moving equipment from their normal duty stations.
0321D	Vegetation prevents proper functioning of signal and/or communication lines.
0321E1	Excessive vegetation at train order office, depot, interlocking plant, a carman's building, etc., prevents employees on duty from visually inspecting moving equipment when their duties so require.
0321E2	Excessive vegetation at train meeting points prevents proper inspection by railroad employees of moving equipment.

§ 213.323 Track gage

323(a) Gage is measured between the heads of the rails at right-angles to the rails in a plane five-eighths of an inch below the top of the rail head.

323(b) Gage shall be within the limits prescribed in the following table:

Class of track	*The gage must be at least*	*But not more than*	*The change of gage within 31 feet must not be greater than*
6	*4' 8"*	*4' 9¼"*	*¾"*
7	*4' 8"*	*4' 9¼"*	*½ "*
8	*4' 8"*	*4' 9¼"*	*½ "*
9	*4' 8¼"*	*4' 9¼"*	*½ "*

Guidance: This rule established the minimum and maximum limits for gage, and the variation in gage differs with the authorized speed. An abrupt change in gage can produce significant wheel forces at high speeds. The minimum and maximum limits for gage values, Classes 6, 7, 8, and 9, were set to minimize the onset of truck hunting.

Inspectors will make measurements at sufficient intervals to assure that track is being maintained within the prescribed limits.

Particular attention will be given to gage in turnouts or where high lateral train forces would be expected.

Gage should be measured where line or surface irregularities are observed by the inspector. Remember to observe evidence of lateral rail movement.

An accurate standard track gage or a ruler graduated in inches is an acceptable measuring device. Gage not within the specified limits of the TSS is a defect.

FRA inspectors may use a Portable Track Loading Fixture (PTLF) described in § 213.110 for the purposes of measuring loaded gage.

Defect Codes

0323B1	Gage dimension exceeds allowable on tangent track.
0323B2	Gage dimension is less than allowable on tangent track.
0323B3	Gage dimension exceeds allowable on curved track.
0323B4	Gage dimension is less than allowable on curved track.
0323B5	Gage variation within 31 feet exceeds allowable.

§ 213.327 Track Alinement

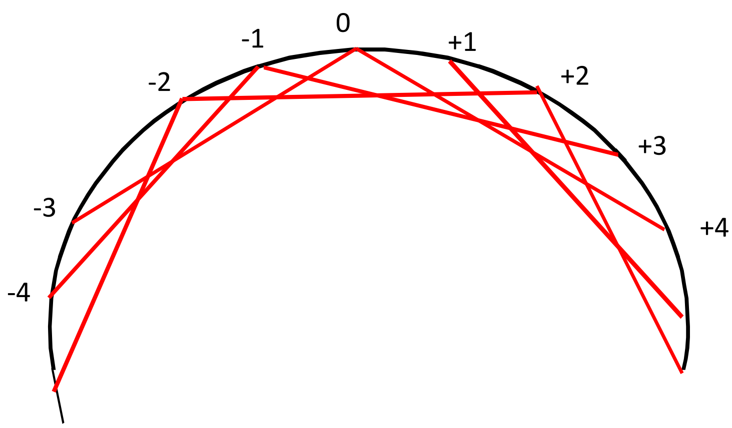
327(a) Uniformity at any point along the track is established by averaging the measured mid-chord offset values for nine consecutive points centered around that point and spaced according to the following table:

Chord Length	***Spacing***

31′	*7′ 9″*
62′	*15′ 6″*
124′	*31′ 0″*

Guidance: Uniformity at any point along the track is established by averaging the measured mid-chord offset (MCO) values for nine consecutive points centered around that point, and which are spaced according to the table in this section. For example, to establish uniformity for the 31-foot chord the inspector should mark the point of concern plus four stations in each direction for a total of nine stations. Stations for the 31-foot chord are set at 7-foot 9 inch intervals. The MCO values are then obtained at each station and averaged. It is difficult to determine compliance with the 124-foot chord in the field using conventional manual methods. The method of determining uniformity is determined in this manner for tangents, spirals, and curves. The following figure illustrates the method to determine uniformity for the 31-foot chord measurement.

Determination of Alinement Uniformity
31-ft. Chord Classes 6 through 9



327(b) Except as provided in paragraph (c) of this section, a single alinement deviation from uniformity may not be more than the amount prescribed in the following table:

Class of track	*Tangent/ Curved track*	*The deviation from uniformity of the mid-chord offset for a 31-foot chord may not be more than—(inches)*	*The deviation from uniformity of the mid-chord offset for a 62-foot chord may not be more than—(inches)*	*The deviation from uniformity of the mid-chord offset for a 124-foot chord may not be more than—(inches)*
Class 6 track	*Tangent*	*½*	*¾*	*1 ½*
	Curved	*½*	*⅝*	*1 ½*
Class 7 track	*Tangent*	*½*	*¾*	*1 ¼*
	Curved	*½*	*½*	*1 ¼*
Class 8 track	*Tangent*	*½*	*¾*	*1*
	Curved	*½*	*½*	*¾*

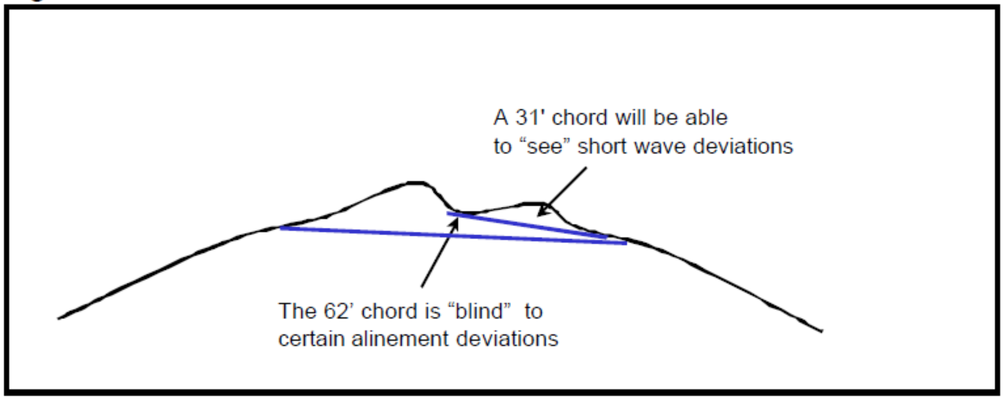
Class 9 track	*Tangent*	½	½	¾
	Curved	½	½	¾

Guidance: Paragraph (b) contains the single-deviation track alinement limits for tangent and curved track. There have been changes from the 1998 rule. The 62-foot mid-chord offset (MCO) limit for Class 6 curved track is 5/8 inch. This limit is intended to provide consistency between the track alinement limits for track Classes 5 and 6, as the Class 5 limit for curved track in § 213.55 is 5/8 inch. The 62-foot MCO limits for Class 7 and Class 8 tangent track have been increased to ¾ inch, while the curved track limits remain at the value of ½ inch. Further, the 124-foot MCO limit for Class 8 tangent track has been increased to 1 inch, while the curved track limit remains at the value of ¾ inch. These changes are based on the results of the simulation studies for determining safe amplitudes of track geometry alinement variations.
In some cases, particularly for repeating noncomplying alinement anomalies specified in paragraph (c), the alinement condition may be difficult to locate without the aid of a qualified geometry car. However, inspectors have the responsibility to identify noncomplying geometry conditions whenever possible. Whether located through visual or automated means, the condition must be field verified using conventional methods. Inspectors must be aware that, in addition to the geometry car, other automated inspections will identify geometry anomalies that contribute to degraded vehicle/track interaction.

Maximum limits are established for alinement for track in Classes 6 through 9, tangent and curved track (including spirals), as measured with three chords, 31-foot, 61-foot and 124-foot. An alinement deviation may be present for any one or more of the chords. If an anomaly of uniformity exists for more than one chord, it shall be reported as a single defect line with a note describing other deviations in noncompliance with another chord. For example, “5/8-inch deviation from uniformity for a 31-foot chord. Note: defect is also a 3/4-inch deviation from uniformity for a 62-foot chord.”

The point of greatest alinement deviation can usually be detected visually and marked as the point where mid-offset will be required. However, inspectors should use the locations identified by the automated inspection methods whenever possible to identify the location of deviation, and then visually verify the location.

For curves in Classes 6 through 9, an alinement condition may be in noncompliance with either the maximum limits for the 31-foot chord, or the 62-foot chord, or the 124-foot chord. As shown in the following figure, certain alinement defects may be “blind” to some chords and “visible” to others. For example, the 31-foot chord is particularly necessary for the determination of short alinement deviations, and the 124-foot chord is useful for locating long wavelengths.



The line will be held taut against the rail 5/8-inch below the rail head using offset blocks if necessary. Methods establishing a line with laser or similar methods may also be used.

327(c) For operations at a qualified cant deficiency, E_u, of more than 5 inches, a single alinement deviation from uniformity of the outside rail of the curve may not be more than the amount prescribed in the following table:

Class of track	***Track type***	***The deviation from uniformity of the mid-chord offset for a 31-foot chord may not be more than—(inches)***	***The deviation from uniformity of the mid-chord offset for a 62-foot chord may not be more than—(inches)***	***The deviation from uniformity of the mid-chord offset for a 124-foot chord may not be more than—(inches)***
Class 6 track	*Curved*	*½*	*⅝*	*1¼*
Class 7 track	*Curved*	*½*	*½*	*1*
Class 8 track	*Curved*	*½*	*½*	*¾*
Class 9 track	*Curved*	*½*	*½*	*¾*

Guidance: This paragraph contains tighter, single-deviation geometry limits for operations above 5 inches of cant deficiency. These include 31-foot, 62-foot, and 124-foot MCO limits. The track geometry limits in this paragraph are based on the results of simulation studies to determine the safe amplitudes of track geometry alinement variations. Adding these track geometry limits is necessary to provide an equivalent margin of safety for operations at higher cant deficiency.

Guidance for paragraph (b) also applies to this paragraph. However, the limits in the table of this paragraph applies only to operations at a qualified cant deficiency of more than 5 inches, and to outside rail of the curve. For operations involving more than 5 inches of cant deficiency, the track owner or railroad must have the necessary FRA approval/documentation showing that the operations are qualified for a cant deficiency higher than 5 inches.

If the track owner or railroad, in response to an alignment exception to table (c), has posted a speed restriction which no longer corresponds to a cant deficiency of more than 5 inches, the inspector should use the limits in table (b) to assess alignment compliance.

327(d) For three or more non-overlapping deviations from uniformity in track alinement occurring within a distance equal to five times the specified chord length, each of which exceeds the limits in the following table, each track owner shall maintain the alinement of the track within the limits prescribed for each deviation:

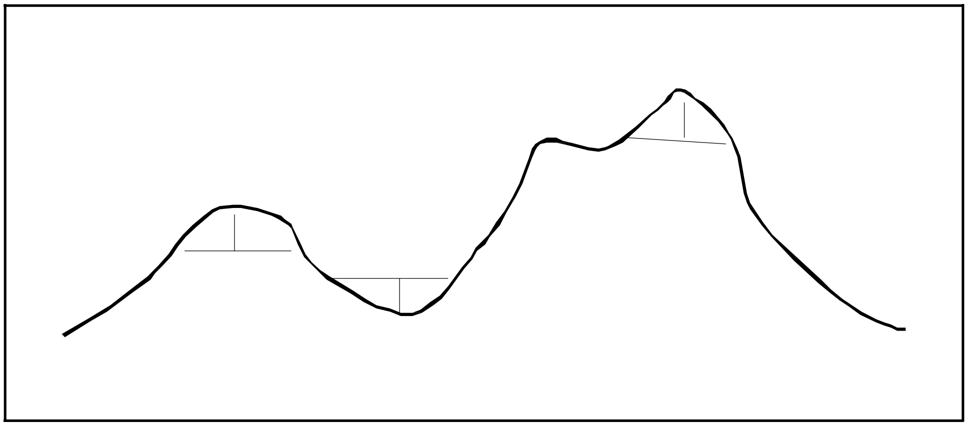
Class of track	*The deviation from uniformity of the mid-chord offset for a 31-foot chord may not be more than (inches)*	*The deviation from uniformity of the mid-chord offset for a 62-foot chord may not be more than (inches)*	*The deviation from uniformity of the mid-chord offset for a 124-foot chord may not be more than (inches)*
Class 6 track	⅜	½	*1*
Class 7 track	⅜	⅜	⅞
Class 8 track	⅜	⅜	½
Class 9 track	⅜	⅜	½

Guidance: Paragraph (d) establishes alinement requirements for repeated deviations (three or more non-overlapping deviations) which occur within a distance equal to five times the specified chord length. Each occurrence of three or more deviations within a distance of five times the chord length, each of which exceeds the limit in the table, is considered one defective condition.

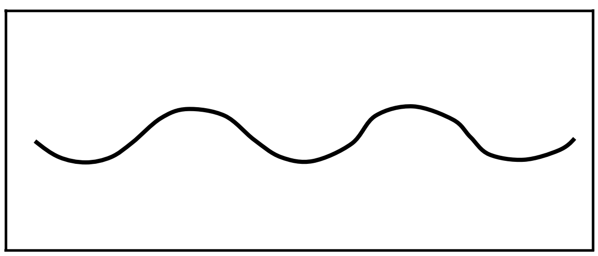
Repeated alinement deviations may excite a vehicle's natural resonance and cause adverse vehicle reaction. Although repeated alinement deviations are rare they are usually identified by automated inspections. However, the inspector must be aware of their significance.

Repeated alinement defects are specific to one rail at a time. If an inspector believes that a geometry condition on the opposite rail within the same area may contribute to the excitation, the inspector should inform the railroad representative and note the condition on the inspection report.

The term "non-overlapping" is a common term but clarifies the concept in relation to track geometry inspection vehicles. Within one alinement "swing," normally several midchord offset measurements will exceed the specified threshold. However, for an alinement deviation to be considered as a repeating defect, the chords themselves must not overlap. The following figure illustrates three repeating alinement deviations. The concept is that one "swing" is not counted more than once.



Multiple alinement deviations may excite harmonic motion in the vehicle. Multiple deviations are three or more non-overlapping deviations from uniformity in track profile occurring within a distance equal to five times the specified chord length. The repeated condition, not each alinement deviation, is considered one defect. However, in the rare case where deviations repeat beyond the distance of five times the specified chord length, the inspector shall consider all the sets of deviations as one exception. However, the total length the repeating condition occurs in feet must be reported along with the number of repeating deviations and the magnitude of each deviation.



Defect Codes

0327B1	The alinement of track exceeds the allowable deviation for a 31-foot chord for a single deviation.
0327B2	The alinement of track exceeds the allowable deviation for a 62-foot chord for a single deviation.
0327B3	The alinement of track exceeds the allowable deviation for a 124-foot chord for a single deviation.
0327C1	The alinement of track exceeds the allowable deviation for a 31-foot chord for three or more deviations.
0327C2	The alinement of track exceeds the allowable deviation for a 62-foot chord for three or more deviations.
0327C3	The alinement of track exceeds the allowable deviation for a 124-foot chord for three or more deviations.

§ 213.329 Curves, elevation and speed limitations

329(a) The maximum elevation of the outside rail of a curve may not be more than 7 inches. The outside rail of a curve may not be lower than the inside rail by design, except when engineered to address specific track or operating conditions; the limits in § 213.331 apply in all cases.

Guidance: Paragraph (a) does not imply that more than 6 inches of superelevation is recommended in a curve; rather the paragraph limits the amount of crosslevel in a curve to control the unloading of the wheels on the high rail, especially at low speeds. The crosslevel limits notwithstanding, this standard establishes the maximum crosslevel at any point on the curve which may not be more than 7 inches. In curves, crosslevel is measured by subtracting the relative difference in height between the top surface (tread) of the inside (low) rail from the tread of the outside (high) rail.

The Associate Administrator for Railroad Safety/Chief Safety Officer shall reach a decision regarding the railroad's request for approval of a level of cant deficiency for specific equipment types based on the staff's review of the engineering information submitted by the railroad. When requested by Headquarters and regional track specialists, the inspector may be asked to provide a memorandum containing recommendations concerning the railroad's request.

In the 1998 rule, the provision had been stated in terms of the maximum crosslevel of the outside rail, with the same limits. As crosslevel is a function of elevation differences between two rails, and is specifically addressed by provisions in § 213.331, this paragraph is intended to focus the provision on the maximum allowable elevation of a single rail.

The phrase "*except when engineered to address specific track or operating conditions*" is intended to address special cases, such as a turnout that comes off the high rail in a curve, to allow reverse elevation to be designed into the curve out of necessity and for safety reasons.

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

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

Where
V_{max} = Maximum allowable posted timetable operating speed (m.p.h.).
E_a = Actual elevation of the outside rail (inches).[1]
E_u = Qualified cant deficiency[2] *(inches) of the vehicle type.*

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[1] *Actual elevation, E_a, for each 155-foot track segment in the body of the curve is determined by averaging the elevation for 11 points through the segment at 15.5-foot spacing. If the curve length is less than 155 feet, the points are averaged through the full length of the body of the curve.*

[2] *If the actual elevation, E_a, and degree of curvature, D, change as a result of track degradation, then the actual cant deficiency for the maximum allowable posted timetable operating speed, V_{max}, may be greater than the qualified cant deficiency, E_u. This actual cant deficiency for each curve may not exceed the qualified cant deficiency, E_u, plus one-half inch.*

D = Degree of curvature (degrees).[3]

Guidance: Several combinations of curvature and elevation resulting in speed limitations may exist and should be considered throughout the curve when determining compliance with this section.

The designation of V_{max} has been changed from “maximum allowable operating speed” in the 1998 rule to “maximum allowable posted timetable operating speed.” The track owners/railroads can use it to establish the “posted timetable operating speed” based on the qualified cant deficiency (E_u) and the design values of elevation (E_a) and curvature (D). The Vmax value will then be the target or reference speed. Track inspectors can use the formula to assess compliance in two ways:

1. Calculating maximum allowable speed by inserting the elevation (E_a), curvature (D) at the time of inspection, and the qualified cant deficiency (E_u). If the resulting speed is lower than the reference speed, there is potentially a limiting speed defect.
2. Calculating cant deficiency by inserting the reference V_{max}, elevation (E_a), and curvature (D) at the time of inspection. If the resulting actual cant deficiency is higher than the qualified cant deficiency, there is potentially a limiting speed defect.

$$E_U = V_{\max}{}^2 \cdot 0.0007D - E_a$$

Speed becomes more critical if surface conditions have deteriorated or curvature has increased due to misalignment near the point of limiting speed and inspectors need to determine compliance with the surface standard in § 213.331 or the alinement standard in § 213.327, which in some cases will be more restrictive.

Curves may exist by design or introduced as a result of maintenance or geometry degradation. In either case, lack of superelevation will cause trains to experience an unbalanced condition. The deviations from uniform profile and uniform alinement, as outlined in §§ 213.331 and 213.327, will not preclude longer wavelength misalinements on the order of 200 feet or greater that resemble the characteristics of a curve from being treated as curves for which the unbalance formula defined in this section will be applied.

Footnote 6 establishes that the actual elevation, E_a, for each 155-foot track segment in the body of the curve is determined by averaging the elevation for 11 points through the segment at 15.5-foot spacing. In calculating elevation, 10 measurements are taken from the point of concern—5 on each side—so that 11 points are actually averaged, which includes the point of concern. The V_{max} equation is intended to be applied in the body of the curve, and the actual elevation and degree of curvature are determined using the averaging technique defined in the Footnote 6. Within spirals, where the degree of curvature and elevation are changing continuously, local deviations from uniform elevation and degree of curvature are governed by the limits in § 213.327 and § 213.331.

Footnote 7 permits the vehicle type to operate at the cant deficiency for which it is approved, E_u, plus ½ inch, if the actual elevation of the outside rail, E_a, and the degree of track

[3] *Degree of curvature, D, is determined by averaging the degree of curvature over the same track segment as the elevation.*

curvature, D, change as a result of track degradation. The note is intended to provide a tolerance to account for the effects of local crosslevel or curvature conditions on V_{max} that may result in the actual cant deficiency exceeding the cant deficiency approved for the equipment. The intent is to allow this tolerance for "local crosslevel or curvature conditions" that result in track degradation below the maintenance limits of the track owner/railroad. The footnote is not intended to provide a tolerance to be factored into the maintenance limits. For example, if the "maximum allowable posted timetable operating speed" is based on a V_{max} corresponding to 3 inches of cant deficiency, the track owner/railroad cannot establish maintenance practices that are intended to result in operation of equipment at a speed that produces up to 3.5 inches of cant deficiency. Yet, in this example, should the equipment actually operate at a speed that produces over 3 inches of cant deficiency due to track degrading below the intended maintenance limits of the track owner/railroad, the track owner/railroad should not be penalized merely because the cant deficiency exceeds 3 inches (see below for additional guidance).

The limiting speed defect can range from a few feet to the entire curve length. Therefore, the defect length alone cannot determine whether the limiting speed defect arose from track degradation or from the failure to carry out appropriate track maintenance.

As noted above, footnote 7 provides that if the actual elevation and degree of curvature change as a result of track degradation, the actual amount of cant deficiency in a curve may be greater than the approved amount of cant deficiency, E_u, but not by more than ½ additional inch. This footnote is consistent with FRA's enforcement practice – namely, to provide a tolerance for limited exceedances of the approved amount of cant deficiency, E_u, in curves. Because a tolerance is now part of the regulation, not all exceedances are actual defects (instances of noncompliance). The inspector should only record the condition as a defect if there is evidence that the maintenance practices of the track owner/railroad created a condition where the actual amount of cant deficiency exceeded the approved value. In such case, FRA expects the track owner/railroad to take appropriate remedial actions. The inspector should consider writing a recommendation for civil penalty if the level of cant deficiency based on the maximum speed, elevation, and curvature exceeds the approved value, E_u, by more than 0.5 inch. When the actual cant deficiency is found to exceed the approved level, there are many scenarios that could involve compliance or noncompliance with the regulation, and all of these different scenarios cannot be easily described here. The inspector should consider multiple factors when determining whether to assess a defect or recommend a violation. For example, if the inspector can establish that a track has been recently machine-tamped and that it was not possible for the track to have degraded to the level of causing an exceedance of the approved cant deficiency in the time period after the tamping, the inspector may assess a defect. In another example, if the track owner/railroad voluntarily performs spot maintenance on a curve, typically by spot-tamping, to bring the curve to uniformity (in terms of curvature and elevation), and the amount of cant deficiency still exceeds the approved level by a nominal amount, the inspector should exercise his or her discretion whether to assess a defect. The inspector should consider assessing a defect when the exceedance is close to the maximum tolerance, which leaves little room for further track degradation. In all cases, if the inspector cannot determine whether a condition is out of compliance, or whether to assess a defect or recommend a civil penalty, he or she should consult with the regional track specialist.

329(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.*

Guidance: This paragraph provides that all vehicle types are considered qualified for up to 3 inches of cant deficiency, as allowed since the 1998 Track Safety Standards final rule.

329(d) Each vehicle type must be approved by FRA to operate on track with a qualified cant deficiency, E_u, greater than 3 inches. 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.*

Guidance:
The paragraph specifies the requirements for vehicle qualification over track with more than 3 inches of cant deficiency in Track Classes 6 through 9. The requirements, consistent with the standards in § 213.57 (for lower-speed track classes), limit both the vertical wheel load remaining on the raised wheels to no less than 60 percent of their static level values and carbody roll for passenger cars to no more than 8.6 degrees, with respect to the horizontal, when the vehicle is standing (stationary) on track with a uniform superelevation equal to the proposed cant deficiency.

The requirements in this paragraph may be met by either static or dynamic testing (consistent with the requirements in § 213.57). As in § 213.57, the vehicle type must be tested in a ready-for-service condition. The vehicle type must be tested in a ready-for-service condition, i.e., in the same vehicle/track performance condition in which it would be in passenger service. For example, the vehicle type may or may not be loaded to simulate passengers on board, and this information would be necessary for a complete evaluation of the vehicle's performance.

Static lean test is a means to evaluate the basic vehicle performance in curves. The test serves as an indicator of the behavior of the vehicle suspension components. The car or locomotive is placed so that the entire vehicle stands on a track with one rail uniformly higher than the other, causing the vehicle to lean toward the lower rail. The vehicle's response to this situation is determined by its weight distribution and by the presence of free play and the stiffness of its overall suspension system.). As required, the static lean test limits the vertical wheel load remaining on the raised wheels to no less than 60 percent of their static level values and limits the roll of a passenger carbody to 8.6 degrees with respect to the horizontal, when the vehicle is standing on track with superelevation equal to the proposed cant deficiency. These requirements prevent a ”top-heavy” vehicle or a vehicle with a high center of gravity, and a very flexible (soft) suspension system from leaning excessively.

The dynamic test limits the steady-state vertical wheel load remaining on the low rail wheels to no less than 60 percent of their static level values and limits the lateral acceleration in a passenger car to 0.15g steady-state, when the vehicle operates through a curve at the proposed cant deficiency. This 0.15g steady-state lateral acceleration limit in the dynamic test is consistent with the 8.6-degree roll limit in the static lean test, in that it corresponds to the lateral acceleration that a passenger would experience in a standing (stationary) vehicle whose carbody is at a roll angle of 8.6 degrees with respect to the horizontal.

Measurements and supplemental research have indicated that a steady-state, carbody lateral acceleration limit of 0.15g is considered to be the maximum, steady-state lateral acceleration above which jolts from vehicle dynamic response to track deviations can present a hazard to passenger safety. While other FRA vehicle/track interaction safety criteria principally address external safety hazards that may cause a derailment, such as damage to track structure and other conditions at the wheel/rail interface, the steady-state, carbody lateral acceleration limit specifically addresses the safety of the interior occupant environment. This steady-state, carbody lateral acceleration will result in a lateral force, pulling passengers to one side of the carbody. It is not the same as sustained, carbody lateral oscillatory accelerations, or continuous side-to-side oscillations (hunting) of the carbody in response to track conditions, which could exist on both curved and tangent track.

The less stringent steady-state, carbody lateral acceleration limit and carbody roll angle limit adopted in VTI final rule (effective July 11, 2013) will minimize both the need to equip vehicles with tilt systems at higher cant deficiencies and the costs associated with such features. Moreover, by facilitating higher cant deficiency operations, savings may also result from shortened trip times. These savings may be particularly beneficial to passenger operations in emerging high-speed rail corridors, enabling faster operations through curves.

So that such savings will not compromise safety, FRA has adopted additional track geometry requirements for operations above 5 inches of cant deficiency, whether or not the vehicles are equipped with tilt systems. These additional track geometry requirements were developed to control undesirable vehicle response to track conditions that could pose derailment risk.

329(e) 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,[9] including the load condition under which the testing was performed, and

[9] *The test procedure may be conducted whereby all the wheels on one side (right or left) of the vehicle are*

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.

Guidance: This paragraph clarifies the submittal requirements to FRA to obtain approval for the qualifying cant deficiency of a vehicle type, including that the load condition under which the testing is performed is included in the description of the test procedure. Additional clarification in this paragraph has been included for submitting suspension system maintenance information. The requirement for submitting suspension system maintenance information applies to vehicle types not subject to 49 CFR parts 238 or 229, such as a freight car operated in a freight train, and then only to safety-critical components.

Footnote 9 references testing at "the proposed cant deficiency", consistent with the requirements of this section.

329(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.

Guidance: The paragraph requires that a track owner/railroad notify FRA prior to the implementation of the approved higher curving speeds. The paragraph also clarifies that in approving the request made pursuant to paragraph (e), FRA may impose conditions necessary for safely operating at the higher curving speeds.

329(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.

Guidance: This paragraph (g) (formerly paragraph (f)) is identical to two other provisions in § 213.57(g)—the counterpart to this section for lower-speed track classes—and § 213.345(i) (see guidance for § 213.345(i)).

329(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 Class 6 track segment. The track owner or

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raised to the proposed cant deficiency, the vertical wheel loads under each wheel are measured, and a level is used to record the angle through which the floor of the vehicle has been rotated.

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, Eu, greater than 5 inches on Class 6 track, or greater than 3 inches on Class 7 through 9 track, shall be considered qualified under this section to operate at those permitted cant deficiencies only for the previously operated or identified track segments(s). Operation of these vehicle types at such cant deficiencies and track class on any other track segment is permitted only in accordance with the qualification requirements in this subpart.

Guidance: This paragraph provides “portability” by allowing vehicles already qualified to operate between 3 and 5 inches cant deficiency to operate on different track segments and by eliminating redundant testing for vehicle types that have been safely operated at the permitted cant deficiency. The rationale for this portability is that the tests in this section, as in § 213.57 for lower-speed track classes, are not location-specific because they can be conducted at a static testing facility, and this portability of qualification for these amounts of cant deficiency can be safely allowed for Class 6 track speeds.

Nonetheless, this paragraph (f) does require that the track owner/railroad still needs to notify FRA no less than 30 calendar days prior to the proposed implementation of such curving speeds on another Class 6 track segment. This notice is intended to identify the new track segments so that FRA can ensure that appropriate permission has been provided for the proposed operation, and otherwise administer the requirements of this rule.

The provision in paragraph (h)(2) restricts the “portability” of cant deficiency qualification for vehicle types that have been permitted by FRA to operate at cant deficiencies greater than 5 inches on Class 6 track, or greater than 3 inches on Class 7 to 9 track. Operations under these conditions over different track segments must be newly qualified in accordance with this rule.

329(i) As used in this section and in §§ 213.333 and 213.345—

(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.

Guidance: This paragraph clarifies “vehicle” and “vehicle type.” The paragraph is of particular importance when determining if a vehicle type is subject to the qualification requirements of this section. For example, a vehicle type with modified primary springs to improve high-speed performance may be considered a new vehicle type.

Defect Codes

0329A	Maximum crosslevel or reverse elevation on curve exceeds allowable.
0329B1	Operating speed exceeds allowable for 3-inches of unbalance, based on curvature and elevation.
0329C	Operating speed exceeds allowable for a fra approved unbalance based on curvature and elevation.

§ 213.331 Track surface

331(a) For a single deviation in track surface, each owner of the track to which this subpart applies shall maintain the surface of its track within the limits prescribed in the following table:

Track surface (inches)	*Class of track*			
	6	*7*	*8*	*9*
The deviation from uniform[1] profile on either rail at the mid-ordinate of a 31-foot chord may not be more than	*1*	*1*	*¾*	*½*
The deviation from uniform profile on either rail at the mid-ordinate of a 62-foot chord may not be more than	*1*	*1*	*1*	*¾*
Except as provided in paragraph (b) of this section, the deviation from uniform profile on either rail at the mid-ordinate of a 124-foot chord may not be more than	*1¾*	*1½*	*1 ¼*	*1*
The deviation from zero crosslevel at any point on tangent track may not be more than[2]	*1*	*1*	*1*	*1*
Reverse elevation on curves may not be more than	*½*	*½*	*½*	*½*
The difference in crosslevel between any two points less than 62 feet apart may not be more than[3]	*1½*	*1½*	*1 ¼*	*1*
On curved track, the difference in crosslevel between any two points less than 10 feet apart (short warp) may not be more than	*1¼*	*1⅛*	*1*	*¾*

[1] Uniformity for profile is established by placing the midpoint of the specified chord at the point of maximum measurement.

[2] 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.

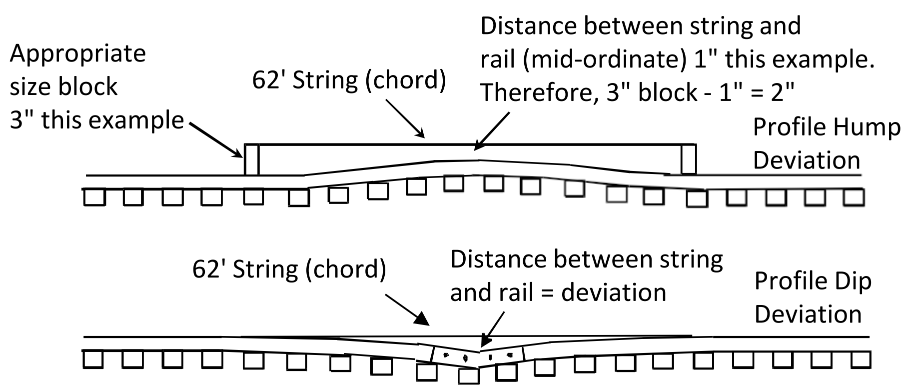
[3] However, to control harmonics on jointed track with staggered joints, the crosslevel differences shall not exceed 1 inch in all of six consecutive pairs of joints, as created by seven low joints. Track with joints staggered less than 10 feet apart shall not be considered as having staggered joints. Joints within the seven low joints outside of the regular joint spacing shall not be considered as joints for purposes of this footnote.

Guidance: There are changes in the rule, which became effective on July 11, 2013:

1. The 124-foot MCO limit for Class 9 track has been reduced to 1 inch, based on a review of simulation results of Acela equipment performance.
2. The limit for the difference in crosslevel between any two points less than 62 feet apart (62-foot warp) has been reduced to 1¼ inches for Class 8 track, and 1 inch for Class 9 track. These two changes are intended to provide more consistent safety limits and are based on simulation studies conducted for short warp conditions.
3. New limits were added:
   a. The deviation from zero crosslevel on tangent track is carried over from Class 5 track.
   b. The ½-inch reverse elevation limit for curved track was transcribed from the text formerly specified in § 213.329(a).
   c. A new limit for the difference in crosslevel between any two points less than 10 feet apart (short warp) has been added to this paragraph.

As in alinement, deviation from uniform profile must be checked by using three chords: 31-foot, 62-foot, and 124-foot. A profile condition may be in noncompliance with any or all the chords. The measurement using all chords is required to cover the necessary wavelengths of interest that may excite undesirable vehicle responses.

Uniformity for profile is different than uniformity established for alinement. In the case of alinement, uniformity as described in § 213.327(a) is determined by averaging mid-chord offset values for nine consecutive points centered around that point. However, uniformity for profile, as described in footnote 1 below the table, is a straight line placed across the deviation in such a manner as to measure the largest mid-ordinate. The following figure illustrates this procedure using a 62-foot chord. Depending upon the length of the profile perturbation, a particular chord may be inside or span the perturbation.

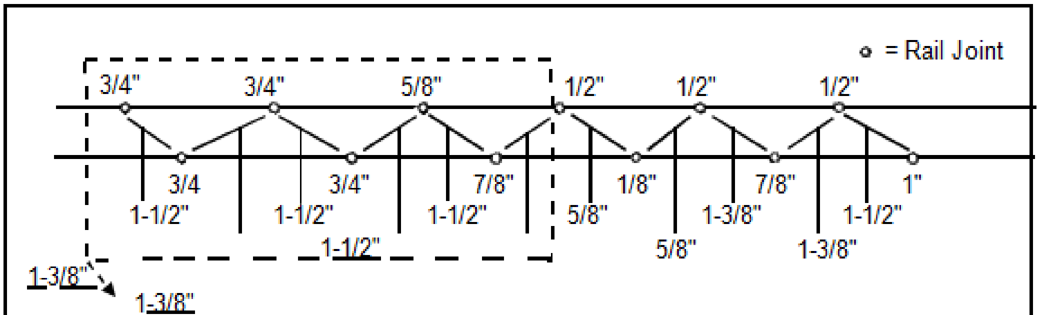


As in the standards for Classes 1 through 5, the "warp" condition is equally valid in contributing to vehicle twist and wheel climb. The difference in crosslevel between any two points less than 62 feet apart may not be more than the limit specified.

Jointed track is not typical for high-speed track. However, inspectors should check for a harmonic rock off condition whenever several joints in a row are low as indicated in footnote 2. Joint stagger that is not identical from stagger to stagger, such as in a curve or when a rail longer than the original construction is installed, shall be considered in the harmonic calculation. Additional joint(s) introduced because of the installation of short rail(s) are ignored in evaluating a harmonic condition.

Construction consisting of 79-foot or 80-foot rails does not result in harmonic rock off conditions since they occur outside of vehicle truck spacing. For 79- foot or 80-foot rails and stagger spacing less than 10 feet, this footnote is not applicable and inspectors shall review the condition for compliance with other track surface parameters. The following figure illustrates a harmonic condition.

Inspectors shall carefully apply the provisions of this footnote. An acceptable remedial action is to raise and tamp one or two joints in the middle of the consecutive low joints. This will break up the harmonics.



The worst single warp is 1-1/2" which is acceptable for Class 6 but six consecutive pair of joints have a difference that exceed 1-1/4" therefore the track must be reduced to Class 1

331(b) For operations at a qualified cant deficiency, E_u, of more than 5 inches, a single deviation in track surface shall be within the limits prescribed in the following table:

Track surface (inches)	*Class of track*			
	6	*7*	*8*	*9*
The difference in crosslevel between any two points less than 10 feet apart (short warp) may not be more than ……………………………...	*1¼*	*1*	*1*[1]	*¾*
The deviation from uniform profile on either rail at the mid-ordinate of a 124-foot chord may not be more than ………………………..	*1½*	*1¼*	*1¼*	*1*

[1] For curves with a qualified cant deficiency, E_u, of more than 7 inches, the difference in crosslevel between any two points less than 10 feet apart (short warp) may not be more than three-quarters of an inch.

Guidance: This paragraph contains tighter geometry limits for operations above 5 inches of cant deficiency on curves. These include tighter limits for 124-footMCO and 10-foot warp (the difference in crosslevel between any two points less than 10 feet apart). Please note that the limits in paragraph (a) continue to apply unless they are superseded by the limits in paragraph (b). Specifically, for operations above 5 inches of cant deficiency, the limits in rows 1 to 2 and 4 through 6 in paragraph (a) are still applicable.

Further, inspectors are reminded that the trigger for the limits in this paragraph is a cant deficiency greater than 5 inches. If a geometry exception in table (b) is encountered, the railroad may lower the speed that will no longer result in a cant deficiency more than 5 inches. In this case, the limits in table (a) apply. In case the speed reduction effectively places the track into track Class 5 or even lower, the limits in 213.63 apply.

331(c) For three or more non-overlapping deviations in track surface occurring within a distance equal to five times the specified chord length, each of which exceeds the limits in the following table, each track owner shall maintain the surface of the track within the limits prescribed for each deviation:

Track surface (inches)	*Class of track*			
	6	*7*	*8*	*9*

The deviation from uniform profile on either rail at the mid-ordinate of a 31-foot chord may not be more than	*¾*	*¾*	*½*	*⅜*
The deviation from uniform profile on either rail at the mid-ordinate of a 62-foot chord may not be more than ..….	*¾*	*¾*	*¾*	*½*
The deviation from uniform profile on either rail at the mid-ordinate of a 124-foot chord may not be more than …...	*1¼*	*1*	*⅞*	*⅝*

Guidance: The limits in this paragraph are intended to restrict repeating occurrences of track geometry conditions, each of which may not represent an exception as an individual event. Please note that as of July 11, 2013, the 124-ft profile MCO limit has been tightened from 7/8 inch to 5/8 inch.

Multiple profile deviations may excite harmonic motion in the vehicle. Multiple deviations are three or more non-overlapping deviations from uniformity in track profile, occurring within a distance equal to five times the specified chord length. Refer to § 213.327 for a description of "non-overlapping." The repeated condition, not each profile deviation, is considered one defect. However, similar to alinement, in the rare case where deviations repeat beyond the distance of five times the specified chord length, the inspector shall consider all the sets of deviations as one exception. However, the total length in feet that the repeating condition occurs must be reported along with the number of repeating deviations when the magnitude of each deviation.

Repeated profile defects are specific to one rail at a time. If an inspector believes that a geometry condition on the opposite rail within the same area may contribute to the excitation, the inspector should inform the railroad representative and note the condition on the inspection report.

Defect Codes

0331A1	The profile of track exceeds the allowable deviation for a 31-foot chord for a single deviation.
0331A2	The profile of track exceeds the allowable deviation for a 62-foot chord for a single deviation.
0331A3	The profile of track exceeds the allowable deviation for a 124-foot chord for a single deviation.
0331A4	Difference in crosslevel between any two points less than 62-feet apart on tangents exceeds allowable.
0331A5	Difference in crosslevel between any two points less than 62-feet apart on curves between spirals exceeds allowable.
0331A6	Difference in crosslevel between any two points less than 62-feet apart on spirals exceeds allowable.
0331A7	Crosslevel differences for six or more consecutive pairs of staggered joints exceeds allowable.
0331A8	*10 feet warp* exceeds allowable
0331B1	Codes for paragraph (b)???
0331C1	The profile of track exceeds the allowable deviation for a 31-foot chord for three or more deviations.
0331C2	The profile of track exceeds the allowable deviation for a 62-foot chord for Three or more deviations.

0331C3	The profile of track exceeds the allowable deviation for a 124-foot chord for three or more deviations.

§ 213.332 Combined track alinement and surface deviations.

332(a) This section applies to any curved track where operations are conducted at a qualified cant deficiency, Eu, greater than 5 inches, and to all Class 9 track, either curved or tangent.

332(b) For the conditions defined in paragraph (a) of this section, the combination of alinement and surface deviations for the same chord length on the outside rail in a curve and on any of the two rails of a tangent section, as measured by a TGMS, shall comply with the following formula: On any curved track where operations are conducted at a qualified cant deficiency, Eu, 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 § 213.327(c) (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 § 213.331(a) and § 213.331(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* $\frac{A_m}{A_L} + \frac{S_m}{S_L}$.

Guidance: This section contains limits addressing combined track alinement and surface deviations. These limits apply to high-speed operations on curved track above 5 inches of cant deficiency, as well as to any operation at Class 9 speeds.

The equation is given for computing the combined track alinement and surface deviations within a single chord length. The limits are intended to be used only with a TGMS. These limits are applicable on the outside rail in curves, as well as to any of the two rails of a tangent section in Class 9 track. The rationale discussed in section § 213.65, the companion provision to this section for lower-speed classes of track, also applies to this section. Please also note that in accordance with § 213.313, the limits specified for curved track apply only to track having a curvature greater than 0.25 degree.

§ 213.333 Automated vehicle-based inspection systems.

General Guidance: This section contains requirements for automated, vehicle-based measurement systems - i.e., track geometry measurement systems, gage restraint measurement systems, and the systems necessary to monitor vehicle/track interaction (acceleration and wheel/rail forces). The section heading is revised as "Automated vehicle inspection systems" to reflect more clearly that the inspection systems are vehicle-based and are for inspecting track conditions and monitoring vehicle/track interactions.

333(a) A qualifying Track Geometry Measurement System (TGMS) shall be operated at the following frequency:

(1) For operations at a qualified cant deficiency, Eu, of more than 5 inches on track Classes 1 through 5, at least twice per calendar year with not less than 120 days between inspections.

(2) For track Class 6, at least once per calendar year with not less than 170 days between inspections. For operations at a qualified cant deficiency, Eu, of more than 5 inches on track Class 6, at least twice per calendar year with not less than 120 days between inspections.

(3) For track Class 7, at least twice within any 120-day period with not less than 25 days between inspections.

(4) For track Classes 8 and 9, at least twice within any 60-day period with not less than 12 days between inspections.

Guidance: Paragraph (a)(1) specifies new TGMS inspection requirements for low-speed, high cant deficiency operations, which apply as required by, but are not provided in, § 213.57(i). These requirements are considered necessary for safe operations at high cant deficiency on lower-speed track classes.

Paragraph (a)(2) specifies TGMS inspection requirements for Class 6 track, with two different inspection frequencies depending on the amount of cant deficiency. The twice-yearly TGMS inspection requirements are for operations at a qualified cant deficiency of more than 5 inches. The inspection requirements can be fulfilled by either the track owner or the railroad.

Paragraph (a)(3) concerns TGMS inspections for Class 7 track. The number of days between inspections has been reduced from 30 days to 25 days.

Paragraph (a)(4) concerns TGMS inspections for Class 8 and 9 track. The number of days between two inspections has been reduced from 15 to 12 days.

333(b) A qualifying TGMS shall meet or exceed minimum design requirements which specify that –

(1) Track geometry measurements shall be taken no more than 3 feet away from the contact point of wheels carrying a vertical load of no less than 10 kips per wheel, unless otherwise approved by FRA;

(2) Track geometry measurements shall be taken and recorded on a distance-based sampling interval preferably at 1 foot not exceeding 2 feet; and

(3) Calibration procedures and parameters are assigned to the system which assure that measured and recorded values accurately represent track conditions. Track geometry measurements recorded by the system shall not differ on repeated runs at the same site at the same speed more than 1/8 inch.

Guidance: Paragraph (b)(1) specifies the requirement that track geometry measurements be taken no more than 3 feet away from the contact point of wheels carrying a vertical load of no less than 10 kips per wheel. The phrase “unless otherwise approved by FRA” provides flexibility to conduct track geometry measurements using GRMS, hi-rail geometry equipment, and other test platforms that do not meet the measurement point or axle load requirement.

Paragraph (b)(2) specifies the track geometry measurement interval. Although most existing track geometry measurement systems record measurements at 1 foot or shorter intervals, there are systems that record the measurements at up to 2 foot intervals.

Adequate sampling intervals provide sufficient data to identify track geometry perturbations. The rule states that the 1-foot sampling interval is the preferable distance. However, an allowance is provided for sampling at up to a 2-foot interval depending on the circumstances involved so that track owners/railroads may continue to use existing equipment. In this regard, the rule allows for the use of GRMS, which takes measurement at 16-inch intervals. In addition, the use of equipment that takes measurement samples on a time-based interval at a rate that corresponds to the distance-based interval specified in this section is permitted.

333(c) A qualifying TGMS shall be capable of measuring and processing the necessary track geometry parameters to determine compliance with—

(1) For operations at a qualified cant deficiency, Eu, of more than 5 inches on track Classes 1 through 5: § 213.53, Track gage; § 213.55(b), Track alinement; § 213.57, Curves; elevation and speed limitations; § 213.63, Track surface; and §213.65, Combined track alinement and surface deviations.

(2) For track Classes 6 through 9: § 213.323, Track gage; § 213.327, Track alinement; § 213.329, Curves; elevation and speed limitations; § 213.331, Track surface; and for operations at a cant deficiency of more than 5 inches § 213.332, Combined track alinement and surface deviations.

Guidance: Paragraph (c) specifies the application of the added TGMS inspection requirements for high cant deficiency operations on lower-speed track classes. These requirements apply to vehicle types intended to operate at any curving speed producing more than 5 inches of cant deficiency, as provided in § 213.57(i). Requirements for track Classes 6 through 9 have been amended to reference § 213.332, the new section for combined track alinement and surface deviations.

333*(d) A qualifying TGMS shall be capable of producing, within 24 hours of the inspection, output reports that –*

(1) Provide a continuous plot, on a constant-distance axis, of all measured track geometry parameters required in paragraph (c) of this section;

(2) Provide an exception report containing a systematic listing of all track geometry conditions which constitute an exception to the class of track over the segment surveyed.

333(e)The output reports required under paragraph (c) of this section shall contain sufficient location identification information which enable field forces to easily locate indicated exceptions.

333(f) Following a track inspection performed by a qualifying TGMS, the track owner shall, within two days after the inspection, field verify and institute remedial action for all exceptions to the class of track.

333(g) The track owner or railroad shall maintain for a period of one year following an inspection performed by a qualifying TGMS, a copy of the plot and the exception report for the track segment involved, and additional records which:

(1) Specify the date the inspection was made and the track segment involved; and

(2) Specify the location, remedial action taken, and the date thereof, for all listed exceptions to the class.

Guidance: This paragraph specifies the requirement for TGMS data retention to support appropriate usage of electronic information to comply with FRA's requirements. "Exception report" can be disseminated in electronic form, if the track owner/railroad chooses to do so.

333(h) For track Classes 8 and 9, a qualifying Gage Restraint Measurement System (GRMS) shall be operated at least once per calendar year with at least 170 days between inspections. The lateral capacity of the track structure shall not permit a Gage Widening Projection (GWP) greater than 0.5 inch.

Guidance: This paragraph mandates annual GRMS inspections for track Classes 8 and 9. The number of days (180 days) between inspections has been reduced to 170 days to provide additional operational flexibility in scheduling inspections.

Gage Widening Projection (GWP) is limited to 0.5 inch. The method to determine the GWP is given in paragraph (i) below.

333(i) A GRMS shall meet or exceed minimum design requirements specifying that—

(1) Gage restraint shall be measured between the heads of the 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 a lateral/vertical load ratio of between 0.5 and 1.25[10]*, and a load severity greater than 3 kips but less than 8 kips per rail. Load severity is defined by the formula:*

$$S = L - cV$$

Where—

S = Load severity, defined as the lateral load applied to the fastener system (kips).
L = Actual lateral load applied (kips).
c = Coefficient of friction between rail/tie, which is assigned a nominal value of 0.4.
V = Actual vertical load applied (kips), or static vertical wheel load if vertical load is not measured.

(2) The measured gage and load values shall be converted to a GWP as follows:

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

Where—

UTG = Unloaded track gage measured by the GRMS vehicle at a point no less than 10 feet from any lateral or vertical load application.
LTG = Loaded track gage measured by the GRMS vehicle at a point no more than 12 inches from the lateral load application.

[10] *GRMS equipment using load combinations developing L/V ratios that exceed 0.8 shall be operated with caution to protect against the risk of wheel climb by the test wheelset.*

L = Actual lateral load applied (kips).
V = Actual vertical load applied (kips), or static vertical wheel load if vertical load is not measured.
GWP = Gage Widening Projection, which 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.

Guidance: Paragraph (i)(1) concerns specifications for a GRMS. The unit for loads is *kips*. Vertical load can be taken as static wheel load where vertical load is not measured.

Paragraph (i)(2) describes the GWP equation. The equation incorporates a correction for the weight of the testing vehicle. This correction is also intended to result in more uniform strength measurements across the variety of testing vehicles that are in operation.

The requirements for GRMS testing on Class 9 track, which is expected to have a superior track structure to the extent it supports high-speed operations on a dedicated right-of-way may potential be met by alternative means as per provisions of § 213.307. FRA's regulatory approval of high-speed operations on a dedicated right-of-way may allow for the use of inspection and maintenance criteria and procedures in the alternative to those contained in this subpart, including the GRMS inspection requirements in this paragraph, based upon a showing that at least an equivalent level of safety is provided.

333(j) As further specified for the combination of track class, cant deficiencies, and vehicles subject to paragraphs (j)(1) through (3) of this section, a vehicle having dynamic response characteristics that are representative of other vehicles assigned to the service shall be operated over the route at the revenue speed profile. The vehicle shall either be instrumented or equipped with a portable device that monitors onboard instrumentation on trains. Track personnel shall be notified when onboard accelerometers indicate a possible track-related problem. Testing shall be conducted at the frequencies specified in paragraphs (j)(1) through (3) of this section, unless otherwise determined by FRA after reviewing the test data required by this subpart.

(1) For operations at a qualified cant deficiency, Eu, of more than 5 inches on track Classes 1 through 6, carbody acceleration shall be monitored at least once each calendar quarter with not less than 25 days between inspections on at least one passenger car of each type that is assigned to the service; and

(2) For operations at track Class 7 speeds, carbody and truck accelerations shall be monitored at least twice within any 60-day period with not less than 12 days between inspections on at least one passenger car of each type that is assigned to the service; and

(3) For operations at track Class 8 or 9 speeds, carbody acceleration shall be monitored at least four times within any 7-day period with not more than 3 days between inspections on at least one non-passenger and one passenger carrying vehicle of each type that is assigned to the service, as appropriate. Truck acceleration shall be monitored at least twice within any 60-day period with not less than 12 days between inspections on at least one passenger carrying vehicle of each type that is assigned to the service, as appropriate.

Guidance: This paragraph specifies requirements for monitoring carbody and truck accelerations with emphasis on monitoring frequency. The rule also provides an option to use a portable device when performing the acceleration monitoring.

Paragraph (j)(1) includes monitoring requirements for operations above 5 inches of cant deficiency on track Classes 1 through 6. These requirements for monitoring apply to vehicle types qualified to operate at any curving speed producing more than 5 inches of cant deficiency, as provided in § 213.57(i) and § 213.345(a), as appropriate.

Paragraph (j)(2) applies to operations at track Class 7 speeds, and requires that carbody and truck accelerations be monitored at least twice within any 60-day period, with a minimum of 12 days between inspections on at least one passenger car of each type that is assigned to the service.

Paragraph (j)(3) contains the requirements for monitoring carbody and truck accelerations of equipment operating at Track Class 8 and 9 speeds. The monitoring frequency is four times within any 7-day period for carbody accelerations, and twice within 60 days for truck accelerations. These frequencies are supported by data collected in the past years.

The requirements apply as specified for the combination of track class, cant deficiencies, and vehicles subject to paragraphs (j)(1) through (3). Consequently, the acceleration monitoring requirements in paragraphs (j)(1) and (2) for speeds up to 125 m.p.h. do not apply to equipment operated in a freight train. Requirements in paragraph (j)(3) apply to equipment operating in a freight train only at speeds above 125 m.p.h., and only as appropriate. If no passenger-carrying vehicles are assigned to the service, there will be no passenger-carrying vehicles to monitor. In the case of Amtrak's Acela service at track Class 8 speeds, the carbody acceleration monitoring requirements of paragraph (j)(3) require only one power car (locomotive), i.e., non-passenger carrying vehicle, and one trailer car (passenger coach) to be monitored. In the current Acela service, the café cars, first class cars, and business class cars are all passenger-carrying vehicles of the same dynamic response type and hence considered as one type of passenger- carrying vehicle.

333(k)(1) The instrumented vehicle or the portable device, as required in paragraph (j) of this section, shall monitor lateral and vertical accelerations of the carbody. The accelerometers shall be attached to the carbody on or under the floor of the vehicle, as near the center of a truck as practicable.

(2) In addition, a device for measuring lateral accelerations shall be mounted on a truck frame at a longitudinal location as close as practicable to an axle's centerline (either outside axle for trucks containing more than 2 axles), or, if approved by FRA, at an alternate location. After monitoring this data for 2 years, or 1 million miles, whichever occurs first, the track owner or railroad may petition FRA for exemption from this requirement.

(3) If any of the carbody lateral, carbody vertical, or truck frame lateral acceleration safety limits in this section's table of vehicle/track interaction safety limits is exceeded, corrective action shall be taken as necessary. Track personnel shall be notified when the accelerometers indicate a possible track-related problem.

Guidance: This paragraph specifies the requirement for monitoring carbody and truck accelerations, with emphasis on monitoring methods and remedial actions.

Paragraph (k)(1) clarifies the requirements for locating the carbody accelerometers.

Paragraph (k)(2) clarifies the requirements for locating the truck accelerometers. It also gives the track owner or railroad an option to petition FRA for exemption from this monitoring requirement after the specified monitoring criteria in this paragraph have been met.

Paragraph (k)(3) clarifies the requirements for remedial actions when carbody or truck frame lateral acceleration safety limits in this section's table of vehicle/track interaction safety limits are exceeded. Track personnel must be notified when the accelerometers indicate a possible track-related problem.

333(l) For track Classes 8 and 9, the track owner or railroad shall submit a report to FRA, once each calendar year, which provides an analysis of the monitoring data collected in accordance with paragraphs (j) and (k) of this section. Based on a review of the report, FRA may require that an instrumented vehicle having dynamic response characteristics that are representative of other vehicles assigned to the service be operated over the track at the revenue speed profile. The instrumented vehicle shall be equipped to measure wheel/rail forces. If any of the wheel/rail force limits in this section's table of vehicle/track interaction safety limits is exceeded, appropriate speed restrictions shall be applied until corrective action is taken.

Guidance: This paragraph contains requirements for conducting instrumented wheelset (IWS) testing on Class 8 and 9 track. IWS testing is not a general requirement applicable for all Class 8 and 9 track. Based on review of past Acela Express trainset IWS data and in consideration of the economics associated with the testing, there has been significant cost and little apparent safety benefit associated IWS testing on an annual basis. The specific need to perform IWS testing will be determined by FRA on a case-by-case basis, after reviewing a report submitted annually by the track owner or railroad, detailing the accelerometer monitoring data collected in accordance with paragraphs (j) and (k) of this section.

333(m) The track owner or railroad shall maintain a copy of the most recent exception records for the inspections required under paragraphs (j), (k), and (l) of this section, as appropriate.

Guidance: This paragraph requires that the track owner or railroad maintain a copy of the most recent exception records for the inspections required under paragraphs (j) and (k) of this section, and, as appropriate, paragraph (l) should IWS testing be required.

The exception data shall be maintained as a record, but not necessarily a printed record. Each railroad or track owner is in the best position to determine the most efficient and effective method for keeping this information. The information may be maintained electronically. In this regard, § 213.369(f) requires that each vehicle/track interaction safety record required under § 213.333(g) and (m) be made available for inspection and copying by FRA, and § 213.369(e) sets conditions for maintaining records in an electronic system (or electronic record keeping).

Vehicle/Track Interaction Safety Limits

Wheel-Rail Forces [1]			
Parameter	***Safety Limit***	***Filter/ Window***	***Requirements***
Single Wheel Vertical Load Ratio	*⩾ 0.15*	*5 ft*	*No wheel of the vehicle shall be permitted to unload to less than 15 percent of the static vertical wheel load*

			for 5 or more continuous feet. The static vertical wheel load is defined as the load that the wheel would carry when stationary on level track.
Single Wheel L/V Ratio	$\leq \frac{\tan(\delta) - 0.5}{1 + 0.5\tan(\delta)}$	*5 ft*	*The ratio of the lateral force that any wheel exerts on an individual rail to the vertical force exerted by the same wheel on the rail shall not be greater than the safety limit calculated for the wheel's flange angle (δ) for 5 or more continuous feet.*
Net Axle Lateral L/V Ratio	$\leq 0.4 + \frac{5.0}{V_a}$	*5 ft*	*The net axle lateral force, in kips, exerted by any axle on the track shall not exceed a total of 5 kips plus 40 percent of the static vertical load that the axle exerts on the track for 5 or more continuous feet.* *V_a = static vertical axle load (kips)*
Truck Side L/V Ratio	*≤ 0.6*	*5 ft*	*The ratio of the lateral forces that the wheels on one side of any truck exert on an individual rail to the vertical forces exerted by the same wheels on that rail shall not be greater than 0.6 for 5 or more continuous feet.*

Carbody Accelerations [2]			
Parameter	***Passenger Cars***	***Other Vehicles***	***Requirements***
Carbody Lateral (Transient)	*≤ 0.65g peak-to-peak* *1 sec window*[3] *excludes peaks < 50 msec*	*≤ 0.75g peak-to-peak* *1 sec window*[3] *excludes peaks < 50 msec*	*The peak-to-peak accelerations, measured as the algebraic difference between the two extreme values of measured acceleration in any 1-second time period, excluding any peak lasting less than 50 milliseconds, shall not exceed 0.65g and 0.75g for passenger cars and other vehicles, respectively.*
Carbody Lateral (Sustained Oscillatory)	*≤ 0.10g* RMS_t[4] *4 sec window*[3] *4 sec sustained*	*≤ 0.12g* RMS_t[4] *4 sec window*[3] *4 sec sustained*	*Sustained oscillatory lateral acceleration of the carbody shall not exceed the prescribed (root mean squared) safety limits of 0.10g and 0.12g for passenger cars and other vehicles, respectively. Root mean squared values shall be determined over a sliding 4-second window with linear trend removed and shall be sustained*

			for more than 4 seconds.
Carbody Vertical (Transient)	*≤ 1.0g peak-to-peak 1 sec window*[3] *excludes peaks < 50 msec*	*≤ 1.25g peak-to-peak 1 sec window*[3] *excludes peaks < 50 msec*	*The peak-to-peak accelerations, measured as the algebraic difference between the two extreme values of measured acceleration in any one second time period, excluding any peak lasting less than 50 milliseconds, shall not exceed 1.0g, or 1.25g, as specified.*
Carbody Vertical (Sustained Oscillatory)	*≤ 0.25g* RMS_t[4] *4 sec window*[3] *4 sec sustained*	*≤ 0.25g* RMS_t[4] *4 sec window*[3] *4 sec sustained*	*Sustained oscillatory vertical acceleration of the carbody shall not exceed the prescribed (root mean squared) safety limit of 0.25g. Root mean squared values shall be determined over a sliding 4-second window with linear trend removed and shall be sustained for more than 4 seconds.*
Truck Lateral Acceleration[5]			
Parameter	***Safety Limit***	***Filter/ Window***	***Requirements***
Truck Lateral	*≤ 0.30g* RMS_t[4]	*2 sec window*[3] *2 sec sustained*	*Truck hunting shall not develop below the maximum authorized speed. Truck hunting is defined as a sustained cyclic oscillation of the truck evidenced by lateral accelerations exceeding 0.3g root mean squared for more than 2 seconds. Root mean squared values shall be determined over a sliding 2-second window with linear trend removed.*

1 *The lateral and vertical wheel forces shall be measured and processed through a low pass filter (LPF) with a minimum cut-off frequency of 25 Hz. The sample rate for wheel force data shall be at least 250 samples per second.*

2 *Carbody accelerations in the vertical and lateral directions shall be measured by accelerometers oriented and located in accordance with § 213.333(k).*

3 *Acceleration measurements shall be processed through an LPF with a minimum cut-off frequency of 10 Hz. The sample rate for acceleration data shall be at least 100 samples per second.*

4 RMS_t *= RMS with linear trend removed.*

5 *Truck lateral acceleration shall be measured on the truck frame by accelerometers oriented and located in accordance with § 213.333(k).*

Guidance on the Vehicle/Track Interaction Safety Limits: The limits in the above table have been updated from the 1998 rule:

- The single wheel vertical load ratio limit is to ensure an adequate safety margin for wheel unloading. The ratio actually means percentage, as explained in the "Requirements" column on the right. That is, 0.15 means 15% of the static vertical wheel load. For example, if the static wheel load is 5 kips, the wheel load during the testing must measure 0.75 (5 x 15%) kips or greater for the specified window.

- The net axle lateral L/V ratio limit takes into account the effect of axle load and more appropriately reflect the cumulative, detrimental effect of track panel shift from heavier vehicles. This net axle lateral load limit is intended to control excessive lateral track shift and is sensitive to a number of track parameters. The well-established European Prud'homme limit is a function of the axle load and this sensitivity is desired to differentiate between coach car and heavier locomotive loads. Computer simulations and testing indicated the dependence on axle load and the importance of initial, small lateral deflections.
- To accommodate variations in vehicle design requirements and passenger ride safety, the carbody accelerations have separate limits for "Passenger Cars" and "Other Vehicles" (such as conventional locomotives).
- The lateral carbody transient acceleration limits also differentiate passenger cars (0.65g) and other vehicles (0.75g).
- The vertical carbody transient acceleration, as with lateral carbody transient acceleration limits, differentiate passenger cars (1.0g) and other vehicles (1.25g).

These limits were developed after considerable research into the performance of existing vehicles during qualification testing and revenue operations. It was found that the carbody transient acceleration limits need not be as stringent as the limits in the 1998 rule to protect against events leading to vehicle or passenger safety issues. In addition, transient acceleration peaks lasting less than 50 milliseconds have been excluded because the energy content associated with high-frequency carbody acceleration events is small.

Limits for sustained carbody lateral oscillatory accelerations are set at 0.10g RMS_t (root mean squared with linear trend removed) for passenger cars and 0.12g RMS_t for other vehicles. The sustained vertical carbody oscillatory acceleration limits are 0.25g RMSt for both passenger cars and other vehicles.

These new limits require that the RMS_t value be used in order to attenuate the effects of the linear variation in oscillatory accelerations resulting from a vehicle negotiating track segments with changes in curvature or grade by design, such as spirals. Root mean squared values shall be determined over a sliding 4-second window with linear trend removed and be sustained for more than 4 seconds.

Minimum requirements for sampling and filtering of the acceleration data have been specified. Acceleration measurements shall be processed through a low-pass filter with a minimum cut-off frequency of 10 Hz, and the sample rate for oscillatory acceleration data need be at least 100 samples per second.

The truck lateral acceleration limit used for the detection of truck hunting is 0.3g. The value would have to be exceeded the limit for more than 2 seconds to be considered as an exceedance. Analyses conducted by FRA have shown that this limit will help better identify the occurrences of excessive truck hunting, while excluding high-frequency, low-amplitude oscillations that do not require immediate attention. In addition, this limit requires that the RMSt value be used rather than the RMSm (root mean squared with mean removed) value, to improve the process for analyzing data while the vehicle is negotiating spiral track segments.

It is of utmost importance that the inspector monitor the railroad's compliance with this requirement. The term "representative" does not mean that every type of car which operates at Classes 8 and 9 speeds is required to be equipped with instrumented wheelsets to measure wheel/rail forces, but the instrumented car must be representative of the equipment operating at those speeds. If the inspector has any doubt as to the effectiveness of the railroad's measurement of wheel/rail forces and its program to initiate remedial action, the inspector should contact the regional track specialist who shall seek the assistance of Headquarter's specialists to evaluate the railroad's program. The railroad must maintain a copy of the most recent exception report.

The vehicle/track interaction safety limits are the cornerstone of the high-speed standards. Vehicle/track interaction has critical consequences in railroad safety, and so establishing safe parameters and developing a measurement system to adhere to those parameters is highly important for any track safety program. There are several hazardous and unacceptable vehicle/track interaction events that are well-known in railroad engineering, and for the most part, may occur on existing high-speed operations, including wheel climb, rail roll-over, vehicle overturning, gage widening, and track panel shift.

Defect Codes

0333A1	Failure to operate qualified tgms as required.
0333A2	Failure to inspect using tgms at required frequency.
0333D2	Failure to make tgms records available for inspection.
0333F1	Failure to field verify an tgms exception within two days.
0333F2	Failure to initiate remedial action for tgms exception within two days.
0333G1	Failure of tgms report to provide required information, date or track segment.
0333G2	Failure of tgms report to provide required information, location, remedial action and date thereof.
0333H1	Failure to operate grms at required frequency.
0333H2	Lateral track capacity of track structure permits a gage widening ratio greater than allowed.
0333J1	Failure to equip at least one vehicle per day with required accelerometers.
0333J2	Failure to have written procedures for notification of track personnel when daily accelerometer measurements indicate a possible track-related condition.
0333J3	Failure to follow written procedures for notification of track personnel when daily accelerometer measurements indicate a possible track-related condition.
0333K1	Failure to operate an instrumented car or portable device to measure carbody and truck frame accelerations at required frequency.
0333K2	Failure to reduce train speeds when carbody and truck frame accelerations exceed allowable.
0333L1	Failure to operate an inspection vehicle with instrumented wheelsets to measure wheel/rail forces at required frequency.
0333L2	Failure to reduce train speed when wheel/rail forces exceed allowable.
0333M1	Failure to keep record of wheel/rail force measurements as required.
0333M2	Failure to keep records of acceleration measurements as required.

§ 213.334 Ballast; general

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

334(a) Transmit and distribute the load of the track and railroad rolling equipment to the subgrade;

334(b) Restrain the track laterally, longitudinally, and vertically under dynamic loads imposed by railroad rolling equipment and thermal stress exerted by the rails;

334(c) Provide adequate drainage for the track; and

334(d) Maintain proper track crosslevel, surface, and alinement.

Guidance: Ballast may consist of crushed slag, crushed stone, screened gravel, pit-run gravel, chat, cinders, scoria, pumice, sand, mine waste, or other native material, and is an integral part of the track structure.

Ballast, regardless of the material, must satisfy the requirements stated in the TSS.

Inspectors should consider the overall condition of a track when citing fouled ballast. For example, fouled ballast would be appropriate for a track that has a poor drainage system coupled with incipient track surface conditions at the area in question.

Defect Codes

0334A	Fouled or insufficient ballast failing to transmit and distribute loading
0334B	Fouled or insufficient ballast failing to restrain the track laterally, longitudinally or vertically.
0334C	Fouled ballast failing to provide adequate drainage for the track.
0334D	Fouled or insufficient ballast failing to maintain proper geometry.

§ 213.335 Crossties

335(a) Crossties shall be made of a material to which rail can be securely fastened.

335(b) Each 39 foot segment of track shall have --

(1) A sufficient number of crossties which in combination provide effective support that will –

(i) Hold gage within the limits prescribed in § 213.323(b);

(ii) Maintain surface within the limits prescribed in § 213.331; and

(iii) Maintain alinement within the limits prescribed in § 213.327.

(2) The minimum number and type of crossties specified in paragraph (c) of this section effectively distributed to support the entire segment; and

(3) Crossties of the type specified in paragraph (c) of this section that are(is) located at a joint location as specified in paragraph (e) of this section.

Guidance: When determining compliance with this section, the inspector must ascertain that crossties meet the "definitional" requirements of soundness, and make geometry measurements to verify that each 39-foot segment of track has:

- A sufficient number of effective ties to maintain geometry;
- The required number of sound ties for the track class as described in paragraph (c) and (d);and
- The proper placement of sound ties as described and positioned in paragraph (e) to support joints.

The failure of the crossties to meet any of the three above criteria constitutes a deviation from the TSS.

If track geometry measurements fail to meet the requirements of §§ 213.323, 213.327 and 213.331, and there is a insufficient number of sound crossties, both geometry and crossties could be cited as defects. If geometry measurements exceed the allowable tolerance, but a determination cannot be made that crossties are at fault, it is appropriate to cite only the defective geometry condition.

Each tie must be evaluated individually by the criteria described for timber crossties in paragraph (c) and for concrete crossties in paragraph (d) below.

When determining compliance with the minimum number of non-defective crossties per 39-foot segment, inspectors are reminded that the 39-foot segment may be taken anywhere along the track and need not coincide with joint locations. This portion of the rule applies independently of any other provision of the TSS; it does not require associated evidence of actual or incipient geometry defects or other defective conditions.

A non-defective joint tie must be found within the prescribed distance of the centerline of the joint measured at the rail and not at the centerline of track. Where a very short piece of rail exists within the joint bar, measure from the bar centerline. Where non-symmetrical bars exist (five-hole bars), measure from the design point where rail ends normally abut.

Effective distribution has not been defined, but must not be interpreted by the inspector as synonymous with equally-spaced. The language is intended to address situations where all of the non-defective ties exist in a group at a short area of the 39-foot segment of track in question. Evidence that crossties are not effectively distributed primarily includes indications of actual or incipient deviations from the geometry standards. The word "incipient" means "beginning to appear."

335(c) For non-concrete tie construction, each 39 foot segment of Class 6 track shall have fourteen crossties; Classes 7, 8 and 9 shall have 18 crossties which are not –

(1) Broken through;

(2) Split or otherwise impaired to the extent the crossties will allow the ballast to work through, or will not hold spikes or rail fasteners;

(3) So deteriorated that the tie plate or base of rail can move laterally 3/8 inch relative to the crossties;

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

(5) Configured with less than 2 rail holding spikes or fasteners per tie plate; or

(6) So unable, due to insufficient fastener toeload, to maintain longitudinal restraint and maintain rail hold down and gage.

335(d) For concrete tie construction, each 39 foot segment of Class 6 track shall have fourteen crossties, Classes 7, 8 and 9 shall have 16 crossties which are not--

(1) So deteriorated that the prestress strands are ineffective or withdrawn into the tie at one end and the tie exhibits structural cracks in the rail seat or in the gage of track;

(2) Configured with less than 2 fasteners on the same rail;

(3) So deteriorated in the vicinity of the rail fastener such that the fastener assembly may pull out or move laterally more than 3/8-inch relative to the crosstie;

(4) So deteriorated that the fastener base plate or base of rail can move laterally more than _ inch relative to the crossties;

(5) So deteriorated that rail seat abrasion is sufficiently deep so as to cause loss of rail fastener toeload;

(6) Completely broken through; or

(7) So unable, due to insufficient fastener toeload, to maintain longitudinal restraint and maintain rail hold down and gage.

Guidance: When citing Defect Code 0335C or D, the inspector must show evidence of one or more of the geometry conditions cited in § 213.335(b)(1). Several factors should be documented if the defect is being cited as a violation. These factors include, but are not limited to:

- Geometry conditions
- Class of track
- Curvature
- Traffic density (annual tonnage)
- Rail weight and condition
- Condition of other components of the track

FRA inspectors may use a Portable Track Loading Fixture (PTLF) described in § 213.110 for the purposes of measuring loaded gage to determine effective distribution of crossties.

The inspector must use judgment and discretion in the application of the crosstie standards. They should be used to describe conditions that constitute a risk to the safe operation of trains, and should not be applied in doubtful cases.

No criterion now exists for the maximum distance between non-defective ties, and this measurement should not be used to describe a tie defect. If such a description is appropriate, it should be in terms of the number of adjacent non-defective ties in a group.

335(e) Class 6 track shall have one non-defective crosstie whose centerline is within 18 inches of the rail joint location or two crossties whose center lines are within 24 inches either side of the rail joint location. Class 7, 8, and 9 track shall have two non-defective ties within 24 inches each side of the rail joint.

Guidance: This paragraph dictates that there must be one effective tie on each side of a joint, within the distance specifies for the class of track.

335(f) For track constructed without crossties, such as slab track and track connected directly to bridge structural components, the track structure shall meet the requirements of paragraphs (b)(1)(i), (ii), and (iii) of this section.

Guidance: This paragraph addresses track constructed without conventional crossties, such as concrete-slab track in which the running rails are secured through fixation to another structural member. Railroads are required to maintain gage, surface, and alinement to the standards specified in paragraphs (b)(1)(i), (ii), and (iii).

For non-concrete-tied construction, the requirements for ties parallel those of the lower standards, except that permissive lateral movement of tie plates is set at 3/8-inch instead of 1/2-inch and a requirement for rail holding spikes is added.

335(g) In Classes 7, 8 and 9 there shall be at least three non-defective ties each side of a defective tie.

Guidance: This is ann absolute requirement for Classes 7, 8, and 9. There must be at least three non-defective ties of each side of a defective tie. Inspectors must determine the effectiveness of the ties using the criteria listed in subsection (b) and (c).

335(h) Where timber crossties are in use there shall be tie plates under the running rails on at least nine of 10 consecutive ties.

Guidance: During an inspection, if the inspector finds a missing tie plate under the rails, the inspector must determine that tie plates are under at least nine out of 10 consecutive ties.

335(i) No metal object which causes a concentrated load by solely supporting a rail shall be allowed between the base of the rail and the bearing surface of the tie plate.

Guidance: The reference to a metal object in paragraph (j) is intended to include only those items of track material which pose the greatest potential for broken base rails such as track spikes, rail anchors, and shoulders of tie plates. The phrase “causes a concentrated load by solely supporting a rail” further clarifies the intent of the regulation to apply only in those instances where there is clear physical evidence that the metal object is placing substantial load on the rail base, as indicated by lack of load on adjacent ties.

Defect Codes

0335A	Crossties not made of material to which rail can be securely fastened
0335B2	Fewer than minimum allowable number of non-defective ties per 39 feet.
0335C	Insufficient number of non-defective non-concrete ties to support a 39-foot segment of track
0335D	Insufficient number of non-defective concrete ties to support a 39-foot segment of track
0335E	No effective support ties within the prescribed distance from a joint.
0335F	Track constructed without crossties does not effectively support track structure.
0335G	Fewer than three non-defective ties each side of a defective tie.

0335H	Less than nine out of 10 consecutive ties with tie plates.
0335I	Metal object causing concentrated load between base of rail and bearing surface of tie plate.

§ 213.337 Defective rails

337(a) When an owner of track to which this part applies learns, through inspection or otherwise, that a rail in that track contains any of the defects listed in the following table, a person designated under § 213.305 shall determine whether or not 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
(2) The remedial action prescribed in the table is initiated –

REMEDIAL ACTION

	Length of defect (inch)		*Percent of rail head cross-sectional area weakened by defect*		*If defective rail is not replaced, take the remedial action prescribed in note*
Defect	*More than*	*But not more than*	*Less than*	*But not less than*	
Transverse fissure			*70…….* *100….*	*5…….* *70……* *100….*	*B.* *A2.* *A.*
Compound fissure			*70…….* *100….*	*5* *70* *100*	*B.* *A2.* *A.*
Detail fracture *Engine burn fracture* *Defective weld*			*25……* *80……* *100…..*	*5* *25* *80* *100*	*C.* *D.* *A2 or [E and H]* *A or [E and H]*
Horizontal or Vertical split head *Split web* *Piped rail* *Head web separation*	*1* *2* *4…..* *([1])*	*2……* *4……* *…….* *([1])*	*……* *……* *……* *([1])*	*……* *……* *……* *……*	*H and F.* *I and G.* *B.* *A.*
Bolt hole crack	*½* *1* *1½* *([1])*	*½* *1* *……* *([1])*	*……* *……* *……* *([1])*	*……* *……* *……* *……*	*H and F.* *I and G.* *B.* *A.*
Broken base	*1* *6*	*6* *……*	*……* *……*	*……* *……*	*D* *A or [E and I]*
Ordinary break	*……*	*……*	*……*	*……*	*A or E.*
Damaged rail	*……*	*……*	*……*	*……*	*D.*

Flattened rail	*Depth ≥ ⅜ and Length ≥ 8*	……	……	……	*H.*

([1])Breakout in rail head.

Notes:

A. Assign person designated under § 213.305 to visually supervise each operation over defective rail.

A2.Assign person designated under § 213.305 to make visual inspection. That person may authorize operation to continue without 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.

B. Limit operating speed over defective rail to that as authorized by a person designated under § 213.305(a)(1)(i) or (ii). The operating speed cannot be over 30 mph.

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. Limit operating speed over defective rail to 30 mph until joint bars are applied; thereafter, limit speed to 50 mph When a search for internal rail defects is conducted under § 213.339 and defects are discovered which require remedial action C, the operating speed shall be limited to 50 mph, 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.

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. Limit operating speed over the defective rail to 30 mph or less as authorized by a person designated under § 213.305(a)(1)(i) or (ii) until joint bars are applied; thereafter, limit speed to 50 mph.

E. Apply joint bars to defect and bolt in accordance with § 213.351(d) and (e).

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

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

H. Limit operating speed over defective rail to 50 mph.

I. Limit operating speed over defective rail to 30 mph.

337(b) As used in this section –

(1) Transverse Fissure means a progressive crosswise fracture starting from a crystalline center or nucleus inside the head from which it spreads outward as a smooth, bright, or dark, round or oval surface substantially at a right angle to the length of the rail. The distinguishing features of a transverse fissure from other types of fractures or defects are the crystalline center or nucleus and the nearly smooth surface of the development which surrounds it.

(2) Compound Fissure means a progressive fracture originating in a horizontal split head which turns up or down in the head of the rail as a smooth, bright, or dark surface progressing until substantially at a right angle to the length of the rail. Compound fissures require examination of both faces of the fracture to locate the horizontal split head from which they originate.

(3) Horizontal Split Head means a horizontal progressive defect originating inside of the rail head, usually one-quarter inch or more below the running surface and progressing horizontally in all directions, and generally accompanied by a flat spot on the running surface. The defect appears as a crack lengthwise of the rail when it reaches the side of the rail head.

(4) Vertical Split Head means a vertical split through or near the middle of the head, and extending into or through it. A crack or rust streak may show under the head close to the web or pieces may be split off the side of the head.

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

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

(7) Broken Base means any break in the base of the rail.

(8) Detail Fracture means a progressive fracture originating at or near the surface of the rail head. These fractures should not be confused with transverse fissures, compound fissures, or other defects which have internal origins. Detail fractures may arise from shelly spots, head checks, or flaking.

(9) Engine Burn Fracture means a progressive fracture originating in spots where driving wheels have slipped on top of the rail head. In developing downward they frequently resemble the compound or even transverse fissures with which they should not be confused or classified.

(10) Ordinary Break means a partial or complete break in which there is no sign of a fissure, and in which none of the other defects described in this paragraph (b) are found.

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

(12) Flattened Rail means a short length of rail, not a joint, which has flattened out across the width of the rail head to a depth of _ inch or more below the rest of the rail. Flattened rail occurrences have no repetitive regularity and thus do not include corrugations, and have no apparent localized cause such as a weld or engine burn. Their individual length is relatively short, as compared to a condition such as head flow on the low rail of curves.

(13) Bolt Hole Crack means a crack across the web, originating from a bolt hole, and progressing on a path either inclined upward toward the rail head or inclined downward toward the base. Fully developed bolt hole cracks may continue horizontally along the head/web or base/web fillet, or they may progress into and through the head or base to separate a piece of the rail end from the rail. Multiple cracks occurring in one rail end are

considered to be a single defect. However, bolt hole cracks occurring in adjacent rail ends within the same joint shall be reported as separate defects.

(14) Defective Weld means a field or plant weld containing any discontinuities or pockets, exceeding 5 percent of the rail head area individually or 10 percent in the aggregate, oriented in or near the transverse plane, due to incomplete penetration of the weld metal between the rail ends, lack of fusion between weld and rail end metal, entrainment of slag or sand, under-bead or other shrinkage cracking, or fatigue cracking. Weld defects may originate in the rail head, web, or base, and in some cases, cracks may progress from the defect into either or both adjoining rail ends.

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

Guidance: The remedial actions required for defective rails specify definite time limits and speeds, and allow certain discretion to the track owner for the continued operation over a defect. All rail defects should be considered dangerous by the inspector and care should be taken to determine that proper remedial action has been undertaken by the railroad. When more than one defect is present in a rail, the defect requiring the most restrictive remedial action shall govern.

The remedial action table and specifications in the rule address the risks associated with rail failure. These risks are primarily dependent upon defect type and size and should not be dependent upon the manner or mechanism that reveals the existence of the defect. Failure of the track owner to comply with the operational (speed) restrictions, maintenance procedures and the prescribed inspection intervals specified in § 213.337 and § 213.339 (defective rails and inspection of rail, respectively), may constitute a violation of the TSS.

Note “A2” addresses mid-range transverse defect sizes. This remedial action allows for train operations to continue at a maximum of 10 mph up to 24 hours, following a visual inspection by a person designated under § 213.305. If the rail is not replaced, another 24-hour cycle begins.

Note “B” limits speed to 30 mph as authorized by a § 213.305 designated person. Notes “C,” “D,” and “H” limit the operating speed, following the application of joint bars, to 50 mph.

The remedial action table for defects failing in the transverse plane (transverse and compound fissures, detail and engine burn fractures, and defective welds) specifies a lower limit range base of five percent of the railhead cross sectional area. If a transverse defect is reported to be less than five percent, the track owner is not legally bound to correct and no remedial action would be required under the TSS. Defects reported less than five percent are not consistently found during rail breaking routines and therefore, defect determination within this range is not always reliable.

Transverse and compound fissure defects, weakened between five and 70 percent of cross-sectional head area, require remedial action (note B), as indicated by the prescribed notes. Defects in the range between 70 and less than 100 percent of cross-sectional head area, require remedial action (note A2), as prescribed. Defects that affect 100 percent of the cross-sectional head area, require remedial action (note A) as prescribed, the most restrictive. Inspectors should be aware that transverse and compound fissures are defects that fail in the transverse plane and are characteristic of rail which has not been control-cooled (normally rolled prior to 1936).

Defects identified and grouped as detail fracture, engine burn fracture, and defective welds, will weaken and also fail in the transverse plane. Detail fractures also fail in the transverse plane and are characteristic of control-cooled rail (usually indicated by the letters CC or CH on the rail brand, i.e., 1360 RE CC CF&I 1982 1111). Their prescribed remedial action relates to a low range between five and 25 percent and a mid-range between 25 and 80 percent, for note (C) and note (D), respectively. Those defects require joint bar applications and operational speed restrictions within certain time frames. Defects extending less than 100 and between 80 percent require a visual inspection, an elective to restrict operation to a maximum of 10 mph for up to 24 hours, then another visual inspection, if the rail is not replaced, effectively repaired or the track removed from service.

The second paragraph in remedial action note (C) addresses defects which are discovered in Classes 3 through 5 track during an internal rail inspection required under § 213.339, and whose size is determined not to be in excess of 25 percent of the rail head cross-sectional area. For these specific defects, a track owner may operate for a period not to exceed four days, at a speed limited to 50 mph. If the defective rail is not removed or a permanent repair made within four days of discovery, the speed is limited to 30 mph, until joint bars are applied or the rail is replaced.

The requirements specified in this second paragraph are intended to promote better utilization of rail inspection equipment and therefore maximize the opportunity to discover rail defects that are approaching service failure size. The result of FRA's research indicates that defects of this type and size range have a predictable slow growth life. Research further indicates that even on the most heavily utilized trackage in use today, defects of this type and size are unlikely to grow to service failure size in four days.

In the remedial action table, all longitudinal defects are combined within one group subject to identical remedial actions based on their reported size. These types of longitudinal defects all share similar growth rates and the same remedial actions are appropriate to each type.

Defective rails categorized as Horizontal split head, Vertical split head, Split web, Piped rail, and Head-web separation, are longitudinal in nature. When any of this group of defects is more than 1 inch, but not more than 2 inches, the remedial action initiated, under note (H), is to limit train speed to 50 mph, and note (F) require reinspecting the rail in 90 days, if deciding operations will continue. Defects in the range of more than 2 inches, but not more than 4 inches, require complying with notes (I) and (G), speed is limited to 30 mph and the rail reinspected in 30 days, if they decide operations will continue in service. When any of the five defects exceed a length of 4 inches, a person designated under § 213.305(a) must limit the operating speed to 30 mph, under note (B).

Another form of head-web separation, often referred to as a "fillet cracked rail," is the longitudinal growth of a crack in the fillet area, usually on the gage side of the outer rail of a curve. The crack may not extend the full width between the head and the web, but it is potentially dangerous. Evidence of fillet cracking is a hairline crack running beneath the head of rail with "bleeding" or rust discoloration. Fillet cracks often result from improper superelevation or from stress reversal as a result of transposing rail. The use of a mirror is an effective aid in examining rail and the determination of head-web cracks or separation in the body of the rail, extending beyond the joint bar.

A "bolt hole crack" is a progressive fracture originating at a bolt hole and extending away from the hole, usually at an angle. They develop from high-stress risers, usually initiating as a result of both dynamic and thermal responses of the joint bolt and points along the edge of the hole, under load. A major cause of this high stress is improper field drilling of the hole. Excessive longitudinal rail movement can also cause high stress along the edge of the hole. When evaluating a rail end which has multiple bolt hole cracks, inspectors will determine the required remedial action based on the length of the longest individual bolt hole crack.

Under note (H), the remedial action for a bolt hole crack, more than 1/2-inch but not more than 1-inch, if the rail is not replaced, is to limit speed to 50 mph then reinspect the rail in 90 days, if operations will continue in service. Cracks discovered greater than 1-inch, but not exceeding 1-1/2 inches, should be reinspected within 30 days and the speed limited to 50 mph. For a bolt hole crack exceeding 1-1/2 inches, a person qualified under § 213.305(a) may elect to designate a speed restriction, but cannot exceed 30 mph.

Where corrective action requires rail to be reinspected within a specific number of days after discovery, the track owner may exercise several options for compliance. One option would be to perform another inspection with rail flaw detection equipment, either rail-mounted or hand-held. Another option would be to perform a visual inspection where the defect is visible and measurable. In the latter case, for certain defects enclosed within the joint bar area such as bolt hole breaks, removal of the joint bars will be necessary to comply with the reinspection requirement. If defects remain in track beyond the reinspection interval, the railroad must continue to monitor the defect and take the appropriate action as required in the remedial action table.

A broken base can result from improper bearing of the base on a track spike or tie plate shoulder, from over-crimped anchors, or it may originate in a manufactured seam. With today's higher axle loads, inspectors can anticipate broken base defects in 75-pound and smaller rail sections with an irregular track surface, especially on the field side. For any broken base discovered that is more than 1 inch but less than 6 inches in length, the remedial action (note D) is to apply joint bars bolted through the outermost holes to defect within
10 days, if operations will continue. The operating speed must be reduced to 30 mph or less, as authorized by a person under § 213.305(a), until joint bars are applied. After that, operating speed is limited to 50 mph.

A broken base in excess of 6 inches requires the assignment of a person designated under § 213.305 to visually supervise each train operation over the defective rail. The railroad may apply joint bars to the defect and bolt them in accordance with § 213.351(d) and (e) and thereafter must limit train operations to 30 mph. As reference, the dimensions between the outermost holes of a 24-inch joint bar vary between approximately 15 and 18 inches and a 36-inch joint bar approaches 30 inches.

Inspectors should point out to the track owner that broken bases nearing these dimensions and originating in track, may negate the purpose for which the joint bars are applied. A broken base rail may be caused by damage from external sources, such as rail anchors being driven through the base by a derailed wheel. It is improper to consider them "damaged rail," as this defect is addressed by more stringent provisions applicable to broken base rail, under note (A) or (E) and (I).

Damaged rail can result from flat or broken wheels, incidental hammer blows, or derailed or dragging equipment. Reducing the operational speed to 30 mph until joint bars are applied, lessens the impact force imparted to the weaken area. Applying joint bars under note (D) insures a proper horizontal and vertical rail-end alinement in the event the rail fails.

Flattened rails (localized collapsed head rail) are also caused by mechanical interaction from repetitive wheel loadings. FRA and industry research indicate that these occurrences are more accurately categorized as rail surface conditions, not rail defects, as they do not, in themselves, cause service failure of the rail. Although it is not a condition shown to affect the structural integrity of the rail section, it can result in less-than-desirable dynamic vehicle responses in the higher speed ranges. The flattened rail condition is identified in the table, as well as in the definition portion of § 213.337(b), as being 3/8-inch or more in depth below the rest of the railhead and 8 inches or more in length. As the defect becomes more severe by reducing railhead depth and width size, wheel forces increase. If located either on the outside or inside rail, the limited cross-sectional area of the rail may increase the lateral-to-vertical ratio and cause a wheel-lift condition. The rule addresses the issue of "flattened rail" in terms of a specified remedial action for those of a certain depth and length. Those locations meeting the depth and length criteria shall be limited to an operating speed of 50 mph or the maximum allowable under § 213.307 for the class of track concerned, whichever is lower.

A "break out in rail head" is defined as a piece which has physically separated from the parent rail. Rail defects meeting this definition are required to have each operation over that rail visually supervised by a person designated under § 213.305(a). Inspectors need to be aware that this definition has applicability across a wide range of rail defects, as indicated in the remedial action table. Where rail defects which have not progressed to the point where they meet this strict definition, but due to the type, length and location of the defect present a hazard to continued train operation, inspectors should determine what remedial actions, if any, are to be instituted by the track owner

The issue of "excessive rail wear" continues to be evaluated by FRA's rail integrity research program. FRA believes that insufficient data exists at this time to indicate that parameters for this condition should be proposed as a minimum standard.

The Sperry Rail Service prints an excellent reference manual on rail defects. Inspectors are expected to be conversant with rail defect types, appearance, growth, hazards, and methods of detection.

Defect Codes

0337A	Operation continued over defective rail without required remedial action.
0337B	Rail defect originating from bond wire attachment
0337B2	Compound fissure
0337B3	Horizontal split head

0337B4	Vertical split head
0337B5	Split web
0337B6	Piped rail
0337B7	Broken base
0337B8	Detail fracture
0337B9	Engine burn fracture
0337B10	Ordinary break
0337B11	Damaged rail
0337B12	Flattened rail
0337B13	Bolt-hole crack
0337B14	Broken or defective weld
0337B15	Head web separation

§ 213.339 Inspection of rail in service

339(a) A continuous search for internal defects shall be made of all rail in track at least twice annually with not less than 120 days between inspections

339(b) Inspection equipment shall be capable of detecting defects between joint bars, in the area enclosed by joint bars.

339(c) Each defective rail shall be marked with a highly visible marking on both sides of the web and base.

339(d) If the person assigned to operate the rail defect detection equipment being used determines that, due to rail surface conditions, a valid search for internal defects could not be made over a particular length of track, the test on that particular length of track cannot be considered as a search for internal defects under paragraph (a) of this section.

339(e) If a valid search for internal defects cannot be conducted for reasons described in paragraph (d) of this section, the track owner shall, before the expiration of time 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.

Guidance: A continuous search for internal rail defects must be made of all rail in track classes 6, 7, 8, and 9 at a frequency of twice annually with a minimum of 120 days interval between inspections.

If a valid search for internal defects cannot be conducted because of surface conditions such as shells, head checks, etc. or lubrication or similar conditions, the inspection is not considered an inspection for the purposes of this section. The railroad must reduce operating speed to 25 mph until the valid search is made or the rail is removed from service.

Defect Codes

0339A	Failure to inspect rail for internal defects at required frequency.

0339B	Failure of equipment to inspect rail at joints.
0339C	Defective rail not marked properly.
0339E2	Failure to reduce operating speed until valid rail inspection is performed.

§ 213.341 Initial Inspection of new rail and welds

The track owner shall provide for the initial inspection of newly manufactured rail, and for initial inspection of new welds made in either new or used rail. A track owner may demonstrate compliance with this section by providing for:

341(a) In-service inspection -- A scheduled periodic inspection of rail and welds that have been placed in service, if conducted in accordance with the provisions of § 213.339, and if conducted not later than 90 days after installation, shall constitute compliance with paragraphs (b) and (c) of this section;

341(b) Mill inspection -- A continuous inspection at the rail manufacturer's mill shall constitute compliance with the requirement for initial inspection of new rail, provided that the inspection equipment meets the applicable requirements specified in § 213.339. The track owner shall obtain a copy of the manufacturer's report of inspection and retain it as a record until the rail receives its first scheduled inspection under § 213.339;

341(c) Welding plant inspection -- A continuous inspection at a welding plant, if conducted in accordance with the provisions of paragraph (b) of this section, and accompanied by a plant operator's report of inspection which is retained as a record by the track owner, shall constitute compliance with the requirements for initial inspection of new rail and plant welds, or of new plant welds made in used rail; and

341(d) Inspection of field welds -- An initial inspection of field welds, either those joining the ends of CWR strings or those made for isolated repairs, shall be conducted not less than one day and not more than 30 days after the welds have been made. The initial inspection may be conducted by means of portable test equipment. The track owner shall retain a record of such inspections until the welds receive their first scheduled inspection under § 213.339.

341(e) Each defective rail found during inspections conducted under paragraph (a) or (d) of this section shall be marked with highly visible markings on both sides of the web and base and the remedial action as appropriate under § 213.337 will apply.

Guidance: The railroad must provide initial inspections of newly manufactured rail and initial inspections of new welds made in either new or used rail.

To comply with the requirement to inspect newly manufactured rail, the railroad may conduct an in-service inspection, if conducted in accordance with § 213.339, within 90 days after installation; or

To comply with the requirement to inspect newly manufactured rail, the railroad may elect to conduct a continuous inspection at the rail manufacturer's mill provided that the inspection equipment meets the requirements of § 213.339.

If the mill inspection option is selected, the railroad shall maintain a record of the inspection as specified in this section.

Similarly, the railroad is required to inspect new welds made in new or used rail, either at the plant or in the track.

Each defective rail found under this section must be clearly marked and the proper remedial action taken. Inspector should cite the appropriate defect code in § 213.339 for the type of rail defect found.

Defect Codes

0341B	Failure to conduct initial inspection of new rail.
0341C	Failure to inspect new welds made in new or used rail.
0341E	Failure to clearly mark rail defect found during initial inspection of new rail and welds.

§ 213.343 Continuous welded rail (CWR)

Each track owner with track constructed of CWR shall have in effect written procedures which address the installation, adjustment, maintenance and inspection of CWR, and a training program for the application of those procedures, which shall be submitted to the Federal Railroad Administration within six months following the effective date of this rule. FRA reviews each plan for compliance with the following --

343(a) Procedures for the installation and adjustment of CWR which include --

(1) Designation of a desired rail installation temperature range for the geographic area in which the CWR is located; and

(2) De-stressing procedures/methods which address proper attainment of the desired rail installation temperature range when adjusting CWR.

343(b) Rail anchoring or fastening requirements that will provide sufficient restraint to limit longitudinal rail and crosstie movement to the extent practical, and specifically addressing CWR rail anchoring or fastening patterns on bridges, bridge approaches, and at other locations where possible longitudinal rail and crosstie movement associated with normally expected train-induced forces, is restricted.

343(c) Procedures which specifically address maintaining a desired rail installation temperature range when cutting CWR including rail repairs, in-track welding, and in conjunction with adjustments made in the area of tight track, a track buckle, or a pull-apart. Rail repair practices shall take into consideration existing rail temperature so that --

(1) When rail is removed, the length installed shall be determined by taking into consideration the existing rail temperature and the desired rail installation temperature range; and

(2) Under no circumstances should rail be added when the rail temperature is below that designated by paragraph (a)(1) of this section, without provisions for later adjustment.

343(d) Procedures which address the monitoring of CWR in curved track for inward shifts of alinement toward the center of the curve as a result of disturbed track.

343(e) Procedures which control train speed on CWR track when --

(1) Maintenance work, track rehabilitation, track construction, or any other event occurs which disturbs the roadbed or ballast section and reduces the lateral and/or longitudinal resistance of the track; and

(2) In formulating the procedures under this paragraph (e), the track owner shall--

(i) Determine the speed required, and the duration and subsequent removal of any speed restriction based on the restoration of the ballast, along with sufficient ballast re-consolidation to stabilize the track to a level that can accommodate expected train-induced forces. Ballast re-consolidation can be achieved through either the passage of train tonnage or mechanical stabilization procedures, or both; and

(ii) Take into consideration the type of crossties used.

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

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

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

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

(i) Specify the timing of the inspection; and

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

343(g) The track owner shall have in effect a comprehensive training program for the application of these written CWR procedures, with provisions for periodic re-training, for those individuals designated under § 213.305(c) of this part as qualified to supervise the installation, adjustment, and maintenance of CWR track and to perform inspections of CWR track.

343(h) The track owner shall prescribe recordkeeping requirements necessary to provide an adequate history of track constructed with CWR. At a minimum, these records shall include:

(1) Rail temperature, location and date of CWR installations. This record shall be retained for at least one year; and

(2) A record of any CWR installation or maintenance work that does not conform with the written procedures. Such record shall include the location of the rail and be maintained until the CWR is brought into conformance with such procedures.

343(i) As used in this section –

(1) "Adjusting/De-stressing" means the procedure by which a rail's temperature is re-adjusted to the desired value. It typically consists of cutting the rail and removing rail anchoring devices, which provides for the necessary expansion and contraction, and then re-assembling the track.

(2) "Buckling Incident" means the formation of a lateral mis-alinement sufficient in magnitude to constitute a deviation of 5 inches measured with a 62-foot chord. These normally occur when rail temperatures are relatively high and are caused by high longitudinal compressive forces.

(3) "Continuous Welded Rail (CWR)" means rail that has been welded together into lengths exceeding 400 feet.

(4) "Desired Rail Installation Temperature Range" means the rail temperature range, within a specific geographical area, at which forces in CWR should not cause a buckling incident in extreme heat, or a pull-apart during extreme cold weather.

(5) "Disturbed Track" means the disturbance of the roadbed or ballast section, as a result of track maintenance or any other event, which reduces the lateral or longitudinal resistance of the track, or both.

(6) "Mechanical Stabilization" means a type of procedure used to restore track resistance to disturbed track following certain maintenance operations. This procedure may incorporate dynamic track stabilizers or ballast consolidators, which are units of work equipment that are used as a substitute for the stabilization action provided by the passage of tonnage trains.

(7) "Rail Anchors" means those devices which are attached to the rail and bear against the side of the crosstie to control longitudinal rail movement. Certain types of rail fasteners also act as rail anchors and control longitudinal rail movement by exerting a downward clamping force on the upper surface of the rail base.

(8) "Rail Temperature" means the temperature of the rail, measured with a rail thermometer.

(9) "Tight/Kinky Rail" means CWR which exhibits minute alinement irregularities which indicate that the rail is in a considerable amount of compression.

(10) "Train-induced Forces" means the vertical, longitudinal, and lateral dynamic forces which are generated during train movement and which can contribute to the buckling potential.

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

(12) "Track Longitudinal Resistance" means the resistance provided by the rail anchors/rail fasteners and the ballast section to the rail/crosstie structure against longitudinal displacement.

343(j) Track owners shall revise their CWR plans to include provisions for the inspection of joint bars in accordance with §§213.119(g) and (i)(3).

Guidance: The definition "buckling incident" is provided to explain the industry-accepted threshold for such an event. However, the rule recognizes the importance of conditions that are precursors to buckles.

Paragraph (a) requires the railroad to have in effect and comply with their own written procedures that address the installation, adjustment, maintenance and inspection of CWR.

The written procedures should be reasonable and consistent with current research results. FRA will review each plan for compliance with paragraphs (a) through (f). The FRA Headquarters track specialists and Regional track specialists shall have primary responsibility for reviewing each set of railroad CWR procedures. Inspectors may be requested to provide recommendations concerning the comprehensiveness of those procedures.

In addition to safety critical procedures listed in this section, the railroad may decide to include procedures based on administrative or economic considerations. For example, a railroad may choose to include instructions that limit the use of worn secondhand replacement rail because of an economic concern about the length of time that it might take to perform a satisfactory weld. The railroad may also include specific actions in their procedures that are to be taken when installation or maintenance work does not comply with its overall procedures.

The railroad must record the location of any installation or maintenance work in CWR that does not conform to its procedures in accordance with Section 213.343(h)(2). The record shall be maintained until the CWR is brought into conformance with the railroad's written procedures. The railroad may also wish to include a narrative explanation of the special circumstances involved. Inspectors should periodically review the information recorded in accordance with § 213.343(h)(2) to determine if any work performed on CWR, which does not comply with the railroad procedures, is being properly recorded.

Inspectors must be aware of the procedures in effect before inspecting each railroad. When conducting inspections, the inspector must make observations to determine if the railroad is following its basic safety procedures. If the railroad fails to follow its procedures and the failure may lead to a serious safety problem, the inspector should consider citing the railroad for failure to comply with their CWR procedures. A violation memorandum must document the circumstances involved, including whether or not the railroad recorded the conditions as required under § 213.343(h)(2). However, the inspector should exercise judgment in the reporting of circumstances that do not fully comply with the written procedures. Minor deviations from written CWR procedures should not be considered for enforcement action unless, together with other violations, they are part of a larger safety problem.

Merely recording an activity which does not conform to the railroad's CWR procedures does not provide the railroad with indefinite relief from responsibility for compliance when its procedures are not followed and continued noncompliance may lead to an unsafe condition. The recordkeeping procedure is intended to provide a safety net by flagging those activities of noncompliance, which if not brought into compliance in a timely manner, could lead to an unsafe condition. For example, CWR track installed in the winter months without adequate rail anchors as prescribed by the written procedures and discovered in late summer would clearly be a deficient condition, whether it was recorded or not. When in doubt as to what activities are considered safety-related, the inspector should consult with the regional track specialist.

Under guidance from the regional track specialist, inspectors must determine the adequacy of the railroad's formal training program under § 213.343(g) and (h). Those training procedures are required to be consistent and current with research results, clear, concise, and easy to understand by maintenance-of-way employees.

Railroads typically establish a desired rail installation temperature range for the geographical area that is higher than the annual mean temperature. This higher installation temperature will account for the expected reduction of the force-free temperature caused by track maintenance, train traffic and other factors. A railroad's failure to establish a designated installation temperature range for a specific territory is addressed under § 213.343(a).

The two failure modes associated with track constructed with CWR are track buckles and a pull-aparts. A track buckle is considered the more serious of the two and is characterized by the formation of a large lateral mis-alinement caused by:

- high compressive forces in the rail (thermal and mechanical loads);
- weakened track conditions (weak track resistance, alinement deviations); and
- vehicle loads (a dynamic "wave" uplift and lateral vs. vertical ratios).

Thermal and mechanical loads are opposed by three parameters: lateral, longitudinal, and torsional resistance of the track. Track buckles almost always occur in the lateral direction. Lateral resistance is the most important and is dependent upon weight and size of crosstie material, ballast material type, shoulder width, crib content and the level of consolidation, and vertical loads.

A crosstie's base, side (crib) friction and ballast shoulder resistance contribute to the overall lateral resistance sustained. In general, each contributes (base 50%, side 20-30%, and shoulder 20-30%) to this resistance but the ratios can vary dependant upon ballast condition. Lateral resistance varies in location depending on the ballast shoulder geometry, crosstie size and type, and state of ballast consolidation.

Thermal loads by themselves can cause a buckle and are often called "static buckling." Most buckling, however, occurs under a combination of thermal and vehicle loads, termed "dynamic buckling." Inspectors should place emphasis on vehicle (dynamic) effects on track lateral stability, where high rail temperatures and vehicle loading could progressively weaken the track due to dynamic uplift (flexural waves) and a buckle mechanism response induced by misalignment "growth."

Because the majority of buckles occur under dynamic train movements, loading is an important element in the buckling mechanism. Elements of track lateral instability include:

- formation of <u>initial track misalinements</u> caused by reduced local resistance;
- high impact loads, initial rail surface (weld) imperfections and 'soft' spots in ballast, and curve (radial breathing) shifting; and
- <u>misalinement growth</u> caused by high lateral loads, increased longitudinal forces, track uplifts due to vertical loads, and train induced vibration.

Inspectors may consider the above elements combined with related evidence of actual or incipient geometry defects or other defective structural conditions when evaluating the adequacy of a railroad's CWR stability procedures (or lack thereof) under § 213.343(b), (c), and (d). Locations where imminent track buckling is more likely to occur include: horizontal and vertical curves, bottom of grades, bridge approaches, highway-rail grade crossings, recently disturbed track, and areas of heavy train starting or braking.

The signs or precursors of buckles include:

- newly formed alinement deviations; wavy, kinky, snaky, <u>*etc.*</u>,
- minute rail alinement;
- rails rotating or lifting out of the tie plates and intermittent loose tie plates;
- excessive "running" rail causing ties to plow or churn the ballast;
- insufficient and moving anchors;

- insufficient ballast section in the crib and shoulder areas;
- gaps at crosstie ends, especially on the low (inner) rail; and
- previous buckles improperly repaired.

Curves are more prone to buckling because of the curvature effect, alinement imperfection sensitivity, and train loads. It is important for inspectors to consider when and where a buckle may occur, e.g., on track segments where the CWR was laid "cold" below the desired rail installation temperature range and there was inadequate control of the laying temperature or inadequate adjustment of the rail afterwards. Also, inspectors should observe areas of recent maintenance involving either ballast or rail, where there was inadequate reconsolidating time for disturbed ballast or inadequate temperature adjustment when replacing a defective rail. As curvature increases, the buckling resistance decreases. Under some conditions, high degree curvature can undergo gradual lateral shift (progressive buckling). Lateral alinement deviations reduce the track buckling strength and can initiate growth to critical levels. Vertical alinement deviations can also influence buckling.

Lateral mis-alinement is an important consideration and it influences buckling strength significantly. An alinement offset or mid-ordinate within allowable limits may "grow" under the imposed loads, the ballast, subgrade movement and settlement. This is called "track shift." A longitudinal force in curved track will cause CWR rail to move radially. Compressive loads in the rail during the summer tend to move the track outwards and tensile loads in the winter will pull the track inward, a term known as "radial breathing." Inspectors should review the allowable limits, under § 213.327, and evaluate the relevant alinement and track strength
(§ 213.311, movement under load) due to repeated thermal and vehicle loadings.

Generally speaking, a decrease in the force-free temperature of 30 to 40 degrees from the installation temperature can be critical and lead directly to buckling. Inspectors should monitor the following factors which may influence shifts in the force-free temperature: improper rail installation, inadequate rail anchors or fastenings, lateral movements in curves through lining operations, "skeletonized" track segments, and inadequate ballast section. Lateral and longitudinal restraint is influenced by the factors mentioned above and, if improperly executed or allowed to exist in a defective state, may produce a potential track buckle.

Tangent track buckling incidents are less frequent than in curves. However, buckling in tangent track will generally occur suddenly and with more severe consequences.

The second of the two failure modes can be associated with track constructed with CWR is a pull-apart. A rail's decrease in temperature in the winter will create tensile forces. The maximum tensile load in the rail is determined by the difference in the installation or force-free temperature and the lowest rail temperatures. Enough tensile force can cause direct fracture at rail cross-sections with prior cracks, weak welds or shear joint bolts at CWR string end locations.

A track owner may update or modify CWR procedures as necessary, upon notification to FRA of those changes.

Defect Code

0343Ai[1]	Failure of track owner to develop and implement written CWR

	procedures.
0343Aii[1]	Failure to comply with written CWR procedures.
0343G	Failure of track owner to develop a training program for the implementation of their written cwr procedures.
0343H	Failure to keep cwr records as required.
0343J	Failure to revise cwr plan to include provisions for the inspection of joint bars in accordance with §§ 213.119(g) and (h(1)through (6).

1. The code does not match 213.343(a). It corresponds to the opening paragraph.

§ 213.345 Vehicle qualification testing

General Guidance to § 213.345: The 1998 Track Safety Standards final rule requires that all (passenger and freight) rolling stock be qualified for operation for its intended track class. Qualification testing was intended to demonstrate that the equipment not exceed the VTI limits specified in § 213.333 at any speed less than 10 m.p.h. above the proposed maximum operating speed. An exception was provided for equipment that had already operated in specified track classes. Rolling stock operating in Class 6 track within one year prior to the promulgation of the 1998 final rule was considered qualified. Further, vehicles operating at Class 7 track speeds under conditional waivers prior to the promulgation of the 1998 final rule were qualified for Class 7 track, including equipment that was then-operating on the Northeast Corridor at Class 7 track speeds.

FRA has made a number of significant changes to this section. The heading is modified from “Vehicle qualification testing” to “Vehicle/track system qualification,” to reflect more appropriately the interaction of the vehicle and the track over which it operates as a system. Changes in the text include modifying and clarifying this section’s substantive requirements, reorganizing the structure and layout of the rule text, and revising the qualification procedures. Among the specific changes, high cant deficiency operations on lower-speed track classes are subject to the requirements of this section in accordance with § 213.57(i).

All requirements contained in paragraphs 345(a)–(d) are summarized in the following table for quick reference:

Vehicle/Track System Qualification Reference Chart

<table>
<tr><th rowspan="4">Cant Deficiency, E_u (in)</th><th colspan="9">New Vehicle Type</th><th colspan="9">Qualified Vehicle Type</th></tr>
<tr><th colspan="18">Track Class
& Maximum Allowable Operating Speed (m.p.h.)</th></tr>
<tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td></tr>
<tr><td>15 (10)[1]</td><td>30 (25)</td><td>60 (40)</td><td>80 (60)</td><td>90 (80)</td><td>110</td><td>125</td><td>160</td><td>220</td><td>15 (10)</td><td>30 (25)</td><td>60 (40)</td><td>80 (60)</td><td>90 (80)</td><td>110</td><td>125</td><td>160</td><td>220</td></tr>
<tr><td>$E_u \leq 3$</td><td colspan="5">No Testing or Simulations</td><td>$A_C + A_T$ +(W or S)</td><td colspan="3">$A_C + A_T$ + W + S</td><td colspan="6">No Testing or Simulations</td><td colspan="3">$A_C + A_T$</td></tr>
<tr><td>$3 < E_u \leq 5$</td><td colspan="5">L</td><td rowspan="2">L +A_C + A_T +(W or S)</td><td colspan="3" rowspan="3">L +A_C +A_T + W + S</td><td colspan="6">N</td><td colspan="3">N + A_C + A_T</td></tr>
<tr><td>$5 < E_u \leq 6$</td><td colspan="5">L + A_c</td><td colspan="6">N + A_C</td><td colspan="3" rowspan="2">N + A_C + A_T +(W or S)</td></tr>
<tr><td>$E_u > 6$</td><td colspan="5">L + A_C + W + S</td><td></td><td colspan="6">N + A_C + (W or S)</td></tr>
</table>

A_C = Car body accelerations　**A_T** = Truck accelerometers　**L**[2] = Lean test

N[3] = FRA Notification　**S** = Simulation (MCAT & Segment)　**W** = Wheel-Rail force measurement

1. Numbers in parentheses are max allowable operating speed for freight trains
2. Lean test requirements may be met by static or dynamic testing (W+A), see sections 213.57(d) & 213.329(d)
3. See sections 213.57(h) & 213.329(h)

345(a) General. All vehicle types intended to operate at track Class 6 speeds or above, or at any curving speed producing more than 5 inches of cant deficiency, shall be qualified for operation for their intended track classes in accordance with this subpart. A qualification program shall be used to demonstrate that the vehicle/track system will not exceed the wheel/rail force safety limits and the carbody and truck acceleration criteria specified in § 213.333—

(1) At any speed up to and including 5 m.p.h. above the proposed maximum operating speed; and

(2) On track meeting the requirements for the class of track associated with the proposed maximum operating speed. For purposes of qualification testing, speeds may exceed the maximum allowable operating speed for the class of track in accordance with the test plan approved by FRA.

Guidance: Paragraph (a) specifies criteria for vehicle types to be qualified for operation.

Paragraph (a)(1) specifies that for qualification purposes, the over-speed testing requirement can be 5 m.p.h. above the maximum proposed operating speed.

Paragraph (a)(2) clarifies that for purposes of qualification testing, speeds may exceed the maximum allowable operating speeds for the class of track in accordance with the test plan approved by FRA. This eliminates any potential needs for a Rule of Particular Applicability (RPA) to allow qualification testing above the maximum speeds proposed for the operation. Upon FRA's approval of the qualification test plan, testing at such speeds conducted in accordance with this plan is deemed in compliance with this part 213. This paragraph become applicable if the speed is the maximum class speed, e.g. 110 m.p.h. for class 6. With the 5 m.p.h. allowance as provided in paragraph (a)(1), the testing speed will fall into class 7. This is allowable for test purpose by this paragraph.

Note that for operations on Class 1 through 5 track at curving speeds producing more than 5 inches of cant deficiency, the 5 m.p.h. above the proposed maximum operating speed, in combination with track class and curvature and elevation, could result in a cant deficiency more than 3 inches above the proposed maximum cant deficiency. Should this happen, the lesser speed of 5 m.p.h. over the proposed maximum operating speed would apply.

345(b) Existing vehicle type qualification. Vehicle types previously qualified or permitted to operate at track Class 6 speeds or above or at any curving speeds producing more than 5 inches of cant deficiency prior to March 13, 2013, shall be considered as being successfully qualified under the requirements of this section for operation at the previously operated speeds and cant deficiencies over the previously operated track segment(s).

Guidance: This paragraph addresses the portability of previously qualified vehicle types. The portability provision is applicable to 1) track Class 6 speeds or above; or 2) cant deficiency of 5 inches regardless of speed; and 3) previously operated track segment(s) only.
To qualify such vehicle types to operate over new routes (even at the same track speeds), the qualification requirements contained in other paragraphs of this section must be met.

345(c) New vehicle type qualification. Vehicle types not previously qualified under this subpart shall be qualified in accordance with the requirements of this paragraph (c).

(1) Simulations or measurement of wheel/rail forces. For vehicle types intended to operate at track Class 6 speeds, simulations or measurement of wheel/rail forces during qualification testing shall demonstrate that the vehicle type will not exceed the wheel/rail force safety limits specified in § 213.333. Simulations, if conducted, shall be in accordance with

paragraph (c)(2) of this section. Measurement of wheel/rail forces, if conducted, shall be performed over a representative segment of the full route on which the vehicle type is intended to operate.

(2) Simulations. For vehicle types intended to operate at track Class 7 speeds or above, or at any curving speed producing more than 6 inches of cant deficiency, analysis of vehicle/track performance (computer simulations) shall be conducted using an industry recognized methodology on:

(i) An analytically defined track segment representative of minimally compliant track conditions (MCAT—Minimally Compliant Analytical Track) for the respective track class(es) as specified in appendix D to this part; and

(ii) A track segment representative of the full route on which the vehicle type is intended to operate. Both simulations and physical examinations of the route's track geometry shall be used to determine a track segment representative of the route.

(3) Carbody acceleration. For vehicle types intended to operate at track Class 6 speeds or above, or at any curving speed producing more than 5 inches of cant deficiency, qualification testing conducted over a representative segment of the route shall demonstrate that the vehicle type will not exceed the carbody lateral and vertical acceleration safety limits specified in § 213.333.

(4) Truck lateral acceleration. For vehicle types intended to operate at track Class 6 speeds or above, qualification testing conducted over a representative segment of the route shall demonstrate that the vehicle type will not exceed the truck lateral acceleration safety limit specified in § 213.333.

(5) Measurement of wheel/rail forces. For vehicle types intended to operate at track Class 7 speeds or above, or at any curving speed producing more than 6 inches of cant deficiency, qualification testing conducted over a representative segment of the route shall demonstrate that the vehicle type will not exceed the wheel/rail force safety limits specified in § 213.333.

Guidance: Paragraph (c) contains the requirements for qualifying new vehicle types and references § 213.333 for the applicable VTI limits for accelerations and wheel/rail forces.

Paragraph (c)(1) allows for vehicle types intended to operate at track Class 6 speeds to be qualified either through simulations or the use of IWS to demonstrate compliance with the wheel/rail force limits specified in § 213.333. It makes clears that computer simulations are an alternative to IWS and does not eliminate use of IWS testing. If opted, simulations must be conducted in accordance with paragraph (c)(2). Note that validation of simulations results needs not be done prior to the qualification testing, but can be done during/after the qualification test, using data from the test.

Paragraph (c)(2) requires computer simulations for new vehicle types intended to operate at track Class 7 speeds or above, as well at any curving speed producing more than 6 inches of cant deficiency. This requirement is additional to IWS as specified in (c)(5).

Note that, although in accordance with § 213.57(i), vehicle types intended to operate at cant deficiencies greater than 5 inches on the Class 1-5 classes are subject to the requirements of this section, the requirements of this paragraph (c)(2) apply only to operations at cant deficiencies greater than 6 inches on these classes.

This paragraph (c)(2) requires computer simulations to be conducted on both an analytically defined track segment representative of minimally compliant track conditions (MCAT) for the respective track classes as specified in appendix D, and on a track segment representative of the full route on which the vehicle type is intended to operate (See the guidance for MCAT in appendix D.)

Paragraph (c)(3) requires carbody acceleration testing for all operations at track Class 6 speeds or above, or for any operation above 5 inches of cant deficiency. Note that, in accordance with § 213.57(i), vehicle types intended to operate at cant deficiencies greater than 5 inches on Class 1-5 track are subject to these requirements.

Paragraph (c)(4) requires truck acceleration testing for all operations at track Class 6 speeds or above.

Paragraph (c)(5) requires measurement of wheel/rail forces, through the use of IWS (or equivalent devices) for all operations at track Class 7 speeds or above, or for any operation above 6 inches of cant deficiency. Again, the requirements of paragraph (c)(5) apply to Class 1–5 track only for operations at cant deficiencies greater than 6 inches.

345(d) Previously qualified vehicle types. Vehicle types previously qualified under this subpart for a track class and cant deficiency on one route may be qualified for operation at the same class and cant deficiency on another route through analysis or testing, or both, to demonstrate compliance with paragraph (a) of this section in accordance with the following:

(1) Simulations or measurement of wheel/rail forces. For vehicle types intended to operate at any curving speed producing more than 6 inches of cant deficiency, or at curving speeds that both correspond to track Class 7 speeds or above and produce more than 5 inches of cant deficiency, simulations or measurement of wheel/rail forces during qualification testing shall demonstrate that the vehicle type will not exceed the wheel/rail force safety limits specified in § 213.333. Simulations, if conducted, shall be in accordance with paragraph (c)(2) of this section. Measurement of wheel/rail forces, if conducted, shall be performed over a representative segment of the new route.

(2) Carbody acceleration. For vehicle types intended to operate at any curving speed producing more than 5 inches of cant deficiency, or at track Class 7 speeds and above, qualification testing conducted over a representative segment of the new route shall demonstrate that the vehicle type will not exceed the carbody lateral and vertical acceleration safety limits specified in § 213.333.

(3) Truck lateral acceleration. For vehicle types intended to operate at track Class 7 speeds or above, measurement of truck lateral acceleration during qualification testing shall demonstrate that the vehicle type will not exceed the truck lateral acceleration safety limits specified in § 213.333. Measurement of truck lateral acceleration, if conducted, shall be performed over a representative segment of the new route.

Guidance: Paragraph (d) contains the qualification requirements and provisions for portability for prequalified vehicle intended to operate on new track routes.

Although the vehicle type may remain unchanged, the vehicle/track system still needs to be appropriately examined for deficiencies prior to its service operation on a new route where performance-based standards are relied upon at track Class 7 speeds or above and at cant deficiencies exceeding 5 inches. This seemed to be supported by past experience with the high-speed and high cant deficiency qualification of the Acela trainset where testing at a well-maintained Class 8 test track did not uncover performance issues that were later identified during the local vehicle/track system testing on the Northeast Corridor. It is therefore considered necessary that new vehicle/track system be examined during qualification testing to demonstrate system safety.

Paragraph (d)(1) provides that for all operations at track Class 7 speeds or above and cant deficiencies exceeding 5 inches, or for any operation above 6 inches of cant deficiency, simulations or measurement of wheel/rail forces is required to demonstrate safe, local vehicle/track system performance on a new route. For performance-based standards that address the vehicle/track system, simulations are especially useful for demonstrating that when qualified vehicles are intended to operate on a new route, the new vehicle/track system is adequately examined for deficiencies prior to revenue service operation. It is noted that, once run for the MCAT deviations, a fully-validated vehicle model required for qualifying new vehicle types under this final rule need not be repeated. Only a simulation for a representative track segment from the new route is required, as the results of the MCAT simulations will be kept on file and be available for reference.

Paragraph (d)(1) specifies the requirements for carbody acceleration testing for vehicle types intended to operate cant deficiency exceed 5 inches but not exceed 6 inches for operations at track Class 1 through 6 speeds. The testing is to demonstrate safe, local vehicle/track system performance on a new route.

Paragraph (d)(3) provides that for previously qualified vehicle types intended to operate on new routes at track Class 7 speeds or above, truck acceleration testing is required to demonstrate safe, local vehicle/track system performance.

345(e) Qualification testing plan. To obtain the data required to support the qualification program outlined in paragraphs (c) and (d) of this section, the track owner or railroad shall submit a qualification testing plan to FRA's Associate Administrator for Railroad Safety/Chief Safety Officer (FRA) at least 60 days prior to testing, requesting approval to conduct the testing at the desired speeds and cant deficiencies. This test plan shall provide for a test program sufficient to evaluate the operating limits of the track and vehicle type and shall include:

(1) Identification of the representative segment of the route for qualification testing;
(2) Consideration of the operating environment during qualification testing, including operating practices and conditions, the signal system, highway-rail grade crossings, and trains on adjacent tracks;
(3) The maximum angle found on the gage face of the designed (newly-profiled) wheel flange referenced with respect to the axis of the wheelset that will be used for the determination of the Single Wheel L/V Ratio safety limit specified in § 213.333;
(4) A target maximum testing speed in accordance with paragraph (a) of this section and the maximum testing cant deficiency;
(5) An analysis and description of the signal system and operating practices to govern operations in track Classes 7 through 9, which shall include a statement of sufficiency in these areas for the class of operation; and
(6) The results of vehicle/track performance simulations that are required by this section.

Guidance: Paragraph (e) clarifies the requirements for the content of the qualification testing plan and adds a requirement for the plan to be submitted to FRA at least 60 days prior to conducting the testing.

The paragraph requires that the test plan:

- Identify the test track segment representative of the route ((e)(1)).
- Identify the maximum angle found on the gage face of the designed (newly profiled) wheel flange referenced with respect to the axis of the wheelset ((e)(3)).
- Identify the target maximum testing speed in accordance with paragraph (a) of this section and the maximum testing cant deficiency ((e)(4)).

  The maximum testing speed will be the maximum allowable operating speed + 5 m.p.h. and the maximum testing cant deficiency will be that intended to achieve during qualification testing.
- Include the results of vehicle/track performance simulations ((e)(6)).

345(f) Qualification testing. Upon FRA approval of the qualification testing plan, qualification testing shall be conducted in two sequential stages as required in this subpart.

(1) Stage-one testing shall include demonstration of acceptable vehicle dynamic response of the subject vehicle as speeds are incrementally increased—

(i) On a segment of tangent track, from acceptable track Class 5 speeds to the target maximum test speed (when the target speed corresponds to track Class 6 and above operations); and

(ii) On a segment of curved track, from the speeds corresponding to 3 inches of cant deficiency to the maximum testing cant deficiency.

(2) When stage-one testing has successfully demonstrated a maximum safe operating speed and cant deficiency, stage-two testing shall commence with the subject equipment over a representative segment of the route as identified in paragraph (e)(1) of this section.

(i) A test run shall be conducted over the route segment at the speed the railroad will request FRA to approve for such service.

(ii) An additional test run shall be conducted at 5 m.p.h. above this speed.

(3) When conducting stage-one and stage-two testing, if any of the monitored safety limits is exceeded on any segment of track intended for operation at track Class 6 speeds or greater, or on any segment of track intended for operation at more than 5 inches of cant deficiency, testing may continue provided that the track location(s) where any of the limits is exceeded be identified and test speeds be limited at the track location(s) until corrective action is taken. Corrective action may include making an adjustment in the track, in the vehicle, or both of these system components. Measurements taken on track segments intended for operations below track Class 6 speeds and at 5 inches of cant deficiency, or less, are not required to be reported.

(4) Prior to the start of the qualification testing program, a qualifying TGMS specified in § 213.333 shall be operated over the intended route within 30 calendar days prior to the start of the qualification testing program.

Guidance: Paragraph (f) contains the requirements for conducting qualification testing upon FRA approval of the test plan. This paragraph expressly requires that TGMS equipment be operated over the intended test route within 30 days prior to the start of the testing, to help ensure the integrity of the test results. It also makes clear that exceptions to the safety limits that occur on track or at speeds that are not part of the test do not need to be reported.

Specifically, any exception to the safety limits that occurs at speeds below track Class 6 speeds when the cant deficiency is at or below 5 inches does not need to be reported.

345(g) Qualification testing results. The track owner or railroad shall submit a report to FRA detailing all the results of the qualification program. When simulations are required as part of vehicle qualification, this report shall include a comparison of simulation predictions to the actual wheel/rail force or acceleration data, or both, recorded during full-scale testing. The report shall be submitted at least 60 days prior to the intended operation of the equipment in revenue service over the route.

Guidance: Paragraph (g) contains the requirements for reporting to FRA the results of the qualification testing program. When simulations are required as part of vehicle qualification this report include a comparison of simulation predictions to the actual wheel/rail force or acceleration data, or both, recorded during full-scale testing.
Validation of computer simulation results as required in ((e)(6)) shall be included in this report, correlating with the qualification testing data FRA has sponsored research to establish a set of procedures for validating models used in simulating vehicle/track dynamic interaction. The results are not conclusive. FRA is working on set up guidelines and procedures for validating models.

FRA encourages parties to approach FRA in the vehicle/track system qualification process should they have any questions or concerns about correlating simulation predictions with actual wheel/rail force or acceleration test data.

345(h) Based on the test results and all other required submissions, FRA will approve a maximum train speed and value of cant deficiency for revenue service, normally within 45 days of receipt of all the required information. FRA may impose conditions necessary for safely operating at the maximum approved train speed and cant deficiency.

Guidance: FRA approves a maximum train speed and value of cant deficiency for revenue service, based on the test results and all other required submissions. FRA intends to provide an approval decision normally within 45 days of receipt of all the required information. This paragraph emphasizes on “receipt of all the required information”. If the submission is incomplete upon preliminary examination, FRA will request for additional information. The 45 day period will start upon receipt of the additional information. This paragraph also makes clear that FRA may impose conditions necessary for safely operating at the maximum train speed and value of cant deficiency approved for revenue service.

345(i) 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.

Guidance: This paragraph specifies that documents required by this section must be submitted to FRA by either the tracker owner or an operating entity that provides service with the vehicle type over trackage of one or more track owners with the written consent of all affected track owners. Paragraph (i)(2) is of relevance when an entity, such as Amtrak, wants to operate a high-speed train over trackage owned by one or more freight railroads. A “railroad” includes an “operator of a passenger or commuter service” identified in former § 213.57(e) and § 213.329(f).

§ 213.347 Automotive or railroad crossings at grade

347(a) There shall be no at-grade (level) highway crossings, public or private, or rail-to-rail crossings at-grade on Class 8 and 9 track.

347(b) If train operation is projected at Class 7 speed for a track segment that will include rail-highway grade crossings, the track owner shall submit for FRA's approval a complete description of the proposed warning/barrier system to address the protection of highway traffic and high-speed trains. Trains shall not operate at Class 7 speeds over any track segment having highway-rail grade crossings unless:

(1) An FRA-approved warning/barrier system exists on that track segment and;
(2) All elements of that warning/barrier system are functioning.

Guidance: Highway/rail crossings, public or private, or rail-to-rail crossings at-grade are prohibited on Classes 8 and 9 track.

The railroad must submit for the approval of the FRA Associate Administrator for Railroad Safety/Chief Safety Officer a complete description of the proposed warning/barrier system to address the protection of highway traffic and high-speed trains before operation at Class 7 speeds is permitted at the crossings unless an FRA-approved warning/barrier system exists and all elements of that system are functioning.

Railroads are encouraged to install and maintain the optimal warning/barrier systems on crossings in Class 6 track.

Defect Codes

0347A	Highway/rail crossings or rail-to-rail crossings at-grade are present on Class 8 and 9 track.
0347B	Unapproved warning/barrier systems on class 7 track.

§ 213.349 Rail-end mismatch

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

Class of track	***Any mismatch of rails at joints may not be more than the following***	
	On the tread of the rail ends (inch)	***On the gage side of the rail ends(inch)***
Class 6, 7, 8, & 9	*1/8*	*1/8*

Guidance: Measure when bolts are tight. If bolts are not tight report the condition as a bolt defect. A deviation from the tolerance, as prescribed in the § 213.349 Table, constitutes a reportable exception.

Particular attention should be given to a mismatch on the gage side. A sharp flange, skewed truck, or combination of both may cause wheel climb at a gage mismatch, particularly on the outer rail of a curve. A mismatch, vertical or lateral, is extremely critical on high-speed railroads and may contribute to adverse dynamics in addition to traditional hazards.

Defect Codes

0349A1	Rail-end mismatch on tread of rail exceeds allowable.
0349A2	Rail-end mismatch on gage side of rail exceeds allowable.

§ 213.351 Rail joints

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

351(b) If a joint bar is cracked, broken, or because of wear allows excessive vertical movement of either rail when all bolts are tight, it shall be replaced.

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

351(d) Each rail shall be bolted with at least two bolts at each joint.

351(e) Each joint bar shall be held in position by track bolts tightened to allow the joint bar to firmly support the abutting rail ends and to allow longitudinal movement of the rail in the joint to accommodate expansion and contraction due to temperature variations. When no-slip, joint-to-rail contact exists by design, the requirements of this section do not apply. Those locations, when over 400 feet long, are considered to be continuous welded rail track and shall meet all the requirements for continuous welded rail track prescribed in this subpart.

351(f) No rail shall have a bolt hole which is torch cut or burned.

351(g) No joint bar shall be reconfigured by torch cutting.

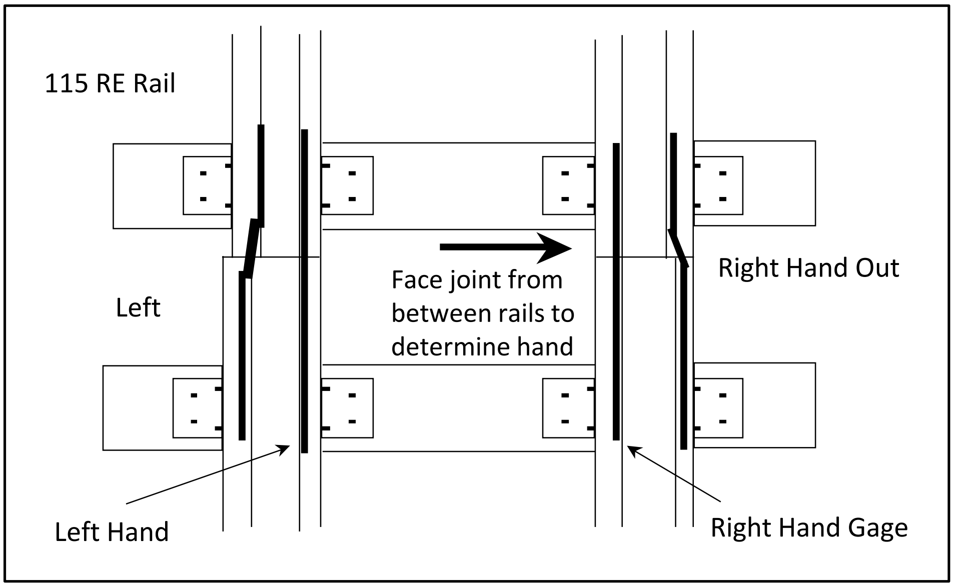
Guidance: Rail joints are considered to be a necessary discontinuity and require special attention by railroad maintenance personnel and safety inspectors.

As far as possible, a rail joint should provide the same strength, stiffness, flexibility, and uniformity as the rail itself.

The TSS recognize these important aspects of rail joints and begin this section with a requirement that rail joints be of a structurally sound design and dimension for the rail on which they are applied (FRA and AREMA/AAR is to convene a working group which will issue guidelines on which joint bars meet the definition of “structurally sound” for the purpose of interchangeability with different rail sections).

For proper rail-load transfer to occur, rail joints must contact the head and base of rail when the bolts are tight. Many rail-joint designs have been used with varying degrees of success, and the TSS do not attempt to single out any particular design as the only acceptable joint. This would inhibit innovation in modern track design.

The TSS only requires structural soundness and bolt condition based on authorized operating train speed. Inspectors are reminded to be alert to locations where different rail sections are joined by rail joints not designed as compromise joints and not identified as fitting both rail sections. The following figure illustrates the proper application of compromise joint bars.



Failure of the owner to change out a center-cracked or other than center-cracked joint bar constitutes a reportable condition. Excessive vertical rail movement within a joint constitutes an exception to the TSS.

Track owners are required to maintain the prescribed number of bolts in rail joints.

Track bolts must be of sufficient tightness to allow the joint bars to support the joint firmly, but will not be so tight as to freeze the joint.

An inspector must be aware that a mechanical bolt tightener has the capability to torque the bolt beyond what is required, and thereby freeze the joint.

Paragraph (f) of this section prohibits the use of a rail containing a bolt hole that has been torch-cut or burned.

Paragraph (g) of this section prohibits the reconfiguration of joint bars by torch cutting.

Rail that has been welded together, either in the field or at a central facility, into lengths exceeding 400 feet are considered continuous welded rail for purposes of applying the requirements of this section.

Defect Codes

0351A	Rail joint not of structurally sound design and dimension.
0351B1	Cracked or broken joint bar (other than center-break).
0351B2	Worn joint bar allows vertical movement of rail in joint.
0351C	center cracked or broken joint bar.

0351D1	Less than 2 bolts per rail at each joint for conventional jointed rail.
0351D2	Less than 2 bolts per rail at any joint in continuous welded rail.
0351E	Loose joint bars.
0351F	Torch-cut or burned-bolt hole.
0351G	Joint bar reconfigured by torch cutting.

§ 213.352 Torch cut rail

352(a) Except as a temporary repair in emergency situations no rail having a torch cut end shall be used. When a rail end with a torch cut is used in emergency situations, train speed over that rail shall not exceed the maximum allowable for Class 2 track. All torch cut rail ends in Class 6 shall be removed be within six months of September 21, 1998.

352(b) Following the expiration of the time limits specified in paragraph (a) of this section, any torch cut rail end not removed shall be removed within 30 days of discovery. Train speed over that rail shall not exceed the maximum allowable for Class 2 track until removed.

Guidance: No torch cutting of rail is permitted except in an emergency such as when the track needs to be quickly returned to service following a derailment or washout.

No torch cut rails are considered to exist in Class 6 and above track prior to the effective date of this rule. Torch cut rails in Class 6, if they exist, must be removed before April 21, 1999. If found, the track speed over the torch cut rail must be reduced to Class 2 and the rail must be removed within 30 days of discovery.

Defect Codes

352A1	Torch cut rail applied for other than emergency.
352A2	Failure to remove torch cut rails within specified time frame.
352B1	Failure to remove non-inventoried torch cut rail within 30 days of discovery.
352B2	Train speed exceeds allowable over torch cut rail.

§ 213.353 Turnouts, track crossings and lift rail assemblies or other transition devices on moveable bridges

353(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 shall be kept free of obstructions that may interfere with the passage of wheels. Use of rigid rail crossings at grade is limited per § 213.347.

Guidance: A turnout is a track arrangement consisting of a switch and frog with connecting and operating parts extending from the point of switch to the heel of frog that allows engines and cars to pass from one track to another. Because of the operating or movable parts and lateral thrust, it is essential that fastenings be in place, tight, and in sound condition.

A crossing is a device used where two tracks intersect at grade permitting traffic on either track to cross the rails of the other. It may consist of four frogs, connected by short rails, or a plant-manufactured diamond. Because of the impact a crossing is subjected to, it is essential that fastenings be in place, tight, and in sound condition. <u>Use of rigid rail crossings at grade is not permitted in Class 8 or 9 track.</u>

Each switch, frog, and guard rail must be kept free of obstruction.

353(b) Track shall be equipped with rail anchoring through and on each side of track crossings and turnouts, to restrain rail movement affecting the position of switch points and frogs. Elastic fasteners designed to restrict longitudinal rail movement are considered rail anchoring.

Guidance: Anchors on each side of a turnout or crossing and through a turnout are mandatory on Class 6 and above. Elastic fasteners designed to restrict longitudinal rail movement are considered rail anchoring. Rail anchoring ensures the:

- Restraint of rail;
- Proper fit of the switch points; and
- Prevention of line irregularities.

Ties and timbers at switches and crossings must be of sound condition and well-tamped, and the roadbed must be adequately drained.

353(c) Each flangeway at turnouts and track crossings shall be at least 1-1/2 inches wide.

Guidance: Flangeways at turnouts and track crossings **must** be at least 1-1/2 inches wide.

353(d) For all turnouts and crossovers, and lift rail assemblies or other transition devices on moveable bridges, the track owner shall prepare an inspection and maintenance Guidebook for use by railroad employees which shall be submitted to the Federal Railroad Administration. The Guidebook shall contain at a minimum –

(1) Inspection frequency and methodology including limiting measurement values for all components subject to wear or requiring adjustment.
(2) Maintenance techniques.

Guidance: For all turnouts and crossovers, and lift rail assemblies or other transition devices on moveable bridges, the railroad must prepare an inspection and maintenance Guidebook for use by railroad employees which shall be submitted to FRA and which shall contain at a minimum:

- Inspection frequency and methodology, including limiting measurement values, for all components subject to wear or requiring adjustment.
- Maintenance techniques.

Inspectors must review the railroad's inspection Guidebook and conduct inspections based on the safety criteria contained therein. In addition, inspectors must ascertain if the Guidebook contains the required information listed above. Inspectors shall use judgment when citing the railroad for its failure to adhere to its Guidebook.

The Guidebook must contain provisions addressing traditional types of high-speed turnouts along with those components which may be developed in the future. Therefore, the inspector has available those defect codes that have been used for several years on lower speed turnouts and switches.

Turnouts must be walked and measurements made before they can be included on the Inspection Report as a unit inspected.

The inspector must do the following when inspecting switches:

- Confirm compliance with railroad Guidebook.
- Check alignment, gage, and surface.
- Examine condition as to wear of switch points and stock rails.
- See that all bolts, nuts, cotter pins, and other fastenings are in place, in good condition, and are properly tightened.
- See that switch points fit snugly against the rail when the switch is thrown in either position.
- Test, in the presence of the owner's representative, the operation of switches for lost motion and loose connections.
- Examine, if applicable, the rod and fastenings that connect the switch point to the switch circuit controller to ensure they are in place and in good condition.
- Examine the condition and support of spring and power switch machines and hand-thrown switch stands, including automatic or safety switch stands. Stand and machine fastenings to the head block ties must be tight to avoid any movement or play.
- Examine switch-lock, keeper (latch), and foot-lock apparatus.
- Examine condition of switch position indicator and note any unnecessary obstruction to its visibility.
- Examine the heel block, its fastenings, and bars; or, in the absence of a heel block, examine the heel of the switch point.
- Examine the seating of stock rails in the switch plates to ensure that the outer tread of a wheel cannot engage the gage side of these rails and that chairs or braces do not cant these rails in.
- Examine the insulation in the gage plates and switch rods in signal territory.

When inspecting frogs, inspectors should do the following:

- Confirm compliance with railroad Guidebook.
- Determine if frogs may be classified as bolted rigid, solid manganese, moveable, rail-bound manganese, or spring rail.
- Ensure that a frog is supported throughout on sound ties and is well-tamped.
- Closely examine every spring rail frog encountered during an inspection. While spring rail frogs have been successfully used for many years, their unique design requires special maintenance attention to avoid derailment hazards to trailing-point train movements on the main track.
- Examine the toe of each spring rail frog. It must be solidly supported and proper hold-down housing clearance maintained to avoid excessive vertical movement of the wing rail. The first sign that this is occurring will be gouging on the gage corner of the wing rail behind the point of frog. Wheel gouging must not be confused with channeling in the spring wing rail that is machined, at the time of manufacture, to accommodate wheel tread transition.
- Determine if the toe is solidly tamped. If it is not, and excessive horn and housing clearance exists, the wing rail may have vertical motion operating on the point rail in a trailing-point movement and the forces on the wing rail will cause the wing rail to move laterally, allowing the wheel to drop in at the throat of the frog.

353(e) Each hand operated switch shall be equipped with a redundant operating mechanism for maintaining the security of switch point position.

Defect Codes

0353A1	Loose, worn, or missing switch clips.
0353A2	Loose, worn, or missing clip bolts (transit, side jaw, eccentric, vertical).
0353A3	Loose, worn, or defective connecting rod.
0353A4	Loose, worn, or defective connecting rod fastening.
0353A5	Loose, worn, or defective switch rod.
0353A6	Loose, worn, or missing switch rod bolts.
0353A7	Worn or missing cotter pins.
0353A8	Loose or missing rigid rail braces.
0353A9	Loose or missing adjustable rail braces.
0353A10	Missing switch, frog, or guard rail plates.
0353A11	Loose or missing switch point stops.
0353A12	Loose, worn, or missing frog bolts.
0353A13	Loose, worn, or missing guard rail bolts.
0353A14	Loose, worn or missing guard rail clamps, wedge, separator block, end block, or other component.
0353A15	Obstruction between switch point and stock rail.
0353A16	Obstruction in flangeway of frog.
0353A17	Obstruction in flangeway of guard rail.
0353A18	Insufficient anchorage to restrain rail movement.
0353A19	Stock rail not securely seated in switch plates.
0353A20	Stock rail canted by overtightening rail braces.
0353A21	Improper fit between switch point and stock rail.
0353A22	Outer edge of wheel contacting gage side of stock rail.
0353A23	Excessive lateral or vertical movement of switch point.
0353A24	Heel of switch insecure.
0353A25	Insecure switch stand or switch machine.
0353A26	Insecure connecting rod.
0353A27	Throw lever operable with switch lock or keeper in place.
0353A28	Switch position indicator not clearly visible.
0353A29	Unusually chipped or worn switch point.
0353A30	Improper switch closure due to metal flow.
0353A31	Insufficient flangeway depth.
0353A32	Frog point chipped, broken, or worn in excess of allowable.
0353A33	Tread portion of frog worn in excess of allowable.
0353A34	Outer edge of wheel contacting side of spring wing rail.
0353A35	Toe of wing rail not fully bolted and tight.
0353A36	Ties under or wing rail not solidly tamped.
0353A37	Bolt-hole defect in frog.
0353A38	Head and web separation in frog.
0353A39	Insufficient tension in spring to hold wing rail against point rail.
0353A40	Excessive clearance between hold-down housing and horn.
0353B	Insufficient rail anchors through or on each side of crossing or turnout.
0353Di	Turnout or crossover not being maintained in accordance with guidebook.

0353Dii	Lift rail assembly or other transition device on moveable bridge not being maintained in accordance with guidebook.
0353E	Hand operated switch not equipped with a redundant operating mechanism for maintaining the security of switch point position

§ 213.355 Frog guard rails and guard faces; gage

The guard check and guard face gages in frogs shall be within the limits prescribed in the following table --

Class of track	*Guard check gage* *The distance between the gage line of a frog to the guard line[1] of its guard rail or guarding face, measured across the track at right angles to the gage line[2], may not be less than*	*Guard face gage* *The distance between guard lines[1], measured across the track at right angles to the gage line[2], may not be more than*
Class 6,7, 8 and 9 track	*4' 6-1/2"*	*4' 5"*

[1] A line along that side of the flangeway which is nearer to the center of the track and at the same elevation as the gage line.
[2] A line five-eighths of an inch below the top of the center line of the head of the running rail, or corresponding location of the tread portion of the track structure.

Guidance: In some high-speed turnout designs, guard rails are not installed.

A guard rail is laid parallel to the running rail opposite a frog to form a flangeway with the rail and thereby to hold wheels of equipment to the proper alignment when passing through the frog.

A guard rail must be maintained in the proper relative position to the frog in order to accomplish its important intended safety function. Inspectors should examine guard rails carefully to see that they are adequately fastened, and when measuring guard rail gage, fully consider any movement of guard rail or frog under traffic conditions.

Section 213.355 clearly specifies allowable tolerances for guard check and guard face gage for Classes 6 through 9 track.

Defect Codes

0355A1	Guard check gage less than allowable.
0355A2	Guard face gage exceeds allowable.
0355A3	Cracked or broken guard rail.

§ 213.357 Derails

357(a) Each track, other than a main track, which connects with a Class 7, 8 or 9 main track shall be equipped with a functioning derail of the correct size and type, unless railroad equipment on the track, because of grade characteristics cannot move to foul the main track.

357(b) For the purposes of this section, a derail is a device which will physically stop or divert movement of railroad rolling stock or other railroad on-track equipment past the location of the device.

357(c) Each derail shall be clearly visible. When in a locked position, a derail shall be free of any lost motion which would prevent it from performing its intended function.

357(d) Each derail shall be maintained to function as intended.

357(e) Each derail shall be properly installed for the rail to which it is applied.

357(f) If a track protected by a derail is occupied by standing railroad rolling stock, the derail shall be in derailing position.

357(g) Each derail on a track which is connected to a Class 7, 8 or 9 main track shall be interconnected with the signal system.

Guidance: Each track, other than a main track, which connects with a Class 7 and above main track must be equipped with a functioning derail of the correct size and type. For purposes of this section, main track is a track, other than an auxiliary track, extending through yards and between stations, upon which trains are operated by timetable or train orders, or both, or the use of which is governed by block signals. Thus, a controlled siding is considered a main track.

For purposes of § 213.357, a derail is a device which will physically stop or divert movement of railroad rolling stock or other railroad on-track equipment past the location of the device.

Inspectors must use judgment in evaluating whether or not a particular situation should constitute an exception to the requirement for derails. If there is any doubt that the railroad equipment, “because of grade characteristics, cannot move to foul the main track,” the inspector should promptly contact the regional track specialist for guidance. The inspector should note that § 213.361 requires the railroad to submit a “right-of-way plan” for FRA approval. This plan must contain provisions for the intrusion of vehicles from adjacent tracks. Inspectors must be constantly vigilant to identify circumstance where intrusion protection is needed.

Derails are of various designs and may be of the following types: switch point, spring switch point, sliding, hinged, and portable.

Derails can be operated by various means: electrical, hand throw, lever, and mechanical rod from a point other than at the derail. They must be installed to derail rolling stock in a direction away from the track or facility to be protected.

If track protected by a derail is occupied by standing railroad rolling stock, the derail must be in derailing position. Of course, the derail would have to be placed in a non-derailing position to prepare for an intentional train movement.

It is absolutely critical that derails on track connected to Class 7 and above main track shall be interconnected with a signal system. Inspectors shall periodically make joint inspection with Signal and Train Control inspectors to determine compliance with this requirement.

Defect Codes

0357A1	Derail not present when required.
0357A2	Improper size derail.
0357B	Derailing device not of proper design physically stop or divert movement.
0357C1	Derail not clearly visible.
0357C2	Derail operable when locked.
0357D	Loose, worn, or defective parts of derail.
0357E	Improperly installed derail.
0357G	Derail not interconnected to the signal system when required.

§ 213.359 Track stiffness

359(a) Track shall have a sufficient vertical strength to withstand the maximum vehicle loads generated at maximum permissible train speeds, cant deficiencies and surface defects. For purposes of this section, vertical track strength is defined as the track capacity to constrain vertical deformations so that the track shall return following maximum load to a configuration in compliance with the vehicle/track interaction safety limits and geometry requirements of this subpart.

359(b) Track shall have sufficient lateral strength to withstand the maximum thermal and vehicle loads generated at maximum permissible train speeds, cant deficiencies and lateral alinement defects. For purposes of this section lateral track strength is defined as the track capacity to constrain lateral deformations so that track shall return following maximum load to a configuration in compliance with the vehicle/track interaction safety limits and geometry requirements of this subpart.

Guidance: Compliance with this section is demonstrated by compliance with track geometry, vehicle/track interaction and CWR requirements in this subpart. Since direct measurements of vertical and lateral track strength are currently difficult to obtain, inspectors must monitor track strength using the tools contained in the track geometry, automated inspection and CWR sections.

Track must have sufficient vertical strength and lateral strength to withstand the maximum loads generated at maximum permissible train speeds, cant deficiency and lateral or vertical defects so that the track will return to a configuration in compliance with the track performance and geometry requirements of this subpart.

It is imperative that the track structure is structurally qualified to accept the loads without unacceptable deformation. The limit of 0.5 for the Net Axle L/V Ratio in the table of vehicle/track interaction safety limits in § 213.333 is based on an extrapolation of the Prud'homme limit and experimental data.

Lateral loads generated by vehicles operating under maximum speed, cant deficiency, thermal loads, and initial line defect conditions should not cause the exception of an allowable deflection limit. Key influencing parameters are the track lateral resistance characteristics, tie/ballast friction coefficients, vehicle vertical axle loads, track curvature, thermal loads, and constant versus variable lateral axle loads.

NO DEFECT CODES

§ 213.361 Right-of-Way

The track owner in Class 8 and 9 shall submit a barrier plan, termed a "right-of-way plan," to the Federal Railroad Administration for approval. At a minimum, the plan will contain provisions in areas of demonstrated need for the prevention of --

361(a) Vandalism;

361(b) Launching of objects from overhead bridges or structures into the path of trains; and

361(c) Intrusion of vehicles from adjacent rights-of-way.

Guidance: The railroad is required to submit a barrier plan to the FRA Associate Administrator for Railroad Safety/Chief Safety Officer for approval. The plan shall address vandalism, launching of objects from overhead bridges or structures, and intrusion.

Inspectors must obtain a copy of the railroad's "right-of-way" plan either from the railroad or the regional track specialist. Inspectors will be asked to evaluate the railroad's right-of-way plan for comprehensiveness and may be directed to prepare a memorandum of recommendations concerning the plan. After the plan becomes effective, inspectors must monitor the safety of the high-speed railroad and advise the regional track specialist of any concerns.

Defect Codes

0361Ai	Failure to provide "Right-of-way" plan.
0361Aii	Failure of "Right-of-way" plan to contain required information.

§ 213.365 Visual inspections

365(a) All track shall be visually inspected in accordance with the schedule prescribed in paragraph (c) of this section by a person designated under § 213.305.

365(b) Each inspection shall be made on foot or by riding over the track in a vehicle at a speed that allows the person making the inspection to visually inspect the track structure for compliance with this part. However, mechanical, electrical, and other track inspection devices may be used to supplement visual inspection. If a vehicle is used for visual inspection, the speed of the vehicle may not be more than 5 mph when passing over track crossings and turnouts, otherwise, the inspection vehicle speed shall be at the sole discretion of the inspector, based on track conditions and inspection requirements. When riding over the track in a vehicle, the inspection will be subject to the following conditions --

(1) *One inspector in a vehicle may inspect up to two tracks at one time provided that the inspector's visibility remains unobstructed by any cause and that the second track is not centered more than 30 feet from the track upon which the inspector is riding;*

(2) *Two inspectors in one vehicle may inspect up to four tracks at a time provided that the inspector's visibility remains unobstructed by any cause and that each track being inspected is centered within 39 feet from the track upon which the inspectors are riding;*

(3) *Each main track is actually traversed by the vehicle or inspected on foot at least once every two weeks, and each siding is actually traversed by the vehicle or inspected on foot at least once every month. On high density commuter railroad lines where track time does not permit an on track vehicle inspection, and where track centers are 15-foot or less, the requirements of this paragraph (b)(3) will not apply; and*

(4) *Track inspection records shall indicate which track(s) are traversed by the vehicle or inspected on foot as outlined in paragraph (b)(3) of this section.*

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

Class of track	***Required frequency***
6, 7, & 8	*Twice weekly with at least 2 calendar-day's interval between inspections.*
9	*Three times per week.*

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

365(e) Each switch, turnout, crossover, and lift rail assemblies on moveable bridges shall be inspected on foot at least weekly. The inspection shall be accomplished in accordance with the Guidebook required under § 213.353.

365(f) In track classes 8 and 9, if no train traffic operates for a period of eight hours, a train shall be operated at a speed not to exceed 100 mph over the track before the resumption of operations at the maximum authorized speed.

Guidance: The success of the track safety program depends on the adequacy of the railroad's inspection and compliance program.

To assure that railroads are providing proper inspection coverage, Federal and State inspectors must periodically examine the railroad's inspection records.

As specified in this section of the TSS, the owner must see that all track is inspected in accordance with the prescribed schedule. Failure of the owner to comply with this schedule may constitute a violation.

If an owner's designated inspector or supervisor finds a deviation from the TSS, failure to initiate remedial action immediately may constitute a violation.
The FRA or State inspector will not make the owner's prescribed inspections, but will monitor them for adherence to the TSS.

For purposes of this section, "main track" is defined as a track, other than an auxiliary track, extending through yards and between stations.

Paragraph (b) does not require five mph over highway crossings. However, this section still requires an operator to perform an adequate inspection regardless of the need to permit safe operation of inspection vehicles through highway crossings.

Paragraph (b) contains language specifying the number of additional tracks that can be inspected, depending on whether one or two qualified individuals are in the vehicle, and depending on the distance between adjacent tracks measured between track center lines. Inspectors may inspect multiple tracks from hi-rail vehicles only if their view of the tracks inspected is unobstructed by tunnels, differences in ground level, or any other circumstance that would prevent an unobstructed inspection of all the tracks they are inspecting.

This section also requires railroad to traverse each main track bi-weekly and each siding monthly, and to so note on the appropriate track inspection records.

It is recognized that many high-speed turnouts (and lift assemblies on moveable bridges) and those which will probably be designed in the future may have unique properties. The railroad must thoroughly understand the nature of these turnouts and establish maintenance and inspection procedures which shall be monitored by FRA and State inspectors. Each turnout, crossover, and lift rail assembly on moveable bridges shall be inspected at least weekly and accomplished in accordance with the Guidebook required under § 213.353. Federal and State inspectors must be familiar with the Guidebook and conduct inspections to monitor the railroad's compliance with the safety limits and procedures established in the Guidebook. The Guidebook must also include provisions for the inspection and maintenance of traditional turnouts. The high-speed railroad must inspect the condition of frogs, stock rails, switch points, etc. as the railroad would do in the lower track classes. (See the discussion in § 213.353.)

In track classes 8 and 9, if traffic is not operated for a period of eight hours, the railroad is required to operate a train not to exceed 100 mph before the resumption of operations at the maximum authorized speed. This provision addresses the possibility of objects or debris being placed on the track. It also mitigates the potential occurrences of vandalism.

This section requires that each inspection performed in accordance with the schedule must be made on foot or by riding over the track in a vehicle at a speed that allows the person making the inspections to visually inspect the track structure for compliance. Therefore, an inspection made from a vehicle driven alongside the track does not constitute an inspection performed at the required frequency. The railroad may make additional inspections using other inspection methods provided that these inspections are Reserved to comply with frequency requirements.

Inspecting after dark is in compliance with the requirements of this Subpart, as long as the railroad inspector is capable of detecting defects. As an example, inspections are routinely made in tunnels or subways with limited or no lighting, and maintenance requirements may require inspections after daylight hours. Appropriate artificial lighting often can be substituted.

When FRA and State inspectors are conducting inspections on a hi-rail vehicle, only the track occupied will be inspected and recorded on the F 6180.96 form. When conducting a walking inspection, multiple tracks may be inspected and counted as units on the F 6180.96

form. It is recognized that walking inspections reveal more defective conditions than hi-rail inspections. Therefore FRA and State inspectors may include multiple tracks while conducting walking inspections. Inspectors will use good judgment in ensuring a high quality inspection while conducting walking inspections. In order to insure that FRA inspections are high quality, when making hi-rail inspections, FRA inspectors will only inspect the track they occupy.

Defect Codes

0365A	Track inspected by other than qualified designated individual.
0365B	Track being inspected at excessive speed.
0365B1	One inspector inspecting more than two tracks.
0365B2	Two inspectors inspecting more than four tracks.
0365B3i	Main track not traversed within the required frequency.
0365B3ii	Siding track not traversed within the required frequency.
0365Bi	Inspection performed on track outside of maximum allowable track center distances.
0365C	Failure to inspect at required frequency.
0365D	Failure to initiate remedial action for deviations found.
0365E1	Failure to inspect turnouts at required frequency.
0365E2	Failure to inspect track crossings at required frequency.
0365E3	Failure to inspect lift rail assemblies or other transition devices on moveable bridges at required frequency.
0365F	Failure to operate a train at 100 mph or less after an eight hour period with no train operation.

§ 213.367 Special inspections

In the event of fire, flood, severe storm, temperature extremes 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.

Guidance: This section is necessarily general in nature because it is not practical to specify all the conditions that could trigger a special inspection, nor the manner and timing which any particular special inspection should be conducted. This section is not meant to imply that train operations must necessarily stop until the special inspection is made. However, all special inspections should be conducted for the primary purpose of determining whether the track structure is safe for the continued operation of trains. Inspectors are directed to review the significant impacts to railroad operations in regard to storms as discussed in any applicable safety advisory.

Because a number of train derailments have been caused by unexpected track damage from moving water in the past, FRA deemed it appropriate to issue a safety advisory recommending procedures that reflect best industry practice for special track inspections. The procedures consist of: (1) prompt notification of dispatchers of expected bad weather; (2) limits on train speed on all track subject to flood damage, following the issuance of a flash flood warning, until special inspection can be performed; (3) identification of bridges carrying Class 4 or higher track which are vulnerable to flooding and over which passenger trains operate; (4) availability of information about each bridge, such as identifying marks, for those who may be called to perform a special inspection; (5) training programs and refresher training for those who perform special inspections; and (6) availability of a bridge maintenance or engineering employee to assist the track inspectors in interpreting the inspectors' findings.

Although the advisory contains a sample list of surprise events that routinely occur in nature, this provision is not limited to only the occurrences listed or to only natural disasters. Section 213.367 addresses the need to inspect after "other occurrences" which include such natural phenomena as temperature extremes, as well as unexpected events that are human-made, e.g., a vehicle that falls on the tracks from an overhead bridge, a water main-break that floods a track roadbed, or terrorist activity that damages track. This interpretation is not new; FRA has always viewed this section to encompass sudden "surprise" events of all kinds that affect the safety and integrity of track.

Inspectors should determine the procedures that have been established by the railroad to comply with § 213.367, mindful that advisory procedures are not mandatory. Procedures should include the method employed by the railroad to receive information on severe weather, i.e., who receives the information and what is done with that information. When the railroad is notified of a track-damaging occurrence, a special inspection must be made. A track owner may designate any official to be responsible to make a determination on whether a special inspection, under § 213.367, is required. The designation is not limited to any certain craft, but the official must be trained and qualified to assure a proper inspection is conducted.

Defect Codes

0367A	Failure to conduct special inspections when required.

§ 213.369 Inspection records

369(a) Each owner of track to which this part applies shall keep a record of each inspection required to be performed on that track under this subpart.

369(b) Except as provided in paragraph (e) of this section, each record of an inspection under § 213.365 shall be prepared on the day the inspection is made and signed by the person making the inspection. Records shall specify the track inspected, date of inspection, location and nature of any deviation from the requirements of this part, and the remedial action taken by the person making the inspection. The owner shall designate the location(s) where each original record shall be maintained for at least one year after the inspection covered by the record. The owner shall also designate one location, within 100 miles of each State in which they conduct operations, where copies of record which apply to those operations are either maintained or can be viewed following 10 days notice by the Federal Railroad Administration.

Guidance: Track owners are required to keep a record of each inspection according to the requirements of this subpart, prepared on the day of inspection and signed by the person making the inspection.

The regulation allows railroads to designate a location within 100 miles of each State (designated locations) where records can be viewed by inspectors. Inspectors are required to give 10 days advance notice before conducting the record keeping inspection of designated locations. The regulation does not require the railroads to maintain the records at these designated locations, only to be able to provide viewing of them at the locations within 10 days after notification. The TSS stipulates locations within 100 miles of each State, rather than locations in each State, to accommodate those railroads whose operations may cross a State's line by only a few miles. In those cases, the railroad could designate a location in a neighboring State, provided the location is within 100 miles of that State's border. Records must be kept for at least 1 year after the inspection covered by the report. It is appropriate for the inspector to expect all records will be available for inspection up to the date of notification

369(c) Rail inspection records shall specify the date of inspection, the location and nature of any internal defects found, the remedial action taken and the date thereof, and the location of any intervals of track not tested per § 213.339(d). The owner shall retain a rail inspection record for at least two years after the inspection and for one year after remedial action is taken.

Guidance: Paragraph (c) requires a track owner to record any locations where a proper rail inspection cannot be performed because of rail surface conditions. Paragraph § 213.339(d) specifies that if rail surface conditions prohibit the railroad from conducting a proper search for rail defects, a test of that rail does not fulfill the requirements of 213.339(a) which requires a search for internal defects at specific intervals. This paragraph requires a record keeping of those instances.

369(d) Each owner required to keep inspection records under this section shall make those records available for inspection and copying by the Federal Railroad Administrator.

369(e) For purposes of compliance with the requirements of this section, an owner of track may maintain and transfer records through electronic transmission, storage, and retrieval provided that --

(1) The electronic system be designed such that the integrity of each record maintained through appropriate levels of security such as recognition of an electronic signature, or other means, which uniquely identify the initiating person as the author of that record. No two persons shall have the same electronic identity;

(2) The electronic storage of each record shall be initiated by the person making the inspection within 24 hours following the completion of that inspection;

(3) The electronic system shall ensure that each record cannot be modified in any way, or replaced, once the record is transmitted and stored;

(4) Any amendment to a record shall be electronically stored apart from the record which it amends. Each amendment to a record shall be uniquely identified as to the person making the amendment;

(5) The electronic system shall provide for the maintenance of inspection records as originally submitted without corruption or loss of data; and

(6) Paper copies of electronic records and amendments to those records, that may be necessary to document compliance with this part, shall be made available for inspection and copying by the FRA and track inspectors responsible under § 213.305. Such paper copies shall be made available to the track inspectors and at the locations specified in paragraph (b) of this section.

(7) Track inspection records shall be kept available to persons who performed the inspection and to persons performing subsequent inspections.

Guidance: Paragraph (e) contains requirements for maintaining and retrieving electronic records of track inspections. This allows each railroad to design its own electronic system as long as the system meets the specified criteria to safeguard the integrity and authenticity of each record. The provision also requires that railroads make available paper copies of electronic records, when needed, by FRA or by railroad track inspectors.

The track owner has the liberty to devise any form deemed sufficient to meet the required standards. If the owner requires inspections at more frequent intervals than specified by § 213.365(c), then the only requirement is to prepare and maintain an inspection record to conform with the minimum inspection frequency. This paragraph is explicit concerning the required information contained in the inspection records. They must specify the track inspected [including the provisions under § 213.365(b)(3)], date of inspection, location and nature of any defect, and the remedial action taken by the person making the inspection. If train operations were conducted over the defect, the nature of the defect would require a measurement to include the specific parameters or limits. When defects are discovered, the track owner's inspectors must determine the risk imposed and immediately initiate remedial action, in accordance with § 213.303. If a speed restriction is used as remedial action, the reduced speed should be shown in the inspection records.

Railroad track inspectors are required to list all deviations from the TSS on their inspection record. FRA and State inspectors should review a railroad inspection record to determine if the reported data accurately indicates the track conditions as they exist in the field. Railroad inspectors are not limited to recording deviations from the TSS (e.g., railroad maintenance items). Inspectors should compare the defects they find with the railroad inspectors reports to determine the level of compliance with the railroad's inspection program. If multiple tracks are being inspected, the records must designate the track traversed, and any tracks not inspected due to visibility obstruction or excessive distance as required under § 213.365.

When two qualified persons inspect multiple tracks in accordance with § 213.365(b), one report or two reports may be optionally prepared. If one report is used, the report must include a notation such as signature, initials or printed name of the second inspector.

Rail inspection records must be maintained by the track owner for at least 2 years after the inspection and for one year after remedial action is taken. The record must specify the location and nature of any rail defects found through internal inspection and the remedial action taken and the date thereof. This record may consist of log sheets combined with a standard rail defect and change-out report, computer records, or other data kept by the track owner and containing all the required information.

The rail inspection records must specify the locations of any rail that, due to rail surface conditions, prohibit the railroad from conducting a valid search for internal defects at the required frequency. If a valid search cannot be conducted before the time or tonnage frequency expires, the remedial action and date of remedial action must be recorded on the inspection records.

369(f) Each vehicle/track interaction safety record required under § 213.333 (g), and (m) shall be made available for inspection and copying by FRA at the locations specified in paragraph (b) of this section.

Guidance: Inspection records must be made available to the FRA or State inspector for inspection and copying. A track owner may elect to maintain and transfer records through electronic transmission, storage, and retrieval procedures. Each record must have sufficient security to maintain the integrity of the record. Levels of security must identify the person making the inspection as the author of the record. No two individuals will have or share the same electronic signature or identity. If individuals use an electronic signature or identity other than their own, violations or personal liability action should be considered for all parties involved. The integrity of electronic inspection record systems is an extremely sensitive issue. Should the system integrity be compromised, an inspector will contact the appropriate track specialist immediately. Should the track specialist be unavailable the inspector will notify the appropriate Regional Administrator. Headquarters Track Division will also be notified.

The system must assure that no record can be replaced, deleted, or modified in any way, once the record has been transmitted and stored. Each amendment to a record shall be stored separately from the record it amends. Each amendment must identify the person making the amendment and have sufficient security to maintain the integrity of the amendment.

For electronic records, inspection records must be completed the day of the inspection either on computer or temporarily on paper. The electronic record must then be uploaded to the permanent electronic storage system where the record will be maintained for 1 year. The uploading of each inspection record must be completed within 24 hours following the completion of the inspection.

An advantage of an electronic system is the associated reduction in paperwork. Inspectors, therefore, must rely on viewing the record on the terminal or monitor screen whenever it is made available for viewing by the railroad. Although printouts of records must be made available to Federal and State inspectors, inspectors are discouraged from requesting paper copies of electronic records unless necessary to document noncompliance. A paper copy of an electronic record may be marked "original" and included in the documentation necessary for a violation report when recommending civil penalties.

Paper copies of electronic records and amendments will be made available for inspection and copying to the FRA or State inspector. These records will be furnished upon request at the location specified by the railroad as required in paragraph (b) of this section. A paper copy of any electronic inspection record or amendment will be made available to the railroad inspector or any subsequent railroad inspectors performing inspections of the same territory upon request.

Defect Codes

0369A	Failure to keep records as required.
0369B1	Failure of inspector to complete report at time of inspection.
0369B2	Failure of inspector to sign report.
0369B3	Failure of inspector to provide required information.
0369C	Failure of rail inspection record to provide required information.
0369D	Failure to make records available for copying and inspection.
0369E1	Electronic system does not maintain the integrity of each record.
0369E2	Electronic storage not initiated within 24 hours.
0369E3	Electronic system allows record or amendments to be modified.

0369E4I	Electronic amendments not stored separately from record.
0369E4II	Person making electronic amendment not identified.
0369E5	Electronic system corrupts or losses data.
0369E6	Paper copies of records not made available for inspection and copying.
0369E7	Inspection reports not available to inspector or subsequent inspectors.

Appendix D to Part 213—Minimally Compliant Analytical Track (MCAT) Simulations Used for Qualifying Vehicles to Operate at High Speeds and at High Cant Deficiencies

1. This appendix contains requirements for using computer simulations to comply with the vehicle/track system qualification testing requirements specified in subpart G of this part. These simulations shall be performed using a track model containing defined geometry perturbations at the limits that are permitted for a specific class of track and level of cant deficiency. This track model is known as MCAT, Minimally Compliant Analytical Track. These simulations shall be used to identify vehicle dynamic performance issues prior to service or, as appropriate, a change in service, and demonstrate that a vehicle type is suitable for operation on the track over which it is intended to operate.

2. As specified in § 213.345(c)(2), MCAT shall be used for the qualification of new vehicle types intended to operate at track Class 7 speeds or above, or at any curving speed producing more than 6 inches of cant deficiency. MCAT may also be used for the qualification of new vehicle types intended to operate at speeds corresponding to Class 6 track, as specified in § 213.345(c)(1). In addition, as specified in § 213.345(d)(1), MCAT may be used to qualify on new routes vehicle types that have previously been qualified on other routes and are intended to operate at any curving speed producing more than 6 inches of cant deficiency, or at curving speeds that both correspond to track Class 7 speeds or above and produce more than 5 inches of cant deficiency.

General Guidance: Appendix D is a new appendix containing the requirements for the use of computer simulations to demonstrate compliance with the vehicle/track system qualification testing requirements specified in subpart G of this part. Comprehensive computational models are capable of assessing the response of vehicle designs to a wide range of track conditions corresponding to the limiting conditions allowed for each class of track. Portions of the qualification requirements in subpart G can be met by simulating vehicle testing using a suitably-validated vehicle model instead of testing an actual vehicle over a representative track segment.

As explained in paragraph 1, the simulations described in this appendix are required to be performed using a track model containing defined geometry deviations for different track segments at the limits that are permitted for a specific class of track and level of cant deficiency. This track model is referred to as MCAT. These simulations shall be used to identify vehicle dynamic performance issues prior to service or, as appropriate, a change in service, and demonstrate that a vehicle type is suitable for operation on the track to be used. The lengths of the MCAT segments identified in this appendix are the same as the segment lengths that were used in the modeling of several representative high-speed vehicles. (for additional information, see the discussion of research and computer modeling in the Technical Background section of the *Federal Register*.)

In order to validate a computer model, the predicted results must be compared to actual data from on-track, instrumented vehicle performance testing using accelerometers, or other instrumentation, or both. Validation must also demonstrate that the model is sufficiently robust to capture fundamental responses observed during field testing. Once validated, the computer model can be used for MCAD or assessing a range of operating conditions or even to examine modifications to current designs.

Paragraph 2 concerns the application of MCAT for vehicle/track system qualification in § 213.345 and was developed in accordance with the changes made to § 213.345.

(a) *<u>Validation</u>. To validate the vehicle model used for simulations under this part, the track owner or railroad shall obtain vehicle simulation predictions using measured track geometry data, chosen from the same track section over which testing shall be performed as specified in § 213.345(c)(2)(ii). These predictions shall be submitted to FRA in support of the request for approval of the qualification testing plan. Full validation of the vehicle model used for simulations under this part shall be determined when the results of the simulations demonstrate that they replicate all key responses observed during qualification testing.*

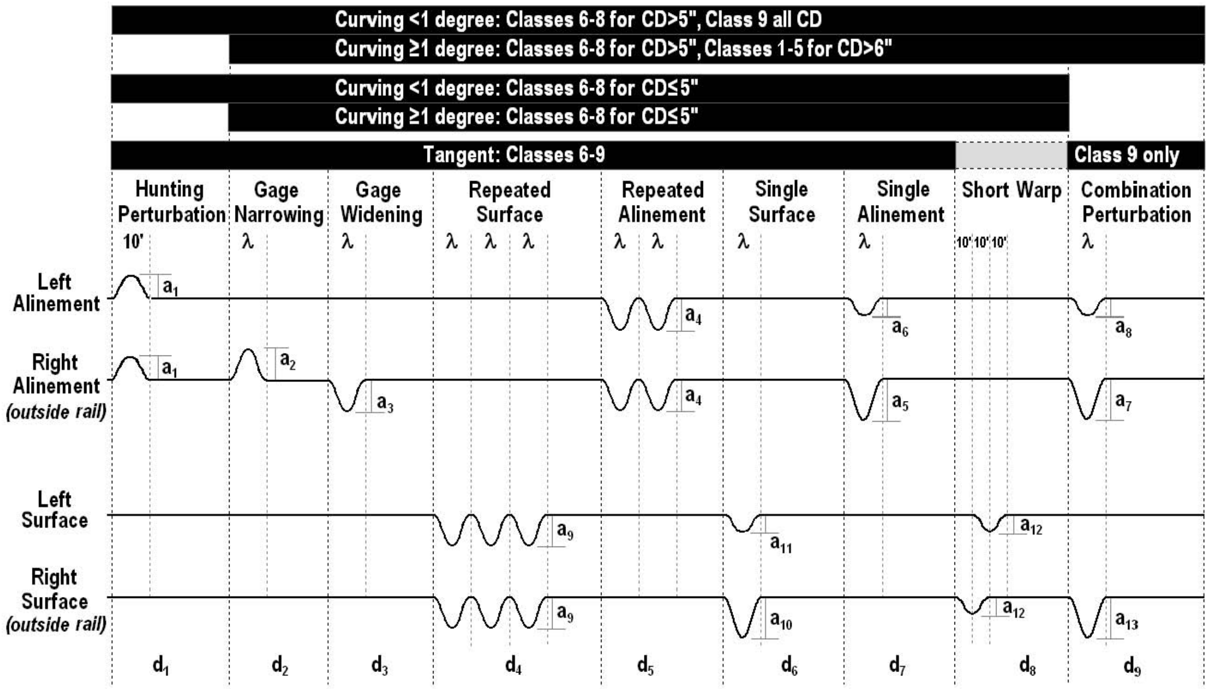
Guidance: Paragraph (a) addresses the validation of the vehicle model used for simulations. As discussed in § 213.345(g). FRA has sponsored research to establish a set of procedures for validating models used in simulating vehicle/track dynamic interaction. FRA intends to publish this research. The results are not conclusive. FRA is working to set up procedures and, when complete, and make it part of FRA's formal guidance on compliance with the Track Safety Standards. Again, in the interim, FRA encourages parties to approach FRA early in the qualification process should they have any questions or concerns about correlating simulation predictions with measured track geometry data.

(b) *<u>MCAT layout</u>. MCAT consists of nine segments, each designed to test a vehicle's performance in response to a specific type of track perturbation. The basic layout of MCAT is shown in figure 1 of this appendix, by type of track (curving or tangent), class of track, and cant deficiency (CD). The values for wavelength, λ, amplitude of perturbation, a, and segment length, d, are specified in this appendix. The bars at the top of figure 1 show which segments are required depending on the speed and degree of curvature. For example, the hunting perturbation section is not required for simulation of curves greater than or equal to 1 degree.*

Guidance: Paragraph (b) specifies the layout of the MCAT segments. The MCAT layout in Figure 1 below clarifies which segments are required depending on the speed and the degree of curvature involved. In particular, the hunting perturbation segment is not required for simulations of curves greater than or equal to 1 degree; the short warp segment is not required for tangent track simulations; and the combined perturbation segment is required on tangent track only for Class 9 track, and is not required for simulations of no more than 5 inches of cant deficiency other than for Class 9 track, where it is required for all cant deficiency values.

Figure 1 of Appendix D to Part 213

Basic MCAT Layout



(1) MCAT segments. MCAT's nine segments contain different types of track deviations in which the shape of each deviation is a versine having wavelength and amplitude varied for each simulation speed as further specified. The nine MCAT segments are defined as follows:

(i) Hunting perturbation (a_1): This segment contains an alinement deviation having a wavelength, λ, of 10 feet and amplitude of 0.25 inch on both rails to test vehicle stability on tangent track and on track that is curved less than 1 degree.

(ii) Gage narrowing (a2): This segment contains an alinement deviation on one rail to reduce the gage from the nominal value to the minimum permissible gage or maximum alinement (whichever comes first).

(iii) Gage widening (a3): This segment contains an alinement deviation on one rail to increase the gage from the nominal value to the maximum permissible gage or maximum alinement (whichever comes first).

(iv) Repeated surface (a9): This segment contains three consecutive maximum permissible profile variations on each rail.

(v) Repeated alinement (a4): This segment contains two consecutive maximum permissible alinement variations on each rail.

(vi) Single surface (a10, a11): This segment contains a maximum permissible profile variation on one rail. If the maximum permissible profile variation alone produces a condition which exceeds the maximum allowed warp condition, a second profile variation is also placed on the opposite rail to limit the warp to the maximum permissible value.

(vii) Single alinement (a5, a6): This segment contains a maximum permissible alinement variation on one rail. If the maximum permissible alinement variation alone produces a condition which exceeds the maximum allowed gage condition, a second alinement variation is also placed on the opposite rail to limit the gage to the maximum permissible value.

(viii) Short warp (a12): This segment contains a pair of profile deviations to produce a maximum permissible 10-foot warp perturbation. The first is on the outside rail, and the second follows 10 feet farther on the inside rail. Each deviation has a wavelength, λ, of 20 feet and variable amplitude for each simulation speed as described below. This segment is to be used only on curved track simulations.

(ix) Combined perturbation (a7, a8, a13): This segment contains a maximum permissible down and out combined geometry condition on the outside rail in the body of the curve. If the maximum permissible variations produce a condition which exceeds the maximum allowed gage condition, a second variation is also placed on the opposite rail as for the MCAT segments described in paragraphs (b)(1)(vi) and (vii) of this appendix. This segment is to be used for all simulations on Class 9 track, and only for curved track simulations at speeds producing more than 5 inches of cant deficiency on track Classes 6 through 8, and at speeds producing more than 6 inches of cant deficiency on track Classes 1 through 5.

Guidance: This paragraph 2(b)(1) describes characteristics of each MCAT segment. Attention need to be paid when using track geometry data from various measurement systems. The data format may have different sign designations for surface and alignment deviations. For example, in FRA's TGMS system, the alignment perturbation that reduces the gage has negative value for the left rail and positive value for the right rail, referencing the traveling direction of track inspection car.

Paragraph (b)(1)(i) makes clear that the hunting perturbation segment applies both to tangent track and to track that is curved less than 1 degree. Figure 1 and the text in paragraph (b)(1)(i) reference curvature conditions under which the hunting segment is to be used. Since the curvature value is calculated using a combination of speed and cant deficiency, there is no need to specify which track classes need to include this section in curving simulations.

The amplitude of 0.25 inch of hunting perturbation *a1* will ensure vehicle stability on tangent track. At this limit, wheel contact should stay on the tread, and the ability of the vehicle to remain stable and resist hunting can appropriately be examined.

Paragraph (b)(1)(ix) makes clear that the combined perturbation segment is to be used for all simulations on Class 9 track. Figure 1 also reflects application of the combined perturbations segment to tangent cases on Class 9 track. These provisions make this appendix consistent with § 213.332.

(2) Segment lengths: Each MCAT segment shall be long enough to allow the vehicle's response to the track deviation(s) to damp out. Each segment shall also have a minimum length as specified in table 1 of this appendix, which references the distances in figure 1 of this appendix. For curved track segments, the perturbations shall be placed far enough in the body of the curve to allow for any spiral effects to damp out.

Table 1 of Appendix D to Part 213

Minimum Lengths of MCAT Segments

Distances (ft)								
d_1	d_2	d_3	d_4	d_5	d_6	d_7	d_8	d_9
1000	*1000*	*1000*	*1500*	*1000*	*1000*	*1000*	*1000*	*1000*

Guidance: Paragraph (b)(2) specifies the required length of MCAT segments. Table 1 lists the minimum lengths of each MCAT segment.
Longer segment lengths can be used at higher speeds to allow for transient response to dissipate and to ensure that the filtering window does not extend to the next MCAT segment.

(3) Degree of curvature.

(i) For each simulation involving assessment of curving performance, the degree of curvature, D, which generates a particular level of cant deficiency, E_u, for a given speed, V, shall be calculated using the following equation, which assumes a curve with 6 inches of superelevation:

$$D = \frac{6 + E_u}{0.0007 \times V^2}$$

Where—
D = Degree of curvature (degrees).
V = Simulation speed (m.p.h.).
E_u = Cant deficiency (inches).

(ii) Table 2 of this appendix depicts the degree of curvature for use in MCAT simulations of both passenger and freight equipment performance on Class 2 through 9 track, based on the equation in paragraph (b)(3)(i) of this appendix. The degree of curvature for use in MCAT simulations of equipment performance on Class 1 track is not depicted; it would be based on the same equation using an appropriate superelevation. The degree of curvature for use in MCAT simulations of freight equipment performance on Class 6 (freight) track is shown in italics for cant deficiencies not exceeding 6 inches, to emphasize that the values apply to freight equipment only.

Guidance: Paragraph (b)(3) concerns degree of curvature for use in MCAT simulations of both passenger and freight equipment performance on Class 2 through 9 track by speed and cant deficiency. Paragraph (b)(3)(i) gives the equation to compute curvature, which is a different form of the V_{max} equation in §§ 213.57 and 213.329.

Paragraph (b)(3)(i) contains the newly added Table 2 that gives the applicable curvature for different track classes and cant deficiency, based on the equation in paragraph (b)(3)(i) of this appendix.

For track Classes 2 through 5, degrees of curvature are identified only where the cant deficiencies are more than 6 inches, since those are the only cant deficiencies that require simulations for such track classes. Degrees of curvature for use in MCAT simulations of equipment performance on Class 1 track are not specified because extraordinarily high values of curvature would correspond to such cant deficiencies, which are not physically practical to allow any rail vehicle to traverse. The highest curvature exiting in the U.S. rail system is approximately 20 degrees. Nonetheless, FRA intends that degrees of curvature for Class 1 track be based on the same equation in paragraph (b)(3)(i) using an appropriate superelevation. FRA also notes that the degrees of curvature for use in MCAT simulations of freight equipment performance on Class 6 (freight) track for speeds of 85 and 90 m.p.h. is shown in italics for cant deficiencies not exceeding 6 inches, to emphasize that these values apply to freight equipment only. MCAT simulations are required for both passenger and freight equipment performance where track Class 6 speeds coincide, i.e., speeds exceeding 90 m.p.h.

Table 2 of Appendix D to Part 213
Degree of Curvature for Use in MCAT Simulations (Track Classes 2 through 9)

Passenger	m.p.h.	Tangent	Cant Deficiency (inches) 3	4	5	6	7	8	9	m.p.h.	Freight
		Degree of curvature used in simulations									
Class 2	20						46.4	50.0	53.6	20	Class 2
Class 2	25						29.7	32.0	34.3	25	Class 2
Class 2	30						20.6	22.2	23.8	30	Class 3
Class 3	35						15.2	16.3	17.5	35	Class 3
Class 3	40						11.6	12.5	13.4	40	Class 3
Class 3	45						9.17	9.88	10.6	45	Class 4
Class 3	50						7.43	8.00	8.57	50	Class 4
Class 3	55						6.14	6.61	7.08	55	Class 4
Class 3	60						5.16	5.56	5.95	60	Class 4
Class 4	65						4.40	4.73	5.07	65	Class 5
Class 4	70						3.79	4.08	4.37	70	Class 5
Class 4	75						3.30	3.56	3.81	75	Class 5
Class 4	80						2.90	3.13	3.35	80	Class 5
Class 5	85	0.00	1.78	1.98	2.18	2.37	2.57	2.77	2.97	85	Class 6
Class 5	90	0.00	1.59	1.76	1.94	2.12	2.29	2.47	2.65	90	Class 6
Class 6	95	0.00	1.42	1.58	1.74	1.90	2.06	2.22	2.37	95	Class 6
Class 6	100	0.00	1.29	1.43	1.57	1.71	1.86	2.00	2.14	100	Class 6
Class 6	105	0.00	1.17	1.30	1.43	1.55	1.68	1.81	1.94	105	Class 6
Class 6	110	0.00	1.06	1.18	1.30	1.42	1.53	1.65	1.77	110	Class 6
Class 7	115	0.00	0.97	1.08	1.19	1.30	1.40	1.51	1.62	115	Class 7
Class 7	120	0.00	0.89	0.99	1.09	1.19	1.29	1.39	1.49	120	Class 7
Class 7	125	0.00	0.82	0.91	1.01	1.10	1.19	1.28	1.37	125	Class 7
Class 8	130	0.00	0.76	0.85	0.93	1.01	1.10	1.18	1.27	130	Class 8
Class 8	135	0.00	0.71	0.78	0.86	0.94	1.02	1.10	1.18	135	Class 8
Class 8	140	0.00	0.66	0.73	0.80	0.87	0.95	1.02	1.09	140	Class 8
Class 8	145	0.00	0.61	0.68	0.75	0.82	0.88	0.95	1.02	145	Class 8
Class 8	150	0.00	0.57	0.63	0.70	0.76	0.83	0.89	0.95	150	Class 8
Class 8	155	0.00	0.54	0.59	0.65	0.71	0.77	0.83	0.89	155	Class 8
Class 8	160	0.00	0.50	0.56	0.61	0.67	0.73	0.78	0.84	160	Class 8
Class 9	165	0.00	0.47	0.52	0.58	0.63	0.68	0.73	0.79	165	Class 9
Class 9	170	0.00	0.44	0.49	0.54	0.59	0.64	0.69	0.74	170	Class 9
Class 9	175	0.00	0.42	0.47	0.51	0.56	0.61	0.65	0.70	175	Class 9
Class 9	180	0.00	0.40	0.44	0.49	0.53	0.57	0.62	0.66	180	Class 9
Class 9	185	0.00	0.38	0.42	0.46	0.50	0.54	0.58	0.63	185	Class 9

	190	*0.00*	*0.36*	*0.40*	*0.44*	*0.47*	*0.51*	*0.55*	*0.59*	*190*	
	195	*0.00*	*0.34*	*0.38*	*0.41*	*0.45*	*0.49*	*0.53*	*0.56*	*195*	
	200	*0.00*	*0.32*	*0.36*	*0.39*	*0.43*	*0.46*	*0.50*	*0.54*	*200*	
	205	*0.00*	*0.31*	*0.34*	*0.37*	*0.41*	*0.44*	*0.48*	*0.51*	*205*	
	210	*0.00*	*0.29*	*0.32*	*0.36*	*0.39*	*0.42*	*0.45*	*0.49*	*210*	
	215	*0.00*	*0.28*	*0.31*	*0.34*	*0.37*	*0.40*	*0.43*	*0.46*	*215*	
	220	*0.00*	*0.27*	*0.30*	*0.32*	*0.35*	*0.38*	*0.41*	*0.44*	*220*	

(c) Required simulations.

(1) To develop a comprehensive assessment of vehicle performance, simulations shall be performed for a variety of scenarios using MCAT. These simulations shall be performed on tangent or curved track, or both, depending on the level of cant deficiency and speed (track class) as summarized in table 3 of this appendix.

Table 3 of Appendix D to Part 213

Summary of Required Vehicle Performance Assessment Using Simulations

	New vehicle types	*Previously qualified vehicle types*
Curved track: cant deficiency ⩽ 6 inches	*Curving performance simulation: not required for track Classes 1 through 5; optional for track Class 6; required for track Classes 7 through 9*	*Curving performance simulation: not required for track Classes 1 through 6; optional for track Classes 7 through 9 for cant deficiency > 5 inches*
Curved track: cant deficiency > 6 inches	*Curving performance simulation required for all track classes*	*Curving performance simulation optional for all track classes*
Tangent track	*Tangent performance simulation: not required for track Classes 1 through 5; optional for track Class 6; required for track Classes 7 through 9*	*Tangent performance simulation not required for any track class*

(i) All simulations shall be performed using the design wheel profile and a nominal track gage of 56.5 inches, using tables 4, 5, 6, or 7 of this appendix, as appropriate. In addition, all simulations involving the assessment of curving performance shall be repeated using a nominal track gage of 57.0 inches, using tables 5, 6, or 7 of this appendix, as appropriate.

(ii) If the wheel profile is different than American Public Transportation Administration (APTA) wheel profiles 320 or 340, then for tangent track segments all simulations shall be repeated using either APTA wheel profile 320 or 340, depending on the established conicity that is common for the operation, as specified in APTA SS-M-015-06, Standard for Wheel Flange Angle of Passenger Equipment (2007). This APTA standard is incorporated by reference into this appendix with the approval of the Director of the Federal Register under 5 U.S.C. 552(a) and 1 CFR part 51. To enforce any edition other than that specified in this appendix, FRA must publish notice of change in the

Federal Register and the material must be made available to the public. All approved material is available for inspection at the Federal Railroad Administration, Docket Clerk, 1200 New Jersey Avenue, SE., Washington, DC 20590 (telephone 202-493-6030), and is available from the American Public Transportation Association, 1666 K Street NW., Suite 1100, Washington, DC 20006 (telephone 202-496-4800; www.apta.com). It is also available for inspection at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, call 202-741-6030 or go to http://www.archives.gov/federal_register/code_of_federal_regulations/ibr_locations.html

An alternative worn wheel profile may be used in lieu of either APTA wheel profile, if approved by FRA.

(iii) All simulations shall be performed using a wheel/rail coefficient of friction of 0.5.

Guidance: Paragraph (c) identifies and describes the simulations that are required using MCAT. Table 3 summarizes the requirements by vehicle type, cant deficiency, and class of track when assessments of vehicle performance using MCAT.

The rule makes explicit when simulations are required, including identifying when simulations are an option for demonstrating compliance with the rule.

Paragraph (c)(1)(ii) addresses the use of worn wheel profiles in simulations.

Simulations using worn wheels will be conducted only for tangent track segments. Worn wheel profiles can both present a problem for stability on tangent track and affect response during curving. However, the effect of wheel wear on stability on tangent track is of paramount concern. For all other vehicle and rail parameters that might equally or more significantly affect response during curving, only nominal values for such parameters are required to be used in MCAT simulations. Therefore, it is not required that simulations be conducted with worn wheel profiles in curves.

(2) Vehicle performance on tangent track Classes 6 through 9. For maximum vehicle speeds corresponding to track Class 6 and higher, the MCAT segments described in paragraphs (b)(1)(i) through (vii) of this appendix shall be used to assess vehicle performance on tangent track. For track Class 9, simulations must also include the combined perturbation segment described in paragraph (b)(1)(ix) of this appendix. A parametric matrix of MCAT simulations shall be performed using the following range of conditions:

(i) Vehicle speed. Simulations shall demonstrate that at up to 5 m.p.h. above the proposed maximum operating speed, the vehicle type shall not exceed the wheel/rail force and acceleration criteria defined in the Vehicle/Track Interaction Safety Limits table in § 213.333. Simulations shall also demonstrate acceptable vehicle dynamic response by incrementally increasing speed from 95 m.p.h. (115 m.p.h. if a previously qualified vehicle type on an untested route) to 5 m.p.h. above the proposed maximum operating speed (in 5 m.p.h. increments).

(ii) Perturbation wavelength. For each speed, a set of three separate MCAT simulations shall be performed. In each MCAT simulation for the perturbation segments described

in paragraphs (b)(1)(ii) through (vii) and (b)(1)(ix) of this appendix, every perturbation shall have the same wavelength. The following three wavelengths, λ, shall be used: 31, 62, and 124 feet. The hunting perturbation segment described in paragraph (b)(1)(i) of this appendix has a fixed wavelength, λ, of 10 feet.

(iii) Amplitude parameters. Table 4 of this appendix provides the amplitude values for the MCAT segments described in paragraphs (b)(1)(i) through (vii) and (b)(1)(ix) of this appendix for each speed of the required parametric MCAT simulations. The last set of simulations shall be performed at 5 m.p.h. above the proposed maximum operating speed using the amplitude values in table 4 that correspond to the proposed maximum operating speed. For qualification of vehicle types at speeds greater than track Class 6 speeds, the following additional simulations shall be performed:

(A) For vehicle types being qualified for track Class 7 speeds, one additional set of simulations shall be performed at 115 m.p.h. using the track Class 6 amplitude values in table 4 (i.e., a 5 m.p.h. overspeed on Class 6 track).

(B) For vehicle types being qualified for track Class 8 speeds, two additional sets of simulations shall be performed. The first set at 115 m.p.h. using the track Class 6 amplitude values in table 4 (i.e., a 5 m.p.h. overspeed on Class 6 track), and a second set at 130 m.p.h. using the track Class 7 amplitude values in table 4 (i.e., a 5 m.p.h. overspeed on Class 7 track).

(C) For vehicle types being qualified for track Class 9 speeds, three additional sets of simulations shall be performed. The first set at 115 m.p.h. using the track Class 6 amplitude values in table 4 (i.e., a 5 m.p.h. overspeed on Class 6 track), a second set at 130 m.p.h. using the track Class 7 amplitude values in table 4 (i.e., a 5 m.p.h. overspeed on Class 7 track), and a third set at 165 m.p.h. using the track Class 8 amplitude values in table 4 (i.e., a 5 m.p.h. overspeed on Class 8 track).

Table 4 of Appendix D to Part 213
Track Class 6 through 9 Amplitude Parameters (in inches)
for MCAT Simulations on Tangent Track

		Gage 56.5"			
		Class 6	***Class 7***	***Class 8***	***Class 9***
Max. Operating Speed (m.p.h.)		*110*	*125*	*160*	*220*
Max. Simulation Speed (m.p.h.)		*115*	*130*	*165*	*225*
MCAT Segments	***Parameter***	***Segment Description***			
Hunting	a_1	*(b)(1)(i)*			
Gage Narrowing	a_2	*(b)(1)(ii)*			
Gage Widening	a_3	*(b)(1)(iii)*			
Repeated Surface	a_9	*(b)(1)(iv)*			
Repeated Alinement	a_4	*(b)(1)(v)*			
Single Surface	a_{10}, a_{11}	*(b)(1)(vi)*			
Single Alinement	a_5, a_6	*(b)(1)(vii)*			
Short Warp	a_{12}				
Combined Perturbation	a_7, a_8,				*(b)(1)(ix)*
		Amplitude Parameters (inches)			
Wavelength λ = 10ft	a_1	*0.250*	*0.250*	*0.250*	*0.250*
Wavelength λ = 20ft	a_{12}				
Wavelength λ= 31ft	a_2	*0.500*	*0.500*	*0.500*	*0.250*
	a_3	*0.750*	*0.500*	*0.500*	*0.500*
	a_4	*0.375*	*0.375*	*0.375*	*0.375*
	a_5	*0.500*	*0.500*	*0.500*	*0.500*
	a_6	*0.000*	*0.000*	*0.000*	*0.000*
	a_7				*0.333*
	a_8				*0.000*
	a_9	*0.750*	*0.750*	*0.500*	*0.375*
	a_{10}	*1.000*	*1.000*	*0.750*	*0.500*
	a_{11}	*0.000*	*0.000*	*0.000*	*0.000*
	a_{13}				*0.333*
Wavelength λ = 62ft	a_2	*0.500*	*0.500*	*0.500*	*0.250*
	a_3	*0.750*	*0.500*	*0.500*	*0.500*
	a_4	*0.500*	*0.375*	*0.375*	*0.375*
	a_5	*0.750*	*0.750*	*0.750*	*0.500*
	a_6	*0.000*	*0.250*	*0.250*	*0.000*
	a_7				*0.333*
	a_8				*0.000*
	a_9	*0.750*	*0.750*	*0.750*	*0.500*
	a_{10}	*1.000*	*1.000*	*1.000*	*0.750*
	a_{11}	*0.000*	*0.000*	*0.000*	*0.000*
	a_{13}				*0.500*
Wavelength λ = 124ft	a_2	*0.500*	*0.500*	*0.500*	*0.250*
	a_3	*0.750*	*0.750*	*0.750*	*0.750*
	a_4	*1.000*	*0.875*	*0.500*	*0.500*
	a_5	*1.500*	*1.250*	*1.000*	*0.750*
	a_6	*0.750*	*0.500*	*0.250*	*0.000*
	a_7				*0.500*
	a_8				*0.000*
	a_9	*1.250*	*1.000*	*0.875*	*0.625*
	a_{10}	*1.750*	*1.500*	*1.250*	*1.000*
	a_{11}	*0.250*	*0.000*	*0.000*	*0.000*
	a_{13}				*0.667*

Guidance: Paragraph (c)(2) addresses vehicle performance on tangent track Classes 6 through 9. The text in paragraphs (c)(2)(ii) and (iii) describes the simulation parameters, i.e., wavelength and amplitude listed in Table 4.

Table 4 in the paragraph provides the amplitude values for the MCAT segments described in paragraphs (b)(1)(i) through (vii) and, for track Class 9, (b)(1)(ix), for each speed of the required parametric MCAT simulations.

The header table contains the maximum operating and simulation speeds for each track class, along with a list of all of the amplitude parameters identifying each MCAT segment to which they correspond, where each segment description can be found, and to which class(es) of track they are applicable.

(3) <u>Vehicle performance on curved track Classes 6 through 9</u>. For maximum vehicle speeds corresponding to track Class 6 and higher, the MCAT segments described in paragraphs (b)(1)(ii) through (viii) of this appendix shall be used to assess vehicle performance on curved track. For curves less than 1 degree, simulations must also include the hunting perturbation segment described in paragraph (b)(1)(i) of this appendix. For track Class 9 and for cant deficiencies greater than 5 inches, simulations must also include the combined perturbation segment described in paragraph (b)(1)(ix) of this appendix. A parametric matrix of MCAT simulations shall be performed using the following range of conditions:

(i) <u>Vehicle speed</u>. Simulations shall demonstrate that at up to 5 m.p.h. above the proposed maximum operating speed, the vehicle type shall not exceed the wheel/rail force and acceleration criteria defined in the Vehicle/Track Interaction Safety Limits table in § 213.333. Simulations shall also demonstrate acceptable vehicle dynamic response by incrementally increasing speed from 95 m.p.h. (115 m.p.h. if a previously qualified vehicle type on an untested route) to 5 m.p.h. above the proposed maximum operating speed (in 5 m.p.h. increments).

(ii) <u>Perturbation wavelength</u>. For each speed, a set of three separate MCAT simulations shall be performed. In each MCAT simulation for the perturbation segments described in paragraphs (b)(1)(ii) through (vii) and paragraph (b)(1)(ix) of this appendix, every perturbation shall have the same wavelength. The following three wavelengths, λ, shall be used: 31, 62, and 124 feet. The hunting perturbation segment described in paragraph (b)(1)(i) of this appendix has a fixed wavelength, λ, of 10 feet, and the short warp perturbation segment described in paragraph (b)(1)(viii) of this appendix has a fixed wavelength, λ, of 20 feet.

(iii) <u>Track curvature</u>. For each speed, a range of curvatures shall be used to produce cant deficiency conditions ranging from greater than 3 inches up to the maximum intended for qualification (in 1 inch increments). The value of curvature, D, shall be determined using the equation defined in paragraph (b)(3) of this appendix. Each curve shall include representations of the MCAT segments described in paragraphs (b)(1)(i) through (ix) of this appendix, as appropriate, and have a fixed superelevation of 6 inches.

(iv) <u>Amplitude parameters</u>. Table 5 of this appendix provides the amplitude values for each speed of the required parametric MCAT simulations for cant deficiencies greater than 3 inches and not more than 5 inches. Table 6 of this appendix provides the amplitude

values for each speed of the required parametric MCAT simulations for cant deficiencies greater than 5 inches. The last set of simulations at the maximum cant deficiency shall be performed at 5 m.p.h. above the proposed maximum operating speed using the amplitude values in table 5 or 6 of this appendix, as appropriate, that correspond to the proposed maximum operating speed and cant deficiency. For these simulations, the value of curvature, D, shall correspond to the proposed maximum operating speed and cant deficiency. For qualification of vehicle types at speeds greater than track Class 6 speeds, the following additional simulations shall be performed:

(A) For vehicle types being qualified for track Class 7 speeds, one additional set of simulations shall be performed at 115 m.p.h. using the track Class 6 amplitude values in table 5 or 6 of this appendix, as appropriate (i.e., a 5 m.p.h. overspeed on Class 6 track) and a value of curvature, D, that corresponds to 110 m.p.h. and the proposed maximum cant deficiency.

(B) For vehicle types being qualified for track Class 8 speeds, two additional set of simulations shall be performed. The first set of simulations shall be performed at 115 m.p.h. using the track Class 6 amplitude values in table 5 or 6 of this appendix, as appropriate (i.e., a 5 m.p.h. overspeed on Class 6 track) and a value of curvature, D, that corresponds to 110 m.p.h. and the proposed maximum cant deficiency. The second set of simulations shall be performed at 130 m.p.h. using the track Class 7 amplitude values in table 5 or 6, as appropriate (i.e., a 5 m.p.h. overspeed on Class 7 track) and a value of curvature, D, that corresponds to 125 m.p.h. and the proposed maximum cant deficiency.

(C) For vehicle types being qualified for track Class 9 speeds, three additional sets of simulations shall be performed. The first set of simulations shall be performed at 115 m.p.h. using the track Class 6 amplitude values in table 5 or 6 of this appendix, as appropriate (i.e., a 5 m.p.h. overspeed on Class 6 track) and a value of curvature, D, that corresponds to 110 m.p.h. and the proposed maximum cant deficiency. The second set of simulations shall be performed at 130 m.p.h. using the track Class 7 amplitude values in table 5 or 6, as appropriate (i.e., a 5 m.p.h. overspeed on Class 7 track) and a value of curvature, D, that corresponds to 125 m.p.h. and the proposed maximum cant deficiency. The third set of simulations shall be performed at 165 m.p.h. using the track Class 8 amplitude values in table 5 or 6, as appropriate (i.e., a 5 m.p.h. overspeed on Class 8 track) and a value of curvature, D, that corresponds to 160 m.p.h. and the proposed maximum cant deficiency.

Table 5 of Appendix D to Part 213
Track Classes 6 through 9 Amplitude Parameters (in inches)
for MCAT Simulations on Curved Track with Cant Deficiency > 3 and ≤ 5 Inches

		Gage 56.5”				Gage 57.0”			
		Class 6	Class 7	Class 8	Class 9	Class 6	Class 7	Class 8	Class 9
Max. Operating Speed (m.p.h.)		110	125	160	220	110	125	160	220
Max. Simulation Speed (m.p.h.)		115	130	165	225	115	130	165	225
MCAT Segments	**Parameter**	**Segment Description**				**Segment Description**			
Hunting	a_1	(b)(1)(i) [1]				(b)(1)(i) [1]			
Gage Narrowing	a_2	(b)(1)(ii)				(b)(1)(ii)			
Gage Widening	a_3	(b)(1)(iii)				(b)(1)(iii)			
Repeated Surface	a_9	(b)(1)(iv)				(b)(1)(iv)			
Repeated Alinement	a_4	(b)(1)(v)				(b)(1)(v)			
Single Surface	a_{10}, a_{11}	(b)(1)(vi)				(b)(1)(vi)			
Single Alinement	a_5, a_6	(b)(1)(vii)				(b)(1)(vii)			
Short Warp	a_{12}	(b)(1)(viii)				(b)(1)(viii)			
Combined Perturbation	a_7, a_8,				(b)(1)(ix)				(b)(1)(ix)
		Amplitude Parameters				**Amplitude Parameters (inches)**			
Wavelength λ = 10ft	a_1	0.250	0.250[1]	0.250[1]	0.250[1]	0.250	0.250[1]	0.250[1]	0.250[1]
Wavelength λ = 20ft	a_{12}	0.625	0.563	0.500	0.375	0.625	0.563	0.500	0.375
Wavelength λ = 31ft	a_2	0.500	0.500	0.500	0.250	0.500	0.500	0.500	0.500
	a_3	0.750	0.500	0.500	0.500	0.250	0.250	0.250	0.500
	a_4	0.375	0.375	0.375	0.375	0.375	0.375	0.375	0.375
	a_5	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500
	a_6	0.000	0.000	0.000	0.000	0.250	0.250	0.250	0.250
	a_7				0.333				0.333
	a_8				0.000				0.083
	a_9	0.750	0.750	0.500	0.375	0.750	0.750	0.500	0.375
	a_{10}	1.000	1.000	0.750	0.500	1.000	1.000	0.750	0.500
	a_{11}	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	a_{13}				0.333				0.333
Wavelength λ = 62ft	a_2	0.500	0.500	0.500	0.250	0.500	0.500	0.500	0.500
	a_3	0.750	0.500	0.500	0.500	0.250	0.250	0.250	0.250
	a_4	0.500	0.375	0.375	0.375	0.500	0.375	0.375	0.375
	a_5	0.625	0.500	0.500	0.500	0.625	0.500	0.500	0.500
	a_6	0.000	0.000	0.000	0.000	0.375	0.250	0.250	0.250
	a_7				0.333				0.333
	a_8				0.000				0.083
	a_9	0.750	0.750	0.750	0.500	0.750	0.750	0.750	0.500
	a_{10}	1.000	1.000	1.000	0.750	1.000	1.000	1.000	0.750
	a_{11}	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	a_{13}				0.500				0.500
Wavelength λ = 124ft		0.500	0.500	0.500	0.250	1.000	1.000	1.000	0.750
	a_3	0.750	0.750	0.750	0.750	0.250	0.250	0.250	0.250
	a_4	1.000	0.875	0.500	0.500	1.000	0.875	0.500	0.500
	a_2	1.500	1.250	0.750	0.750	1.500	1.250	0.750	0.750
	a_6	0.750	0.500	0.000	0.000	1.250	1.000	0.500	0.500
	a_7				0.500				0.500
	a_8				0.000				0.250
	a_9	1.250	1.000	0.875	0.625	1.250	1.000	0.875	0.625
	a_{10}	1.750	1.500	1.250	1.000	1.750	1.500	1.250	1.000
	a_{11}	0.250	0.000	0.000	0.000	0.250	0.000	0.000	0.000
	a_{13}				0.667				0.667

[1] For curves <1 degree

Table 6 of Appendix D to Part 213
Track Class 6 through 9 Amplitude Parameters (in inches)
for MCAT Simulations on Curved Track with Cant Deficiency > 5 Inches

		Gage 56.5”				Gage 57.0”			
		Class 6	Class 7	Class 8	Class 9	Class 6	Class 7	Class 8	Class 9
Max. Operating Speed (m.p.h.)		110	125	160	220	110	125	160	220
Max. Simulation Speed (m.p.h.)		115	130	165	225	115	130	165	225
MCAT Segments	**Parameter**	**Segment Description**				**Segment Description**			
Hunting	a_1	(b)(1)(i) [1]				(b)(1)(i) [1]			
Gage Narrowing	a_2	(b)(1)(ii)				(b)(1)(ii)			
Gage Widening	a_3	(b)(1)(iii)				(b)(1)(iii)			
Repeated Surface	a_9	(b)(1)(iv)				(b)(1)(iv)			
Repeated Alinement	a_4	(b)(1)(v)				(b)(1)(v)			
Single Surface	a_{10}, a_{11}	(b)(1)(vi)				(b)(1)(vi)			
Single Alinement	a_5, a_6	(b)(1)(vii)				(b)(1)(vii)			
Short Warp	a_{12}	(b)(1)(viii)				(b)(1)(viii)			
Combined Perturbation	a_7, a_8, a_{13}				(b)(1)(ix)				(b)(1)(ix)
		Amplitude Parameters (inches)				**Amplitude Parameters (inches)**			
Wavelength λ = 10ft	a_1	0.250[1]	0.250[1]	0.250[1]	0.250[1]	0.250[1]	0.250[1]	0.250[1]	0.250[1]
Wavelength λ = 20ft	a_{12}	0.625	0.500	0.500[2]	0.375	0.625	0.500	0.500[2]	0.375
Wavelength λ = 31ft	a_2	0.500	0.500	0.500	0.250	0.500	0.500	0.500	0.500
	a_3	0.750	0.500	0.500	0.500	0.250	0.250	0.250	0.500
	a_4	0.375	0.375	0.375	0.375	0.375	0.375	0.375	0.375
	a_5	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500
	a_6	0.000	0.000	0.000	0.000	0.250	0.250	0.250	0.250
	a_7	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333
	a_8	0.000	0.000	0.000	0.000	0.083	0.083	0.083	0.083
	a_9	0.750	0.750	0.500	0.375	0.750	0.750	0.500	0.375
	a_{10}	1.000	1.000	0.750	0.500	1.000	1.000	0.750	0.500
	a_{11}	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	a_{13}	0.667	0.667	0.500	0.333	0.667	0.667	0.500	0.333
Wavelength λ = 62ft	a_2	0.500	0.500	0.500	0.250	0.500	0.500	0.500	0.500
	a_3	0.750	0.500	0.500	0.500	0.250	0.250	0.250	0.250
	a_4	0.500	0.375	0.375	0.375	0.500	0.375	0.375	0.375
	a_5	0.625	0.500	0.500	0.500	0.625	0.500	0.500	0.500
	a_6	0.000	0.000	0.000	0.000	0.375	0.250	0.250	0.250
	a_7	0.417	0.333	0.333	0.333	0.417	0.333	0.333	0.333
	a_8	0.000	0.000	0.000	0.000	0.167	0.083	0.083	0.083
	a_9	0.750	0.750	0.750	0.500	0.750	0.750	0.750	0.500
	a_{10}	1.000	1.000	1.000	0.750	1.000	1.000	1.000	0.750
	a_{11}	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	a_{13}	0.667	0.667	0.667	0.500	0.667	0.667	0.667	0.500
Wavelength λ = 124ft	a_2	0.500	0.500	0.500	0.250	1.000	1.000	1.000	0.750
	a_3	0.750	0.750	0.750	0.750	0.250	0.250	0.250	0.250
	a_4	1.000	0.875	0.500	0.500	1.000	0.875	0.500	0.500
	a_5	1.250	1.000	0.750	0.750	1.250	1.000	0.750	0.750
	a_6	0.500	0.250	0.000	0.000	1.000	0.750	0.500	0.500
	a_7	0.833	0.667	0.500	0.500	0.833	0.667	0.500	0.500
	a_8	0.083	0.000	0.000	0.000	0.583	0.417	0.250	0.250
	a_9	1.250	1.000	0.875	0.625	1.250	1.000	0.875	0.625
	a_{10}	1.500	1.250	1.250	1.000	1.500	1.250	1.250	1.000
	a_{11}	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	a_{13}	1.000	0.833	0.833	0.667	1.000	0.833	0.833	0.667

[1] For curves <1 degree *[2] 0.375 for E_u>7”*

Guidance: Paragraph (c)(3) addresses vehicle performance on curved track Classes 6 through 9. Paragraphs (c)(3)(ii) and (iv) contain the descriptive text regarding the information in tables 5 and 6. Paragraph (c)(3)(ii) makes clear that running simulations using all three wavelengths is a requirement. Paragraph (c)(3)(iv) specifies the need to run the final simulations at 5 m.p.h. over the maximum proposed operating speed and cant deficiency. Paragraphs (c)(3)(iv)(A) through (C) specifies that this 5 m.p.h. overspeed is required when transitioning between classes, e.g., 115 m.p.h. for Class 6 track when qualifying a vehicle for Class 7 track. In addition, the text in paragraphs (c)(3)(iv)(A) through (C) describes how the 5 m.p.h. overspeed cases at the end of a track class will be conducted at the maximum proposed cant deficiency, using the curvature value, D, calculated using the maximum track class speed and maximum proposed cant deficiency.

Table 5 applies to Class 6 through 9 curved track with cant deficiency greater than 3 inches but not greater than 5 inches; table 6 applies to Class 6 through 9 curved track with cant deficiency greater than 5 inches. Both tables contain the maximum operating and simulation speeds for each track class, along with a list of all of the amplitude parameters identifying each MCAT segment to which they correspond, where each segment description can be found, and to which class(es) of track they are applicable.

(4) Vehicle performance on curved track Classes 1 through 5 at high cant deficiency. For maximum vehicle speeds corresponding to track Classes 1 through 5, the MCAT segments described in paragraphs (b)(1)(ii) through (ix) of this appendix shall be used to assess vehicle performance on curved track if the proposed maximum cant deficiency is greater than 6 inches. A parametric matrix of MCAT simulations shall be performed using the following range of conditions:

(i) Vehicle speed. Simulations shall demonstrate that at up to 5 m.p.h. above the proposed maximum operating speed, the vehicle shall not exceed the wheel/rail force and acceleration criteria defined in the Vehicle/Track Interaction Safety Limits table in § 213.333. Simulations shall also demonstrate acceptable vehicle dynamic response at 5 m.p.h. above the proposed maximum operating speed.

(ii) Perturbation wavelength. For each speed, a set of two separate MCAT simulations shall be performed. In each MCAT simulation for the perturbation segments described in paragraphs (b)(1)(ii) through (vii) and paragraph (b)(1)(ix) of this appendix, every perturbation shall have the same wavelength. The following two wavelengths, λ, shall be used: 31 and 62 feet. The short warp perturbation segment described in paragraph (b)(1)(viii) of this appendix has a fixed wavelength, λ, of 20 feet.

(iv) Track curvature. For a speed corresponding to 5 m.p.h. above the proposed maximum operating speed, a range of curvatures shall be used to produce cant deficiency conditions ranging from 6 inches up to the maximum intended for qualification (in 1 inch increments). The value of curvature, D, shall be determined using the equation in paragraph (b)(3) of this appendix. Each curve shall contain the MCAT segments described in paragraphs (b)(1)(ii) through (ix) of this appendix and have a fixed superelevation of 6 inches.

(v) Amplitude parameters. Table 7 of this appendix provides the amplitude values for the MCAT segments described in paragraphs (b)(1)(ii) through (ix) of this appendix for each speed of the required parametric MCAT simulations.

Table 7 of Appendix D to Part 213
Track Class 1 through 5 Amplitude Parameters (in inches)
for MCAT Simulations on Curved Track with Cant Deficiency > 6 Inches

		Gage 56.5”					Gage 57.0”				
		Class 1	Class 2	Class 3	Class 4	Class 5	Class 1	Class 2	Class 3	Class 4	Class 5
Max. Operating Speed (m.p.h.)		15	30	60	80	90	15	30	60	80	90
Max. Simulation Speed (m.p.h.)		20	35	65	85	95	20	35	65	85	95
MCAT Segments	**Parameter**	**Segment Description**					**Segment Description**				
Hunting	a_1										
Gage Narrowing	a_2	(b)(1)(ii)					(b)(1)(ii)				
Gage Widening	a_3	(b)(1)(iii)					(b)(1)(iii)				
Repeated Surface	a_9	(b)(1)(iv)					(b)(1)(iv)				
Repeated Alinement	a_4	(b)(1)(v)					(b)(1)(v)				
Single Surface	a_{10}, a_{11}	(b)(1)(vi)					(b)(1)(vi)				
Single Alinement	a_5, a_6	(b)(1)(vii)					(b)(1)(vii)				
Short Warp	a_{12}	(b)(1)(viii)					(b)(1)(viii)				
Combined Perturbation	a_7, a_8, a_{13}	(b)(1)(ix)					(b)(1)(ix)				
		Amplitude Parameters (inches)					**Amplitude Parameters (inches)**				
Wavelength λ = 10ft	a_1										
Wavelength λ = 20ft	a_{12}	1.000	1.000	0.875	0.875	0.750	1.000	1.000	0.875	0.875	0.750
Wavelength λ = 31ft	a_2	0.500	0.500	0.500	0.500	0.500	1.250	1.250	1.250	0.500	0.500
	a_3	1.250	1.250	1.250	0.500	0.500	0.750	0.750	0.750	0.500	0.500
	a_4	0.750	0.750	0.750	0.750	0.500	0.750	0.750	0.750	0.750	0.500
	a_5	0.750	0.750	0.750	0.750	0.500	0.750	0.750	0.750	0.750	0.500
	a_6	0.000	0.000	0.000	0.250	0.000	0.000	0.000	0.000	0.250	0.000
	a_7	0.500	0.500	0.500	0.500	0.333	0.500	0.500	0.500	0.500	0.333
	a_8	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	a_9	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	a_{10}	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	a_{11}	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	a_{13}	0.667	0.667	0.667	0.667	0.667	0.667	0.667	0.667	0.667	0.667
Wavelength λ = 62ft	a_2	0.500	0.500	0.500	0.500	0.500	1.250	1.250	1.250	0.500	0.500
	a_3	1.250	1.250	1.250	0.500	0.500	0.750	0.750	0.750	0.500	0.500
	a_4	1.250	1.250	1.250	0.875	0.625	1.250	1.250	1.250	0.875	0.625
	a_5	1.250	1.250	1.250	0.875	0.625	1.250	1.250	1.250	0.875	0.625
	a_6	0.000	0.000	0.000	0.375	0.125	0.500	0.500	0.500	0.375	0.125
	a_7	0.833	0.833	0.833	0.583	0.417	0.833	0.833	0.833	0.583	0.417
	a_8	0.000	0.000	0.000	0.083	0.000	0.083	0.083	0.083	0.083	0.000
	a_9	1.750	1.750	1.750	1.250	1.000	1.750	1.750	1.750	1.250	1.000
	a_{10}	1.750	1.750	1.750	1.250	1.000	1.750	1.750	1.750	1.250	1.000
	a_{11}	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	a_{13}	1.167	1.167	1.167	0.833	0.667	1.167	1.167	1.167	0.833	0.667

Guidance: Paragraph (c)(4) addresses vehicle performance on curved track Classes 1 through 5 at high cant deficiency.
Paragraph (c)(4)(ii) makes it clear that running simulations using both the 31-foot and 62-foot wavelengths is required for assessing vehicle performance on curved track Classes 1 through 5 at high cant deficiency.
Table 7 contain information for Classes 1 to 5 track similar to that in tables 5 and 6 for curved track Classes 6 through 9.

(End of Volume II, Chapter 2)

Federal Railroad Administration

Track and Rail and Infrastructure Integrity Compliance Manual

Volume III Railroad Workplace Safety
Chapter 1 General

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Text in italic font of this manual is regulatory language, whereas indented paragraphs provide field guidance for FRA inspectors. Indented paragraphs are not to be construed as regulatory language in any manner.

CHAPTER 1 General

Introduction

This chapter provides the necessary information for FRA personnel to properly interpret and enforce the general provisions of the Railroad Workplace Safety Rule. It is not to be construed as a modification, alteration, or revision of the Standards as published. It includes all definitions used in the specific subparts of the rule.

Any legal proceeding instituted against a railroad must be based on the official regulations found in the Code of Federal Regulations, Title 49, Part 214, published annually by the Government Printing Office. However, the inspector should refer to this manual as often as necessary to understand the intent of any particular standard, thereby assuring to the extent practicable the nationally uniform application of these rules as intended by Congress in the Federal Railroad Safety Act of 1970.

Summary

The Railroad Workplace Safety Rule requires railroads and railroad contractors to provide, and employees to use, fall protection and personal protective equipment, including head, foot, eye, and face equipment when employees work on railroad bridges, and to protect employees from the hazards of moving trains and other railroad equipment. The purpose of this rule is to prevent accidents and casualties to employees involved in railroad construction and maintenance activities.

Section Analysis of the General Provisions of the Rule

§ 214.1 Purpose and scope

(a) The purpose of this part is to prevent accidents and casualties to employees involved in certain railroad inspection, maintenance and construction activities.

(b) This part prescribes minimum Federal safety standards for the railroad workplace safety subjects addressed herein. This part does not restrict a railroad or railroad contractor from adopting and enforcing additional or more stringent requirements not inconsistent with this part.

Section Analysis from original 49 CFR 214, the Bridge Worker Safety Rule:

This section limits application of the safety standards set forth in this part to those inspection, maintenance, and construction activities described in Subpart B, Bridge Worker Safety Standards, and any additional subparts that may follow. FRA does not in any way intend that Part 214, Railroad Workplace Safety, be read to establish standards for any occupational hazards beyond those addressed by this part.

Additional Discussion:

This section is unchanged in the Roadway Worker Safety Rule. The original section analysis left room for the additional subparts, of which Subpart C, Roadway Worker Protection, is the first.

§ 214.3 Application

This part applies to railroads that operate rolling equipment on track that is part of the general railroad system of transportation.

Section Analysis from original 49 CFR 214, the Bridge Worker Safety Rule:

The Rule does not apply to urban rapid transit systems or other self-contained systems that are not part of the general railroad system of transportation, nor to railroad bridges that are part of industrial facilities, neither owned nor operated by a railroad.

Should FRA later determine that this rule should apply to certain self-contained railroads that are not part of the general system (E.g., certain tourist railroads), it will propose a new rule to accomplish that change. Such a proceeding could explore whatever unique factors apply in the context of such railroads.

Section Analysis from NPRM of March 14, 1996, the Roadway Worker Protection Rule:

FRA proposes that this subpart will apply to all railroads and contractors to railroads in the general system of railroad transportation, including commuter rail operations. Accordingly, existing section 214.3 will not change. This means that tourist and excursion railroads that are not part of the general system of railroad transportation will not be subject to these rules. The data illustrating the serious nature of the hazards addressed in this subpart did not include tourist and excursion railroads. FRA has not otherwise been notified that these hazards causing death and injury to roadway workers are a serious problem for tourist and excursion railroads or any other railroads not operating over the general system of railroad transportation. However, FRA reserves the right to include tourist and excursion railroads that do not operate on the general system of railroad transportation in the final rule, if the record reflects such a need.

Section Analysis from Final Rule of December 16, 1996, the Roadway Worker Protection Rule:

Two comments were submitted essentially requesting clarification regarding FRA jurisdiction. Specifically, clarification was sought regarding whether these rules apply on track that is not subject to FRA jurisdiction and not on the general system of railroad transportation. As noted in Sec. 214.3, Application, FRA is concerned with track that is part of the general system of railroad transportation. For further information regarding FRA's exercise of jurisdiction, one should consult 49 CFR Part 209, Appendix A. This Federal regulation, as all other rules issued under FRA authority will only apply in instances were FRA exercises jurisdiction, on track that is part of the general system.

Additional Discussion:

The application of this rule will generally follow the applicability of 49 CFR 213, the Federal Track Safety Standards. Contractors to railroads, and the employees of such contractors, would be covered where they are working on and near the track of the railroad to which they are contracted. A contractor to a railroad would be responsible for compliance with this rule at locations where it is performing work for a covered railroad. Employees of the same contractor who might be performing work for a non-railroad industry on a track owned by that industry would not be covered by this rule.

This regulation does not apply to a contractor or other party working on railroad property but not under contract to the railroad. An example would be a communications company installing or maintaining fiber optic lines buried alongside the track, or a highway agency inspecting agency-owned bridges over the track.

As noted in §214.3, the Federal Railroad Administration (FRA) is concerned with track that is part of the general system of railroad transportation. However, Part 209, Appendix A, details FRA's policy in regard to operations of general system railroads on trackage that is not part of the general system of transportation (e.g., plant railroads). Part 209, Appendix A, states: "*...the railroad that is part of that system while inside the installation; thus, all of its activities are covered by FRA's regulations during that period*." Therefore, 49 CFR Part 214 will apply to roadway workers who are on-duty with a general system railroad when conducting engineering functions within plant trackage. When working independently and directly for an industry (plant railroad), a person performing engineering type functions in this environment would not be subject to the RWP regulation. However, such activities come under the jurisdiction of other Federal agencies and FRA highly encourages workers follow on-track safety procedures when working under this environment.

§ 214.4 Preemptive effect

Under 49 U.S.C. 20106 (formerly section 205 of the Federal Railroad Safety Act of 1970 (45 U.S.C. 434)), issuance of these regulations preempts any State law, rule, regulation, order, or standard covering the same subject matter, except a provision directed at an essentially local safety hazard that is not incompatible with this part and that does not unreasonably burden on interstate commerce.

(This section was added with the Roadway Worker Protection Rule in December, 1996.)

Section Analysis from Final Rule Notice of December 16, 1996, Roadway Worker Protection:

Preemption Comments were submitted addressing the potential preemptive effect of this rule. One commenter wanted FRA to expressly state that the provision requiring an audible warning from trains preempts state and local whistle ban laws. FRA believes there is no need to include rule language indicating that state and local whistle bans are preempted. FRA could potentially include language in all provisions of this rule, and all others, stating that any state and local rules covering the same subject matter as the identified Federal regulatory provision are preempted. Instead, FRA has issued a general statement regarding the preemptive effect of all the provisions of the rule in §214.4. In addition, the section-by-section analysis corresponding to §214.339, Audible Warning from trains, expressly states FRA's intention to preempt state and local whistle ban ordinances. Although preemption decisions in any particular factual context are a matter for courts to resolve, courts generally afford great deference to the subject matter the appropriate regulatory agency intended to cover. In this instance, the rulemaking record establishes FRA's intent to cover the same subject matter as state and local whistle bans in the section-by-section analysis and the Federalism Assessment which acknowledges potential Federalism implications that was prepared for the docket at the NPRM stage of this rulemaking. (61 FR at 10542).

FRA notes that no comments were submitted to the docket substantively in opposition to this provision requiring audible warnings. States and local governments did not respond to the NPRM with concerns regarding this provision potentially in conflict with their whistle ban orders.

Additional comments regarding preemption focused on this regulation's impact on state clearance requirements. The NPRM uses the term fouling a track to essentially specify the proximity to railroad track at which an individual or equipment could be struck by a moving train or on-track equipment. Conversely, state clearance requirements establish specifications to govern the minimum distance between track and fixed structures. Although the two concepts, proximity of humans and equipment to track and proximity of fixed structures to track, are distinguishable, the potential for misinterpretation of the Advisory Committee's intent persuaded the agency to address this issue. To clarify the situation, FRA wants to explicitly state that FRA and the Advisory Committee did not intend to affect state clearance requirements.

§ 214.5 Responsibility for compliance

Any person (any 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; and any employee of such owner, manufacturer, lessor, lessee, or independent contractor) who violates any requirement of this part or causes the violation of any such requirement is subject to a civil penalty of at least $650 and not more than $25,000 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, or has caused death or injury, a penalty not to exceed $105,000 per violation may be assessed. See Appendix A to this part for a statement of agency civil penalty policy.

Section Analysis from original 49 CFR 214, the Bridge Worker Safety Rule:

The RSIA established liability for individuals who willfully violate any of the railroad safety regulations. The authority to impose penalties against individual violators exists with respect to all of the safety standards enforced by FRA, but with the addition of § 214.5 in this final rule, FRA now expressly incorporates that authority in Part 214. In addition, as a logical concomitant of this provision, various provisions requiring that certain forms of protection be provided have been amended to require that, when provided, they be used.

§ 214.7 Definitions

Adjacent tracks *mean two or more tracks with track centers spaced less than 25 feet apart.*

The spacing of less than 25 feet between track centers, which defines adjacent tracks for this rule, represents a consensus decision of the Advisory Committee. Several railroads have recently extended their lateral track spacing to 25 feet. Tracks spaced at that distance may not cause a hazard to employees in one track from trains and equipment moving on the other track. FRA believes that no purpose would be served by requiring these tracks to be again spaced at a slightly greater distance. Therefore, tracks spaced at 25 feet are not defined as adjacent tracks, but tracks spaced at a lesser distance will be so defined. Tracks that converge or cross will be considered as adjacent tracks in the zone through which their centers are less than 25 feet apart.

As a practical matter, FRA will apply a rule of reason to the precision used in measuring track centers, so that minor alignment deviations within the limits of the Federal Track Safety Standards (49 CFR 213) would not themselves place such short segments of track within the definition of adjacent tracks.

Anchorage *means a secure point of attachment for lifelines, lanyards or deceleration devices that is independent of the means of supporting or suspending the employee.*

The common terminology now employed to mean a lanyard, lifeline, and safety belt system for fall protection is a "personal fall arrest system." Anchorage is an integral component of a personal fall arrest system, and therefore is defined. FRA chose the definition utilized by OSHA in its regulations concerning fall protection, which reflects common trade usage. A particular worksite will determine the type of anchorage available, and so the definition allows for flexibility by stating only that it be a secure point of attachment for the other personal fall arrest system components.

Body belt *means a strap that can be secured around the waist or body and attached to a lanyard, lifeline, or deceleration device.*

The use of body harnesses, rather than body belts, is now preferred practice. The body belt does not absorb stress forces in a fall as well as a harness can, and therefore, may cause serious internal injury to the wearer. According to commenters, many companies no longer manufacture belts because of this risk, and the construction industry will phase out their use in the near future. However, there are limited situations, climbing poles for instance, in which belts can be utilized safely. FRA adopts the definition used by OSHA that reflects current trade language. Although the final rule permits the use of safety belts as part of a personal fall arrest system, use of harnesses is preferred.

Body harness *means a device with straps that is secured about the person in a manner so as to distribute the fall arrest forces over (at least) the thighs, shoulders, pelvis, waist, and chest* *and that can be attached to a lanyard, lifeline, or deceleration device.*

The harness distributes the fall arrest forces over the thighs, shoulders, pelvis, waist, and chest, and therefore decreases the likelihood of serious injury to the wearer.

The majority of industry participants in this proceeding stated that harnesses are most often used.

Class I, Class II, and Class III have the meaning assigned by, Title 49 CFR part 1201, General Instructions 1-1.

The rule distinguishes among railroads of various classes in the effective dates of this regulation, and in the applicability of § 214.329, Definite Train Location. The largest railroads are Class I. Class II railroads are generally termed "regional railroads" and Class III railroads are generally termed "short line railroads" although these terms are not definitive.

Competent person *means one who is capable of identifying existing and predictable hazards in the workplace and who is authorized to take prompt corrective measures to eliminate them.*

The rule requires oversight or supervision by a person with knowledge, training, and relevant experience to adequately assess safety hazards. The definition contains these factors, and a requirement that the individual also possess the authority to take prompt corrective measures, if necessary.

Control operator *means the railroad employee in charge of a remotely controlled switch or derail, an interlocking, or a controlled point, or a segment of controlled track.*

This term may encompass several types of employees. A control operator might relay instructions from a train dispatcher, or operate independently, depending upon the rules of the railroad. On some terminal railroads, a yardmaster might control a remotely controlled switch and thereby be considered a control operator. The term as used here has no connection with the hours of service law.

A yardmaster who gives permission to trains to use non-controlled track is not a control operator. The general distinction is that the actual authorization to use non-controlled track is found in the rules, and the granting or withholding of permission is not an assurance of protection. It is intended to facilitate operations, such as by advising a train not to use an occupied track to attempt to move through a yard.

Controlled *track means track upon which the railroad's operating rules require that all movements of trains must be authorized by a train dispatcher or a control operator.*

See the discussion under § 214.321 Exclusive track occupancy.

Deceleration device *means any mechanism, including, but not limited to, rope grabs, ripstitch lanyards, specially woven lanyards, tearing or deforming lanyards, and automatic self-retracting lifelines/lanyards that serve to dissipate a substantial amount of energy during a fall arrest, or otherwise limit the energy on a person during fall arrest.*

This is defined is a device that dissipates fall forces during a fall arrest. It is often a type of lanyard, an attachment to a lanyard or harness, or a self-retracting lifeline.

Designated official *means any person(s) designated by the employer to receive notification of non-complying conditions on on-track roadway maintenance machines and hi-rail vehicles.*

Definite train location *means a system for establishing on-track safety by providing* *roadway workers with information about the earliest possible time that approaching trains may pass specific locations as prescribed in section 214.331 of this part.*

See the discussion under § 214.331 Definite train location.

Effective securing device *when used in relation to a manually operated switch or derail means one which is:*

(a) Vandal resistant;
(b) Tamper resistant; and
(c) Designed to be applied, secured, uniquely tagged and removed only by the class, craft or group of employees for whom the protection is being provided.

Effective securing device is defined in this part as one means of preventing a manually operated switch or derail from being operated so as to present a hazard to roadway workers present on certain non-controlled tracks. This definition is specifically intended to include the use of special locks on switch and derail stands that will accommodate them, and switch point clamps that are properly secured. It also includes the use of a spike driven into the switch tie against the switch point firmly enough that it cannot be removed without proper tools, provided that the rules of the railroad prohibit the removal of the spike by employees not authorized to do so. Every effective securing device must be tagged. FRA will examine each railroad's on-track safety program to determine that the rules governing the securement of switches will provide the necessary level of protection.

The language in the regulation clearly shows that the Federal Railroad Administration (FRA) acknowledged that there were other securing devices in addition to locks that are acceptable to use, as long as they were vandal resistant, tamper resistant and are designed to be applied, secured, uniquely tagged and removed by the class, craft or group of employees for whom the protection is being provided. The preamble language specifically discussed locks, clamps and spikes when utilized as effective securing devices. Portable derails that are secured with wedges, would also be in compliance with the regulation, as long as the device is secure, vandal and tamper resistant, and can only be removed by the class, craft or group of employees for whom the protection is being provided.

Employee *means an individual who is engaged or compensated by a railroad or by a contractor to a railroad to perform any of the duties defined in this part.*

Employer *means a railroad, or a contractor to a railroad, that directly engages or compensates individuals to perform any of the duties defined in this part.*

The responsibility for compliance with this rule follows the employer-employee relationship. Each employer subject to the rule, be it a railroad or a contractor, assumes the employer's responsibilities regarding its own employees.

Equivalent *means alternative designs, materials, or methods that the railroad or railroad contractor can demonstrate will provide equal or greater safety for employees than the means specified in this part.*

In order to give railroads and railroad contractors flexibility in choosing equipment not specified in the final rule, but perhaps more amenable to the railroad environment or more technically advanced, this term has been added to the rule at various locations. The railroad or railroad contractor bears the burden of demonstrating that the alternative device does not in any way decrease employee safety.

Exclusive track occupancy *means a method of establishing working limits on controlled track in which movement authority of trains and other equipment is withheld by the train dispatcher or control operator, or restricted by flagmen, as prescribed in section 214.321 of this part.*

See the discussion under § 214.321 Exclusive track occupancy.

Flagman *when used in relation to roadway worker safety means an employee designated by the railroad to direct or restrict the movement of trains past a point on a track to provide on-track safety for roadway workers, while engaged solely in performing that function.*

Care should be taken not to confuse flagman with watchman/lookout. A flagman directs or controls the approach of trains on a track, while the watchman/lookout detects the approach of trains and warns roadway workers of the approaching train.

Some railroads have transportation employees, such as conductors, providing protection against trains to contractors and others who are working on railroad property. Other railroads have maintenance of way employees performing the same function, and some railroads use both classifications of employees.

Although the railroad might term these employees “flagmen,” they are not considered as such in this rule unless they actually perform the function of directly stopping trains at their location. Communicating with the train dispatcher to establish working limits does not by itself classify these employees as flagmen under this rule.

The question of whether or not these employees are roadway workers and covered as such under this rule depends on their other functions at the site. Under the definition of Roadway workers, they are roadway workers if they are protecting a roadway work group. Generally, if they have any responsibility for inspection, adjustment or repair of roadway facilities they would be considered to be roadway workers. Finally, if the employer designates them as roadway workers, FRA would normally accept that designation.

Foul time *is a method of establishing working limits on controlled track in which a roadway worker is notified by the train dispatcher or control operator that no trains will operate within a specific segment of controlled track until the roadway worker reports clear of the track, as prescribed in section 214.323 of this part.*

Foul time is an abbreviated method of establishing working limits on controlled track where permitted by the rules of the railroad. It is distinguished from exclusive track occupancy by the absence of a requirement for a written document in the possession of the roadway worker who has been granted the foul time, and the prohibition of any train movements in the working limits. Some railroads utilize this procedure to protect people or machines that are on or near the track where the condition of the track has not been affected.

Fouling a track *means the placement of an individual or an item of equipment in such proximity to a track that the individual or equipment could be struck by a moving train or on-track equipment, or in any case is within four feet of the field side of the near running* *rail.*

An individual could be farther than four feet from the rail and still be fouling the track if the individual's position or actions could cause movement into the four-foot zone, or if there were any possibility of the individual being struck by a part of a moving train or on-track machine that might extend more than four feet outside the rail. An example would be an individual working on the slope of a cut above the track, where a slip could cause movement into the track area.

Free fall *means the act of falling before the personal fall arrest system begins to apply force to arrest the fall.*

This term is significant in determining the amount of force applied to one who wears a personal fall arrest system. It is defined as the act of falling until the arresting forces begin to take effect.

Free fall distance *means the vertical displacement of the fall arrest attachment point on a person's body belt or body harness between onset of the fall and the point at which the system begins to apply force to arrest the fall. This distance excludes deceleration distance and lifeline and lanyard elongation, but includes any deceleration device slide distance or self-retracting lifeline/lanyard extension before they operate and fall arrest forces occur.*

As stated above, this phrase is important in determining the amount of force applied to a body before the fall arrest system begins to take effect. As defined, the distance does not include deceleration distance, or lifeline and lanyard elongation.

Hi-rail vehicle *means a roadway maintenance machine that is manufactured to meet Federal Motor Vehicle Safety Standards and is equipped with retractable flanged wheels so that the vehicle may travel over the highway or on railroad tracks.*

Hi-rail vehicle, new *means a hi-rail vehicle that is ordered after December 26, 2003 or completed after September 27, 2004.*

Inaccessible track *means a method of establishing working limits on non-controlled track by physically preventing entry and movement of trains and equipment.*

See the discussion under § 214.327 Inaccessible track.

Individual train detection *means a procedure by which a lone worker acquires on-track safety by seeing approaching trains and leaving the track before they arrive and which may be used only under circumstances strictly defined in this part.*

See the discussion under § 214.337 On-track safety procedures for lone workers.

Informational line-up of trains *means Information provided in a prescribed format to a roadway worker by the train dispatcher regarding movements of trains authorized or expected on a specific segment of track during a specific period of time.*

An informational line-up provides information as to the last known location, and expected movements, of trains in a specific segment of track. It does not necessarily show restrictions placed on trains as would be the case with definite train location, nor are trains necessarily restricted as to the time at which they may pass certain locations.

Lanyard *means a flexible line of rope, wire rope, or strap that is used to secure a body harness to a deceleration device, lifeline, or anchorage.*

FRA adopted the definition used by OSHA that reflects current trade language. The term is defined as a flexible line of rope, wire rope or strap that secures a body harness to a deceleration device, lifeline or anchorage.

Lifeline *means a component of a fall arrest system consisting of a flexible line that connects to an anchorage at one end to hang vertically (vertical lifeline) or to an anchorage at both ends to stretch horizontally (horizontal lifeline), and that serves as a means for connecting other components of a personal fall arrest system to the anchorage.*

The definition states that a lifeline is a flexible line connected to an anchorage from which other portions of a fall arrest system are attached. More than one person may be attached to a lifeline, as common practice indicates, so long as the line complies with required standards.

Lone worker *means an individual roadway worker who is not being afforded on-track safety by another roadway worker, who is not a member of a roadway work group, and who is not engaged in a common task with another roadway worker.*

Lone workers are defined in this part as roadway workers who are not being afforded on-track safety by another roadway worker, are not members of a roadway work group, and are not engaged in a common task with another roadway worker. Generally, a common task is one in which two or more roadway workers must coordinate and cooperate in order to accomplish the objective. Other considerations are whether the roadway workers are under one supervisor at the worksite; or whether the work of each roadway worker contributes to a single objective or result.

For instance, a foreman and five trackmen engaged in replacing a turnout would be engaged in a common task. A signal maintainer assigned to adjust the switch and replace wire connections in the same turnout at the same time as the track workers would be considered a member of the work group for the purposes of on-track safety. On the other hand, a bridge inspector working on the deck of a bridge while a signal maintainer happens to be replacing a signal lens on a nearby signal would not constitute a roadway work group just by virtue of their proximity. FRA does not intend that a common task may be subdivided into individual tasks to avoid the use of on-track safety procedures required for roadway work groups.

Non-controlled track *means track upon which trains are permitted by railroad rule or special instruction to move without receiving authorization from a train dispatcher or control operator.*

See the discussion under § 214.327 Inaccessible track.

On-track roadway maintenance machine *means a self-propelled, rail-mounted, non-highway, maintenance machine whose light weight is in excess of 7,500 pounds, and whose purpose is not for the inspection of railroad track.*

On-track roadway maintenance machine, existing *means any on-track roadway maintenance machine that does not meet the definition of a "new on-track roadway maintenance machine."*

On-track roadway maintenance machine, new *means an on-track roadway maintenance machine that is ordered after December 26, 2003, and completed after September 27, 2004.*

On-track safety *means a state of freedom from the danger of being struck by a moving railroad train or other railroad equipment, provided by operating and safety rules that govern track occupancy by personnel, trains and on-track equipment.*

> The term On-track safety embodies the ultimate goal of this regulation, which is for workers to be safe from the hazards related to moving trains and equipment while working on or in close proximity to the track. The regulation requires railroads to adopt comprehensive programs and rules to accomplish this objective. This regulation, and the required programs, together are intended to produce a heightened awareness among railroad employees of these hazards and the methods necessary to reduce the related risks.

Personal fall arrest system *means a system used to arrest the fall of a person from a working level. It consists of an anchorage, connectors, body harness or body belt, lanyard, deceleration device, lifeline, or combination of these.*

> This terminology for the safety belt, lanyard, lifeline fall protection system reflects common trade language. The rule defines this term as a system used to stop a fall from a working level, consisting of an anchorage, connectors, body harness, lanyard, deceleration device, lifeline, or suitable combination of these.

Qualified *means a status attained by an employee who has successfully completed any required training for, has demonstrated proficiency in, and has been authorized by the employer to perform the duties of a particular position or function.*

> The term Qualified as used in the rule with regard to roadway workers implies no provision or requirement for Federal certification of persons who perform those functions.

Railroad *means all forms of non-highway ground transportation that run on rails or electro-magnetic guideways, including (1) commuter or other short-haul rail passenger service in a metropolitan or suburban area, and (2) high speed ground transportation systems that connect metropolitan areas, without regard to whether they use new technologies not associated with traditional railroads. Such term does not include rapid transit operations within an urban area that are not connected to the general railroad system of transportation.*

> This definition is taken from section 202(e) of the Federal Railroad Safety Act of 1970, as amended by the RSIA, and includes all forms of non-highway transportation that run on rails or electro-magnetic guideways.

Railroad bridge *means a structure supporting one or more railroad tracks above land or water with a span length of 12 feet or more measured along the track centerline. This term applies to the entire structure between the faces of the backwalls of abutments or equivalent components, regardless of the number of spans, and includes all such* *structures, whether of timber, stone, concrete, metal, or any combination thereof.*

Railroad bridge is defined as a structure supporting one or more railroad tracks, above land or water, spanning at least 12 feet, and including the entire structure between the faces of the abutments. The term "span length" in this definition includes bridges that might have a total length with multiple spans of 12 feet or more between the extreme backwalls, even if no single span reaches 12 feet in length.

The definition does not apply to structures carrying highways or other structures over railroads, nor to signals or signal bridges that are not located on or part of railroad bridges as defined in this section. A railroad bridge remains a railroad bridge while the track has been temporarily removed for maintenance or repair. A bridge with the track permanently removed is no longer a railroad bridge. A bridge being built by a railroad, or a contractor to a railroad, intended to carry track, is a railroad bridge.

A bridge being built to carry track, but not yet in possession of a railroad, will not be considered a railroad bridge until it is acquired by a railroad or placed in service to carry railroad traffic. For instance, a railroad bridge under construction by a highway agency, separate from an operating railroad, as part of a highway project, would come under the same OSHA jurisdiction as the rest of the highway construction project until such time as ownership or control of the bridge passes to a railroad, or until railroad traffic begins operating over the bridge.

Railroad bridge worker or bridge worker *means any employee of, or employee of a contractor of, a railroad owning or responsible for the construction, inspection, testing, or maintenance of a bridge whose assigned duties, if performed on the bridge, include inspection, testing, maintenance, repair, construction, or reconstruction of the track, bridge structural members, operating mechanisms and water traffic control systems, or signal, communication, or train control systems integral to that bridge.*

The term Railroad bridge worker or bridge worker replaces the term railroad employee or employee formerly used in the Bridge Worker Safety Rule, to recognize the broadened scope of this part after the inclusion of the Roadway Worker Protection Rule and to more precisely define those who are covered by rule as bridge workers.

Restricted speed *means a speed that will permit a train or other equipment to stop within one-half the range of vision of the person operating the train or other equipment, but not exceeding 20 miles per hour, unless further restricted by the operating rules of the railroad.*

This definition varies slightly from the standard definition of restricted speed found in most books of operating rules. It is meant only to apply in the context of roadway worker protection. The primary difference is the inclusion of the term ".. of the person operating the train or other equipment." In the context of an operating rule, the meaning is clear without this term. However, it was thought to be necessary to include the additional language in this regulation because most other references to range of vision apply to persons on the track seeing the train, rather than the range of vision of the operator of the train. This terminology is not meant to apply to any FRA regulations on other topics.

Roadway maintenance machine *means a device powered by any means of energy other than hand power which is being used on or near railroad track for maintenance,* *repair, construction or inspection of track, bridges, roadway, signal, communications, or electric traction systems. Roadway maintenance machines may have road or rail wheels or may be stationary.*

Roadway work group *means two or more roadway workers organized to work together on a common task.*

See the discussion under § 214.335 On-track safety for roadway work groups.

Roadway worker *means any employee of a railroad, or of a contractor to a railroad, whose duties include inspection, construction, maintenance or repair of railroad track, bridges, roadway, signal and communication systems, electric traction systems, roadway facilities or roadway maintenance machinery on or near track or with the potential of fouling a track, and flagmen and watchmen/lookouts as defined in this part.*

Some railroad employees whose primary function is transportation, that is, the movement and protection of trains, will be directly involved with on-track safety as well. These employees would not necessarily be considered roadway workers in the rule. They must, of course, be capable of performing their functions correctly and safely.

The rule requires that the training and qualification for their primary function, under the railroad's program related to that function, will also include the means by which they will fulfill their responsibilities to roadway workers for on-track safety. For instance, a train dispatcher would not be considered a roadway worker, but would be capable of applying the railroad's operating rules to the establishment of working limits for roadway workers. Likewise, a conductor who protects a roadway maintenance machine, or who protects a contractor working on railroad property, would not necessarily be considered a roadway worker unless he or she performs the strict function of a flagman as defined in this part (which definition see), but would receive training on functions related to on-track safety as part of the training and qualification of a conductor.

Employees of a contractor to a railroad are included in the definition when they perform duties under that contract on or near the track of a railroad. They should be protected as well as employees of the railroad. The responsibility for on-track safety of employees will follow the employment relationship. Contractors are responsible for the on-track safety of their employees and any required training for their employees. FRA expects that railroads will require their contractors to adopt the on-track safety rules of the railroad upon which the contractor is working. Where contractors require specialized on-track safety rules for particular types of work, those rules must, of course, be compatible with the rules of the railroad upon which the work is being performed.

The regulation does not apply to employers, or their employees, if they are not engaged by or under contract to a railroad. Personnel who might work near railroad tracks on projects for others, such as cable installation for a telephone company or bridge construction for a highway agency, come under the jurisdiction of other Federal agencies with regard to occupational safety.

Self-retracting lifeline/lanyard *means a deceleration device that contains a drum-wound line that may be slowly extracted from, or retracted onto, the drum under slight tension during normal employee movement, and which, after onset of a fall, automatically locks the drum and arrests the fall.*

The definition adopts OSHA's language, which reflects common trade usage.

Snap-hook *means a connector comprised of a hook-shaped member with a normally closed keeper, that may be opened to permit the hook to receive an object and, when released, automatically closes to retain the object.*

The final rule adopts OSHA's language, which reflects common trade usage. The keeper must close automatically, else it is not a snap hook.

Train approach warning *means a method of establishing on-track safety by warning roadway workers of the approach of trains in ample time for them to move to or remain in a place of safety in accordance with the requirements of this part.*

See the discussion under § 214.329 Train approach warning provided by watchmen/lookouts.

Train coordination *means a method of establishing working limits on track upon which a train holds exclusive authority to move whereby the crew of that train yields that authority to a roadway worker.*

See the discussion under § 214.325 Train coordination.

Train dispatcher *means the railroad employee assigned to control and issue orders governing the movement of trains on a specific segment of railroad track in accordance with the operating rules of the railroad that apply to that segment of track.*

Watchman/lookout *means an employee who has been annually trained and qualified to provide warning to roadway workers of approaching trains or on-track equipment. Watchmen/lookouts shall be properly equipped to provide visual and auditory warning such as whistle, air horn, white disk, red flag, lantern, fusee. A watchman/lookout's sole duty is to look out for approaching trains/on-track equipment and provide at least fifteen seconds advanced warning to employees before arrival of trains/on-track equipment.*

Working limits *means a segment of track with definite boundaries established in accordance with this rule upon which trains and engines may move only as authorized by the roadway worker having control over that defined segment of track. Working limits may be established through "exclusive track occupancy," "inaccessible track," "foul time" or "train coordination" as defined herein.*

See the discussions under and following § 214.319 Working limits, generally.

Federal Railroad Administration

Track and Rail and Infrastructure Integrity Compliance Manual

Volume III Railroad Workplace Safety
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Text in italic font of this manual is regulatory language, whereas indented paragraphs provide field guidance for FRA inspectors. Indented paragraphs are not to be construed as regulatory language in any manner.

CHAPTER 3 Roadway Worker Protection

Introduction

This chapter is based upon the Final Rule on Railroad Roadway Worker Protection issued by FRA on December 16, 1996.

The Roadway Worker Protection Rule is issued by FRA as Subpart C to 49 CFR 214. Railroad Workplace Safety. Subpart A of that part contains the general provisions and definitions, and Subpart B is the Bridge Worker Safety Rule. This chapter addresses all of Subpart C, and those parts of Subpart A that are affected or changed by this rulemaking.

FRA will have a major role in reviewing the on-track safety programs of all railroads, and it will be necessary for inspectors and specialists to understand the rule and its application. This preliminary document is therefore intended to fill this need.

Summary:

The Roadway Worker Protection Rule requires railroads and contractors to railroads to devise and adopt procedures to prevent their roadway worker employees being struck by trains and other on-track machinery. The Rule also requires roadway workers to follow the on-track safety procedures in order to protect themselves and others dependent upon them. Each railroad employer is required to have in place an on-track safety program, including rules, procedures, training and equipment, to be used for the protection of roadway workers. That program is subject to critical review by FRA.

Principles:

The rule is based upon a few very elemental principles:

1. A person who is not fouling a track will not be struck by a train.
2. A person who is fouling a track upon which a train will not move will not be struck by a train.
3. No person should foul a track unless that person knows either that:
    a. No train will arrive, or
    b. The person on the track will be able to move to a place of safety before a train arrives.
4. Each roadway worker bears the ultimate responsibility for his own on-track safety.
5. Each employer is responsible for providing the means for achieving on-track safety to each roadway worker employee.

Railroad On-track Safety Programs:

Each railroad is required to adopt and implement program that will afford on-track safety to all roadway workers performing duties on that railroad. FRA will review each railroad's on-track safety plan. FRA review and approval is not necessary before the program is implemented, but the railroad is responsible for having a complying plan regardless of FRA review.

Every railroad on-track safety program should include the following components:

1. Documentation.
    a. Operating rules.

   b. Safety rules.
   c. Established procedures.
   d. Required records.
2. Training.
3. Communication.
4. Action.
5. Internal monitoring.

The regulation calls for each of these provisions. Each railroad has considerable latitude in the implementation of the provisions, within the requirements of the regulation. The intent of the regulation is to have each railroad cover the required points, and adapt them to the operating situation of the railroad. Certain points should be noted when reviewing a railroad's on-track safety program, which are discussed in the following paragraphs.

Documentation of On-track Safety Programs:

The Paperwork Reduction Act of 1995 requires that the documentation requirements of any regulation must be kept to the absolute minimum necessary to accomplish the objective of the regulation. The documentation requirements of this regulation are considered to be necessary for a railroad or an employer to properly perform the duties which the regulation requires.

The Advisory Committee agreed on one fundamental principle with respect to operating rules, safety rules and established procedures, which is reflected in the regulation. That principle calls for a roadway worker to have one well-known reference to all the information needed to work according to the railroad's on-track safety program. A roadway worker should be able to turn to one location in one book to begin a reference to all on-track rules and procedures.

That does not mean that all the material must be found in that section of the book. Certain operating rules, special instructions, timetables and similar documents will necessarily be published in separate documents. The On-Track Safety program manual should have clear references to those documents wherever they have a bearing on on-track safety procedures. The manner in which they affect on-track safety procedures should also be clearly stated.

The program documents must include the written procedure by which the employer will resolve challenges of on-track safety procedures made by employees under 214.311 and 214.313.

The regulation requires that certain actions and items of information be recorded. A checklist follows:

§ 214.309 - On-track safety program documents - The fundamental document discussed above.

§ 214.321 - Exclusive track occupancy.

§ 214.321(b) (1) and (b) (2) - Written authority for track occupancy held by roadway worker in charge of working limits.

§ 214.321(b)(3) - Written record of authority for track occupancy maintained by train dispatcher or control operator.

§ 214.335(f) - Statement of On-track Safety prepared by each lone worker before fouling a track,

§ 214.341 - Records of training and qualification of all employees designated as roadway workers.

§ 214.351 - Recorded examination of training and qualification of roadway workers who provide on-track safety for members of roadway work groups.

Program Review by FRA:

Section 214.307 requires that employers notify FRA when their on-track safety programs are ready for review by FRA. The review will normally occur at the railroad's headquarters, or at another location on the railroad's property. The discussion under § 214.307 explains the intent of this section.

When FRA is notified that an on-track safety program is effective, the Office of Safety Assurance and Compliance will direct the appropriate FRA Regional Administrator (RA) to conduct the program review for that railroad. The RA will designate the regional staff personnel who will perform or assist in the review, and will arrange with the person designated by the railroad for a suitable time and place to begin.

Every encouragement should be given to railroads to provide the opportunity for roadway workers or their designated representatives to participate in the program review. The section analysis of § 214.307 notes as strongly as possible that willing cooperation is essential to the success of any on-track safety program. Early involvement of employees and their representatives in the design and review of an on-track safety program will contribute to its success. In any event, employee representatives have the right to express any differences with a program to FRA. If those expressions are made during the review process it is more likely that they can be addressed before the railroad has fully committed to its on-track safety program. If the differences arise from a misunderstanding, that issue can also be addressed before the misunderstanding becomes widespread.

The review process should be informal and open. The designated railroad personnel, the employee representatives if invited by the railroad, and the FRA representatives should read and discuss the program manual. They should give particular attention to connections made between the procedures called for in the manual, and the particular operating rules that are involved in those procedures. It is not necessary that the railroad submit any documentation to FRA before or during the review process, but it might be convenient for all concerned if the manuals can be reviewed before the review session.

Any concerns or questions held by FRA reviewers should be presented as soon as they arise to the railroad representatives. The concerns and questions, and the response or explanation provided by the railroad, should be noted in the report of the review. Within two weeks of the conclusion of the review, the RA should submit a memo of the results of the review to the Director, Office of Safety Analysis and Compliance, Office of Safety.

The memo should include a recommendation for approval or disapproval, any reasons behind a recommendation for disapproval, and a fair characterization of the railroad's on-track safety program. Approval or disapproval will be determined by the Associate Administrator for Safety.

It is anticipated that many smaller railroads will adopt the appropriate features of a common program that is being devised by the American Short Line Railroad Association. That program will be reviewed in general by FRA Headquarters, and that information will be provided after that general review. When such a program is adopted by a railroad, the issues to be determined will be whether the program provisions are appropriate to the individual railroad, the manner in which they are issued, and the degree with which personnel are familiar with their implementation.

Section Analysis of the Roadway Worker Protection Rule

§ 214.301 Purpose and scope.

(a) The purpose of this subpart is to prevent accidents and casualties caused by moving railroad cars, locomotives or roadway maintenance machines striking roadway workers or roadway maintenance machines.

(b) This subpart prescribes minimum safety standards for roadway workers. Each railroad and railroad contractor may prescribe additional or more stringent operating rules, safety rules, and other special instructions that are consistent with this subpart.

(c) This subpart prescribes safety standards related to the movement of roadway maintenance machines where such movements affect the safety of roadway workers. This subpart does not otherwise affect movements of roadway maintenance machines that are conducted under the authority of a train dispatcher, a control operator, or the operating rules of the railroad.

Guidance. Section 214.301 states the purpose for the minimum standards required under this subpart to protect roadway workers. Railroads can adopt more stringent standards as long as they are in accordance with this subpart.

Paragraph (c) defines the scope of the rule as applying to the protection of individual roadway workers from being struck by roadway maintenance machines, but not applying to the manner in which roadway maintenance machines are protected from trains and each other by the operating rules of a railroad.

§ 214.302 Information Collection Requirements.

(a) The information collection requirements of this part were reviewed by the Office of Management and Budget pursuant to the Paperwork Reduction Act of 1995, Public Law 104-13, § 2, 109 Stat.163 (1995) (codified as revised at 44 U.S.C. §§ 3501-3520), and are assigned OMB control number 2130-0539. FRA may not conduct or sponsor and a respondent is not required to respond to, a collection of information unless it displays a currently valid OMB control number.

(b) The information collection requirements are found in the following sections: §§ 214.303, 214.307, 214.309, 214.311, 214.313, 214.315, 214.319, 214.321, 214.323, 214.325, 214.327, 214.329, 214.331, 214.335, 214.341.

Guidance. This section is required by the Paperwork Reduction Act of 1995, cited in the section. It was mislabeled as Information and Collection Requirements in the final rule, and will be corrected to Information Collection Requirements in a subsequent amendment.

§ 214.303 Railroad on-track safety programs, generally.

(a) Each railroad to which this part applies shall adopt and implement a program that will afford on-track safety to all roadway workers whose duties are performed on that railroad. Each such program shall provide for the levels of protection specified in this subpart.

(b) Each on-track safety program adopted to comply with this part shall include procedures to be used by each railroad for monitoring effectiveness of and compliance with the program.

Guidance. Section 214.303 gives the general requirement that railroads shall adopt and implement their own program for on-track safety, which meets Federal minimum standards. Rather than implement a “command and control” rule, FRA decided to establish the parameters for such a program and defer to the expertise of each individual railroad to adopt a suitable on-track safety program for their railroad, in accordance with these parameters. FRA felt that establishing an internal monitoring process to determine compliance and effectiveness would be a necessary component of any On-Track Safety Program. Consequently, each railroad must incorporate an internal monitoring process as a component of its individual program. It should be noted that this internal monitoring will not replace FRA's inspection and monitoring efforts for compliance with this subpart.

§ 214.305 Compliance Dates

Each program adopted by a railroad shall comply not later than the date specified in the following schedule:

(a) For each Class I railroad (including National Railroad Passenger Corporation) and each railroad providing commuter service in a metropolitan or suburban area, March 15, 1997.

(b) For each Class II railroad, April 15, 1997.

(c) For each Class III railroad, switching and terminal railroad, and any railroad not otherwise classified, May 15, 1997.

(d) For each railroad commencing operations after the pertinent date specified in this section, the date on which operations commence.

Guidance. Section 214.305 establishes the dates upon which the different classes of railroads must comply with the rule. FRA believes that staggering effective dates allows the largest number of workers who are exposed to the highest level of risk to benefit from the On-Track Safety Program first. FRA hopes to be able to expedite the review process, as the smallest number of individual programs will be put in place by the major carriers. After this initial phase of reviews for Class I railroads, FRA will have established review policies and resolved many recurrent issues, making the larger number of reviews for smaller railroads more efficient. The experience gained through the initial phase of the review process will contribute to the next and larger phase of reviews. Although the rule formally establishes a later required effective date on smaller railroads, this would not prevent smaller railroads from implementing their programs sooner.

The Preamble of the Final Rule of December 16, 1996, also states:

Dates: Effective Dates: This rule is effective January 15, 1997. Each railroad must notify the FRA not less than 30 days before their respective date for compliance. Each railroad must be in compliance with this rule no later than the date specified in the following schedule: For each Class I railroad (including National Railroad Passenger Corporation) and each railroad providing commuter service in a metropolitan or suburban area, March 15, 1997; For each and any railroad not otherwise classified, May 15, 1997; For each railroad commencing operations after the pertinent date specified in this paragraph, the date on which operations commence.

§ 214.307 Review and approval of individual on-track safety programs by FRA.

(a) Each railroad shall notify, in writing, the Associate Administrator for Safety, Federal Railroad Administration, RRS-15, 400 Seventh Street SW, Washington, DC 20590, not less than one month before its on-track safety program becomes effective. The notification shall include the effective date of the program, the address of the office at which the program documents are available for review and photocopying by representatives of the Federal Railroad Administrator, and the name, title, address and telephone number of the primary person to be contacted with regard to review of the program. This notification procedure shall also apply to subsequent changes to a railroad's on-track safety program.

(b) After receipt of the notification from the railroad, the Federal Railroad Administration will conduct a formal review of the on-track safety program. The Federal Railroad Administration will notify the primary railroad contact person of the results of the review, in writing, whether the on-track safety program or changes to the program have been approved by the Administrator, and if not approved, the specific points in which the program or changes are deficient.

(c) A railroad's on-track safety program will take effect by the established compliance dates in § 214.305, without regard to the date of review or approval by the Federal Railroad Administration. Changes to a railroad's program will take effect on dates established by each railroad without regard to the date of review and approval by the Federal Railroad Administration.

Guidance. Section 214.307 specifies the process for review and approval of each railroad's on-track safety program by FRA. The intent of the review and approval is to be constructive, rather than restrictive. FRA prefers that a review of each program take place at the railroad because an open discussion of the program would be beneficial to all concerned. The effective date of a railroad's program will not be delayed by FRA's scheduling of a review, or granting approval. The railroad will be responsible for compliance with this rule regardless of FRA review or approval of its program.

Likewise, a railroad may amend its program following FRA approval without prior approval of the amendment from FRA. Of course, should FRA later disapprove the amendment, the program would have to be changed to secure FRA's approval. The railroad will still be responsible for compliance with this rule, and subject to compliance monitoring and enforcement by FRA. FRA will make every effort, when requested, to provide a timely review of a program or amendment before its effective date, and to assist in any manner possible to enhance the on-track safety afforded to roadway workers.

Contractors will be required to conform to the on-track safety programs on the railroads upon which they are working. Contractors whose employees are working under a railroad's approved on-track safety program need not submit a separate on-track safety program to FRA for review and approval.

Some contractors operate highly specialized equipment on various railroads on a regular basis. That equipment might require special methods to provide on-track safety for railroad and contractor employees. Such a special method will require a clear and reasonable way to mesh with the on-track safety programs of the railroads upon which the equipment is operated.

The rule does not specifically call for the involvement of employees or their representatives in the program design or review process, because the responsibility for the program's compliance with this rule lies with the employer. However, it should be noted that this rule itself is the product of a successful proceeding in which management, employee representatives and the Federal government were fully involved from the beginning. That fact should be an encouragement to all concerned to realize that the success of an on-track safety program will require the willing cooperation of all persons whose duties or personal safety are affected by the program.

§ 214.309 On-track safety program documents.

Rules and operating procedures governing track occupancy and protection shall be maintained together in one manual and be readily available to all roadway workers. Each roadway worker responsible for the on-track safety of others, and each lone worker, shall be provided with and shall maintain a copy of the program document.

Guidance. Section 214.309 specifies the type of on-track safety manual each railroad must have. Essentially, the railroad must have all on-track safety rules in one place, easily accessible to roadway workers. This provision is intended to provide the roadway worker with a single resource to consult for on-track safety, to avoid fragmentation of the rules and the ultimate dilution of their vital message.

The regulation does not specify how a railroad is to provide one manual encompassing the necessary information and make it readily available. FRA also does not intend that all related operating rules, timetables or special instructions must be reproduced in this manual; however, all rules and operating procedures governing track occupancy protection should be included. Any related publications or documents should be cross-referenced in the On-Track Safety Manual and provided to employees whose duties require them.

The procedures governing the good faith challenge is a subset of this information as these procedures govern any challenges to be made to track occupancy and protection. Thus the rules associated with the Good Faith Challenge found in §214.311(c) and §214.313(d) is considered to be part of the rule and should be contained in the document with the on-track safety manual. Roadway workers need this resource at the work site, in order to execute a challenge should one arise. This resource can take the form of:

- One document containing on-track safety procedures, good faith challenge, and on-track safety operating rules (absent operating rules not pertaining to on-track safety); or
- A binder system containing all operating rules/special instructions and on-track safety operating rules. The on-track safety procedures and good faith challenge can be a section or tab of this resource.

Section 214.309 establishes the responsibility of the employer to provide the on-track safety program document to all employees who are responsible for the on-track safety of others, and those who are responsible for their own on-track safety as lone workers. Roadway workers who provide on-track safety for others must have the manual at the work site for easy reference. FRA recognizes that the on-track safety document may be of various sizes. As such, “readily available” at the work site for a roadway workgroup would include having the manual in a vehicle, roadway maintenance machine, with the roadway worker who provides on-track safety, etc.

Lone workers must also have this manual easily available to them including track inspectors or signal maintainers, who may be walking track. FRA does not intend that an individual should have this manual on his or her person while performing work, but to have the appropriate sections available and readily accessible to all roadway workers at the work site. Readily available for a lone worker means the document may be on their person, in a vehicle, yard office, workshop, etc.

Railroads issue changes to on-track safety programs by the use of bulletins and notices. The changes can be in effect for a considerable period of time before being incorporated into the on track safety field manual. All changes to on-track safety procedures and rules governing track occupancy must be made a part of the on-track safety field manual and readily available to roadway workers, as soon as they are effective. These changes may be temporarily incorporated into the field manual, perhaps through incorporation of bulletins and general orders, and made readily available to all roadway workers. The Federal Railroad Administration (FRA) expects that any changes to the on-track safety program carried on bulletin or general orders would be permanently included in new printings of the field manual.

An employer, such as a contractor, whose roadway workers work on another employer's railroad, will usually adopt and issue the on-track safety manual of that railroad for use by their employees. It will be the employer's responsibility to provide the manual to its employees who are required to have it and to know that each of its employees is knowledgeable about its contents.

The manual must be at the work site available for reference by all roadway workers. Many roadway workers will not be responsible for providing protection for themselves or others, but still must comply with the rules. All employees have a responsibility to remain at a safe distance from the track unless they are assured that adequate protection is provided. Although not responsible for providing protection for others, they must be familiar with the rules to determine whether adequate protection is provided and have the rules readily available if it is necessary to consult them.

§ 214.311 Responsibility of Employers.

(a) Each employer is responsible for the understanding and compliance by its employees with its rules and the requirements of this part.

(b) Each employer shall guarantee each employee the absolute right to challenge in good faith whether the on-track safety procedures to be applied at the job location comply with the rules of the operating railroad, and to remain clear of the track until the challenge is resolved.

(c) Each employer shall have in place a written procedure to achieve prompt and equitable resolution of challenges made in accordance with §§ 214.311(b) and 214.313(d).

Guidance. Section 214.311 addresses the employer's responsibility in this rule. This section applies to all employers of roadway workers. Employers may be railroads, contractors to railroads, or railroads whose employees are working on other railroads. Although most on-track safety programs will be implemented by railroads rather than contractors, the employer is responsible to its employees to provide them with the means of achieving on-track safety.

Railroads are specifically required by § 214.303 to implement their own on-track safety programs. Section 214.311 however, places responsibility with all employers (whether they are railroads or contractors) to see that employees are trained and supervised to work with the on-track safety rules in effect at the work site. The actual training and supervision of contractor employees might be undertaken by the operating railroad, but the responsibility to see that it is done rests with the employer.

The guarantee required in paragraph (b) of an employee's absolute right to challenge on-track safety rules compliance will be a required part of each railroad's on-track safety program, as will be the process for resolution of such challenges. On-track safety depends upon the faithful and intelligent discharge of duty by all persons who protect or are protected by it. Any roadway worker who is in doubt concerning the on-track safety provisions being applied at the job location should resolve that uncertainty immediately.

The term at the job location is not meant to restrict who can raise an issue or where an issue can be raised. Rather, the challenge must address the on-track safety procedures being applied at a particular job location.

A fundamental principle of on-track safety is that a roadway worker who is not entirely certain that it is safe to be on the track should not be there. A discrepancy might be critical to the safety of others, and the first roadway worker who detects it should take the necessary action to provide for the safety of all.

The Advisory Committee used the term No-Fault Right in its report to describe the absolute right of each employee to challenge, without censure, punishment, harm or loss, the on-track safety compliance expressed in paragraph (b) of this section. A challenge must be made in good faith in order to fall within the purview of this rule. A good faith challenge would trigger the resolution process called for in paragraph (c).

The initiation of a challenge by one or more roadway workers in a work group regarding the on-track safety procedures provided may not necessitate all of the workers in the group clearing the track. The guarantee required in paragraph (b) gives every roadway worker the absolute right to challenge on-track safety rules. The good faith challenge process and the means for resolution of such challenges are required parts of every employer’s on-track safety program. On-track safety depends upon the faithful and intelligent discharge of duty by all persons who provide protection or are protected under it. Any roadway worker who is in doubt concerning the on-track safety provisions being applied at the job location should act to resolve that uncertainty immediately. Although a fundamental principle of on-track safety is that any roadway worker who is not entirely certain that it is safe to be on the track should not be there, the rule does not require that all roadway workers clear the track whenever a challenge is made. They have the right to do so, but the Roadway Worker in Charge (RWIC) is not specifically obligated to shut down the work while the challenge is resolved. However, if the challenge is found valid, and if the RWIC has improperly placed persons in a hazardous situation after having been notified of the error, the RWIC or the employer may be in violation of section 214.311 (responsibility of employers).

The written process to resolve challenges found in paragraph (c) is intended to provide a prompt and equitable resolution of these concerns. This is necessary in order that any problems that arise regarding on-track safety should be resolved and that any possible lapses in safety are quickly corrected.

The resolution process should include provisions to permit determination by all parties as to the safe, effective application of the on-track safety rule(s) being challenged at the lowest level possible, and for successive levels of review in the event of inability to resolve a concern at lower levels. FRA believes it best for employers, consulting with employees and their representatives where applicable, to write effective processes to accomplish these objectives.

A railroad's on-track safety program will be reviewed and approved in accordance with § 214.307(b). FRA will consider this written process during its review and approval of the overall on-track safety submission. FRA will consider whether the written processes afford a prompt and equitable resolution to concerns asserted in good faith and their effectiveness in promoting the intelligent, reasoned application of the on-track safety principles.

§ 214.313 Responsibility of Individual Roadway Workers.

(a) Each roadway worker is responsible for following the on-track safety rules of the railroad upon which the roadway worker is located.

(b) A roadway worker shall not foul a track except when necessary for the performance of duty.

(c) Each roadway worker is responsible to ascertain that on-track safety is being provided before fouling a track.

(d) Each roadway worker may refuse any directive to violate an on-track safety rule, and shall inform the employer in accordance with § 214.311 whenever the roadway worker makes a good faith determination that on-track safety provisions to be applied at the job location do not comply with the rules of the operating railroad.

Guidance. Section 214.313 addresses the individual responsibility of each roadway worker. Each roadway worker has a responsibility to comply with this subpart which is enforceable under the provisions of individual liability. Paragraph (a) requires that each roadway worker follow the railroad's on-track safety rules. Paragraph (b) prohibits roadway workers from fouling a track unnecessarily. It is FRA's opinion, as well as that of the Advisory Committee, that roadway workers should under no circumstances foul a track unless it is necessary to accomplish their duties.

A reference to the definition of fouling a track is useful to understand when protection is required. Fouling a track describes the circumstance in which a person is in danger of being struck by a moving train.

Under paragraphs (c) and (d), each roadway worker has the responsibility to know that on-track safety is being provided before actually fouling a track, and to remain clear of the track and inform the employer when the required level of protection is not provided. If a roadway worker is not sure that sufficient on-track safety is being provided, he or she can satisfy paragraph (c) by simply not fouling the track.

It is a roadway worker's responsibility to advise the employer of exceptions taken to the application of a railroad's rules, or provisions of this subpart, in accordance with paragraph (d). Employees must approach this responsibility in good faith. Essentially an employee must have honest concerns whether the on-track safety procedures being used provide the necessary level of safety in accordance with the rules of the operating railroad. Furthermore, employees must be able to articulate those concerns in order to invoke the resolution process of the railroad. Initiating an action under the resolution process, absent a good faith concern regarding the on-track safety procedures being applied, would not be in compliance with this subpart.

§ 214.315 Supervision and communication.

(a) When an employer assigns duties to a roadway worker that call for that employee to foul a track, the employer shall provide the employee with a job briefing that includes information

on the means by which on-track safety is to be provided, and instruction on the on-track safety procedures to be followed.

(b) A job briefing for on-track safety shall be deemed complete only after the roadway worker has acknowledged understanding of the on-track safety procedures and instructions presented.

(c) Every roadway work group whose duties require fouling a track shall have one roadway worker designated by the employer to provide on-track safety for all members of the group. The designated person shall be qualified under the rules of the railroad that conducts train operations on those tracks to provide the protection necessary for on-track safety of each individual in the group. The responsible person may be designated generally, or specifically for a particular work situation.

(d) Before any member of a roadway work group fouls a track, the designated person providing on-track safety for the group under paragraph (c) of this section shall inform each roadway worker of the on-track safety procedures to be used and followed during the performance of the work at that time and location. Each roadway worker shall again be so informed at any time the on-track safety procedures change during the work period. Such information shall be given to all roadway workers affected before the change is effective, except in cases of emergency. Any roadway workers who, because of an emergency, cannot be notified in advance shall be immediately warned to leave the fouling space and shall not return to the fouling space until on-track safety is re-established.

(e) Each lone worker shall communicate at the beginning of each duty period with a supervisor or another designated employee to receive a job briefing and to advise of his or her planned itinerary and the procedures that he or she intends to use for on-track safety. When communication channels are disabled, the job briefing shall be conducted as soon as possible after the beginning of the work period when communications are restored.

Guidance. Section 214.315 details supervision and communication of on-track safety methods prior to working. Employees must be notified and acknowledge understanding of the on-track safety methods they are to use, prior to commencing duties on or near the track. Paragraphs (a) and (b) establish the duty of notification by the employer and the reciprocal duty of communicating acknowledgment by the employee. These sections essentially require a job briefing to inform all concerned of on-track safety methods at the beginning of each work period. The acknowledgment is an indication by the employee of understanding, or the opportunity to request explanation of any issues that are not understood.

Paragraph (c) requires that an employer designate at least one roadway worker to provide on-track safety while a group is working together. This designation can either be for a specific job or for a particular work situation. This section is vital to the success of any on-track safety program because the mere presence of two or more persons together can be distracting for all persons involved. FRA believes that awareness will be enhanced and confusion limited by requiring railroads to formally designate a responsible person. This designation must be clearly understood by all group members in order to be effective. An individual, such as a foreman, may generally be designated to be responsible for his or her group, but if two groups are working together or roadway workers of different crafts are assisting one another, it is imperative that this formal designation be communicated to and understood by all affected employees.

Usually, the RWIC will provide the briefing to a roadway work group. However, it is acceptable for other responsible employees to provide this briefing in situations where a roadway work group may be located along a considerable distance such as a large scale mechanized production activity.

It is a common practice for two or more separate work groups to utilize the same working limits (and authority). The regulation clearly specifies that only one roadway worker can be in charge (RWIC) of the working limits. However, questions have arisen regarding the required qualifications for the workers providing on-track safety for a second or third roadway work group that may be utilizing the working limits held by the initial RWIC.

When working limits are established as a form of on-track safety, the provisions of §214.319(b) apply, which states: "Only one roadway worker shall have control over working limits on any one segment of track." Therefore, it is imperative that only one worker have control, even when multiple work groups may be using common working limits. This is necessary to avoid the complications of multiple or confusing instructions to trains and on-track equipment (OTE) that may be entering working limits.

For example, group B has asked and been given permission by the initial RWIC of group A to use their working limits to foul the track. Sharing the working limits would not necessarily require a person with the qualification under §214.353 for group B, depending upon the type of work being performed. This would not be considered overlapping working limits, but group B would conduct its work within the initial RWIC's working limits. Group A, if affected, would receive a second job briefing prior to giving group B permission to occupy the same working limits. Should a member of group B be asked to perform a duty such as a watchman/lookout, then that individual would need to be qualified to perform that function.

It is also important to remember that only one RWIC can control working limits (214.319(b)). In this scenario, it would be RWIC of group A. Should group B require additional on-track safety above and beyond that afforded by the RWIC controlling the working limits (group A), then an equally qualified worker must be present with that group to provide any additional or changed on-track safety. For example, group B needs to foul an adjacent track not included in group A's working limits. Sec. 214.315 - Supervision and Communication - is a key element with respect to this discussion:

To summarize the foregoing, when a second work group joins another work group within an existing working limits in a common task, it generally would not be necessary for the second work group to have an employee that has the qualification prescribed by §214.353. However, if the RWIC of the working limits (group A) calls upon someone from group B that is not engaged in a common task to provide on-track safety for their work group, they must have an employee with the qualification prescribed by §214.353.

Prior to the RWIC who controls the working limits (group A) permitting trains and other on-track equipment (OTE) into the limits; all effected workers must be notified. For example, if the RWIC holding the working limits (group A) directs a train or OTE to move into their limits he or she may ask group B to provide their own on-track safety in the form of train approach warning or flagman (if the work is to continue). If group B does not have a worker qualified to perform flagging or watchman/lookout duties then all workers must vacate the track. If an individual is qualified to act as the flagman or watchman/lookout and all workers determine during a "new" job briefing that one of these types of on-track safety is sufficient, the group can continue to work.

It is also necessary to consider the scenario where an RWIC becomes unavailable or calls upon another individual to establish additional on-track safety such as train approach warning. Should a qualified RWIC not be available, then the work group must vacate the track. In the event on-track safety conditions change, a new job briefing should be conducted before any worker continues to foul the track.

The forgoing example is based on working limits on controlled track under the provisions of exclusive track occupancy. Therefore, the RWIC of the working limits must direct all movements in accordance with §214.321(d).

Paragraph (d) explains the duties of the roadway worker designated to provide on-track safety for the work group. Before roadway workers foul a track, the designated person must inform each roadway worker in the group of the on-track safety methods to be used at that time and location. Essentially, the designated person must conduct an on-track safety briefing prior to the beginning of work on or near the track. This briefing might also fulfill the requirements of paragraph (a) of this section.

Before changing on-track safety methods during a work period, the designated roadway worker must again inform the group of the new methods to be used for their safety. If, for example, roadway workers are working on a track within working limits when the on-track safety method changes to train approach warning, all roadway workers fouling the track must first be informed that trains might approach on that track, and that they will be warned of the approaching train by watchmen/lookouts. They must also know that they can no longer depend on that track as a place of safety when a train approaches.

This provision also establishes methods to be used in the face of unforeseen circumstances. In these emergency situations, where notification of a change in methods cannot be accomplished, an immediate warning to leave the fouling space and not return until on- track safety is reestablished is required.

Given the above duties of the RWIC, it is important that he or she coordinate all on-track safety activities at a work site. This responsibility is an essential element of on-track safety especially when working limits are established and there are activities occurring such as train or on-track equipment movements within the working limits.

The Rule does not specify the location of the RWIC in relation to any work activity where on-track safety has been established or may be established. As such, it may be necessary for a RWIC to depart the work activity for a short period to travel to another area encompassing the same on-track safety (e.g., conduct on-track safety checks throughout a large mechanized production activity). However, during such periods where the RWIC may be away from a work site for short periods, it is imperative the roadway work group have readily available means to communicate with this employee. When a RWIC departs a work site for an extended period, a substitute employee, with the relevant qualifications may be designated. If any exclusive track occupancy authorities are involved, the change in the RWIC designation must be formally addressed in the railroad operating rule procedures.

Paragraph (e) addresses the lone worker. The lone worker must also have a job briefing before fouling the track. This briefing will be slightly different, since the lone worker is not working under direct supervision. At the beginning of the duty period, and prior to fouling the track, the lone worker must communicate with a supervisor or another designated employee to advise of his itinerary and the means by which he plans to protect himself. This briefing should include his geographical location, approximate period of time he is expected to be in this general locality, different locations planned for the day, and the planned method of protection. This paragraph assumes that in accordance with other sections, the lone worker is capable of determining the proper means to achieve his own on-track safety.

The benefits of a lone worker briefing include triggering the lone worker to think about his or her on-track safety, providing a means to inform the railroad where the lone worker will be located during a tour of duty, and providing information (e.g., special instruction changes, etc.) to the lone worker. The regulation does not specify the qualifications that a supervisor or other designated employee must have in order to participate in a briefing with a lone worker. Therefore, in order to ensure the benefits associated with a lone worker briefing, the supervisor or other designated employee should be familiar with railroad operations and on-track safety rules.

This paragraph also provides for emergencies in which the channels of communication are disabled. In those cases, the briefing must be conducted as soon as possible after communication is restored. An interruption in communication does not prevent the lone worker from commencing work. However, since the lone worker will not have described his itinerary and the on-track safety methods to be used in this location to another qualified employee, he must do all that is necessary to maintain the requisite awareness of his surroundings.

§ 214.317 On-track safety procedures, generally.

Each employer subject to the provisions of this part shall provide on-track safety for roadway workers by adopting a program that contains specific rules for protecting roadway workers that comply with the provisions of §§ 214.319 through 214.337 of this part.

Guidance. Section 214.317 refers to the following sections 214.319 through 214.337 that prescribe several different types of procedures that may be used to achieve on-track safety. It requires employers to use one or more of these types of procedures whenever employees foul a track.

The definition of fouling a track includes a minimum distance limit of four feet from the field, or outer, side of the running rail nearest to the roadway worker. A person could be outside that distance and still be fouling the track under this rule if the person's expected or potential activities or surroundings could cause movement into the space that would be occupied by a train, or if components of a moving train could extend outside the four-foot zone.

Railroad equipment is commonly 10 feet 8 inches wide. Standard track gauge is 4 feet 8-1/2 inches but when adding the nominal width of the rail, the rail spacing can be taken as 5 feet 0 inches for the purposes of this rule. The fouling space would therefore be 13 feet wide (5+4+4 feet).

One exception to the four-foot minimum distance is found in paragraph § 214.341(c) (Roadway maintenance machines) and is discussed in the analysis of that section.

The report of the Advisory Committee includes the statement that ``The provisions of restricted speed do not solely provide protection for track equipment, or roadway workers, performing maintenance.'' The rule does not recognize restricted speed as a sole means of providing on-track safety.

The Advisory Committee also found, and FRA agrees, that although the definitions of “restricted speed'' found in this rule and in use throughout the railroad industry provide adequate separation between trains and on-track machines in a traveling mode, a blanket provision that would rely upon restricted speed to protect persons working while fouling the track would not be effective. Individual locations at which unusual circumstances could result in sufficient protection for roadway workers from trains moving at restricted speed would be addressed by FRA through the waiver process.

§ 214.319 Working limits, generally.

Working limits established on controlled track shall conform to the provisions of § 214.321 Exclusive track occupancy, or § 214.323 Foul time, or § 214.325 Train coordination. Working limits established on non-controlled track shall conform to the provision of § 214.327 Inaccessible track. Working limits established under any procedure shall, in addition, conform to the following provisions:

(a) Only a roadway worker who is qualified in accordance with § 214.353 of this part shall establish or have control over working limits for the purpose of establishing on-track safety.

(b) Only one roadway worker shall have control over working limits on any one segment of track.

(c) All affected roadway workers shall be notified before working limits are released for the operation of trains. Working limits shall not be released until all affected roadway workers have either left the track or have been afforded on-track safety through train approach warning in accordance with § 214.329 of this subpart.

Guidance. Working limits is an on-track safety measure which when established eliminates the risk of being struck by trains. Several methods of establishing working limits are found in this subpart. Those methods are distinguished by the method by which trains are authorized to move on a track segment, the physical characteristics of the track, and the operating rules of the railroad.

Paragraphs (a) and (b) specifically refer to the roadway worker who is given control over working limits. These requirements assure that the roadway worker has the requisite knowledge and training, and prevent confusion by giving control to only one qualified roadway worker.

Paragraph (c) provides the restrictions under which trains and roadway maintenance machines will be allowed to operate within working limits. The intent is that the roadway worker in charge will be able to communicate with a train while it is within the working limits, and to control its movement to prevent conflicts between trains, machines and roadway workers.

The requirement that trains move at restricted speed in working limits unless otherwise authorized by the roadway worker in charge is intended as a fail-safe provision to afford the highest level of safety in the absence of authority for higher speed. FRA does not contemplate, nor would it condone, a situation in which a roadway worker could authorize a higher speed for a train than would be otherwise permitted by the operating rules and instructions of the railroad.

Paragraph (d) addresses the procedure when working limits are released. It requires that all affected roadway workers be notified before trains will begin moving over the affected track. They must be either away from the track, or provided with another form of on-track safety.

An example is a work group using a crane to replace rail. Rails are removed from the track, the crane is on the track, and on-track safety is provided by the establishment of working limits. When the rails have been replaced, the crane moves out of the working limits onto another track, the roadway worker in charge stations watchmen/lookouts to provide train approach warning and notifies all the roadway workers at the work site that train approach warning is now in effect and the working limits are to be released. The roadway worker in charge then releases the working limits to the train dispatcher to permit the movement of trains. The roadway workers at the work site continue to work with hand tools while on-track safety is provided by the watchmen/lookouts.

§ 214.321 Exclusive track occupancy.

Working limits established on controlled track through the use of exclusive track occupancy procedures shall comply with the following requirements:

(a) The track within working limits shall be placed under the control of one roadway worker by either:

(1) Authority issued to the roadway worker in charge by the train dispatcher or control operator who controls train movements on that track,

(2) Flagmen stationed at each entrance to the track within working limits and instructed by the roadway worker in charge to permit the movement of trains and equipment into the working limits only as permitted by the roadway worker in charge, or

(3) The roadway worker in charge causing fixed signals at each entrance to the working limits to display an aspect indicating ``Stop.''

(b) An authority for exclusive track occupancy given to the roadway worker in charge of the working limits shall be transmitted on a written or printed document directly, by relay through a designated employee, in a data transmission, or by oral communication, to the roadway worker by the train dispatcher or control operator in charge of the track.

(1) Where authority for exclusive track occupancy is transmitted orally, the authority shall be written as received by the roadway worker in charge and repeated to the issuing employee for verification.

(2) The roadway worker in charge of the working limits shall maintain possession of the written or printed authority for exclusive track occupancy while the authority for the working limits is in effect.

(3) The train dispatcher or control operator in charge of the track shall make a written or electronic record of all authorities issued to establish exclusive track occupancy.

(c) The extent of working limits established through exclusive track occupancy shall be defined by one of the following physical features clearly identifiable to a locomotive engineer or other person operating a train or railroad equipment:

(1) A flagman with instructions and capability to hold all trains and equipment clear of the working limits;

(2) A fixed signal that displays an aspect indicating ``Stop'';

(3) A station shown in the time-table, and identified by name with a sign, beyond which train movement is prohibited by train movement authority or the provisions of a direct train control system.

(4) A clearly identifiable milepost sign beyond which train movement is prohibited by train movement authority or the provisions of a direct train control system; or

(5) A clearly identifiable physical location prescribed by the operating rules of the railroad that trains may not pass without proper authority.

(d) *Movements of trains and roadway maintenance machines within working limits established through exclusive track occupancy shall be made only under the direction of the roadway worker having control over the working limits. Such movements shall be restricted speed unless a higher speed has been specifically authorized by the roadway worker in charge of the working limits.*

Guidance. Section 214.321 prescribes working limits on controlled track as one form of on-track safety allowed in accordance with the provisions of this subpart. Reference to the definitions of Controlled Track and Exclusive Track Occupancy are helpful to the understanding of this section.

Controlled track is track on which trains may not move without authorization from a train dispatcher or a control operator. On most railroads, trains move on main tracks outside of yard limits, and through interlockings, only when specifically authorized by a train dispatcher or control operator. This authorization might take the form of an indication conveyed by a fixed signal, or a movement authority transmitted in writing, orally, or by digital means. Such track would conform to the definition of controlled track.

Some railroads extend the control of a train dispatcher to main tracks within yard limits. This control is exercised by requiring the crew of every train and engine to obtain a track warrant specifying the limits of the territory in which the crew may operate. The track warrant lists all restrictions that are in effect within the limits specified, including any working limits established to protect roadway workers or train movements. The working limits are delineated by flags as specified in § 214.321(c)(5). Track from which trains can be effectively withheld by such a procedure would conform to the definition of controlled track.

Exclusive track occupancy is the means prescribed in this section to establish working limits on controlled track. The procedures associated in this section with exclusive track occupancy are intended to assure that unauthorized train movements will not occur within working limits established by exclusive track occupancy.

This section addresses controlled track, as it is the type of track upon which exclusive track occupancy can be established by the dispatcher or control operator. By virtue of their authority to control train movements on a segment of controlled track, a dispatcher or control operator can also hold trains clear of that segment by withholding movement authority from all trains. The procedure depends upon communication of precise information between the train dispatcher or control operator, the roadway worker in charge of the working limits, and the crews of affected trains. This section is intended to prescribe that level of precision.

Paragraph (a) requires that authority for exclusive track occupancy may only be granted by the train dispatcher or control operator who has control of that track to a roadway worker who has been trained and designated to hold such an authority. No other person may be in control of the same track at the same time.

The Rule clearly defines three methods by which the tracks within exclusive track occupancy are placed under the control of a roadway worker in charge (RWIC):

1. Authority issued to the RWIC by the train dispatcher or control operator who controls train movements on that track;
2. Flagmen stationed at each entrance to the track within working limits and instructed by the RWIC to permit the movement of trains and on-track equipment (OTE) into the working limits only as permitted by him or her; or
3. The RWIC causing fixed signals at each entrance to the working limits to display an aspect indicating “stop” (local control). For the purposes of the Rule, a “fixed signal” is

a wayside block or interlocking signal which the most restrictive indication that can be conveyed is "stop."

Paragraph (b) and corresponding subparagraphs prescribe the methods for transferring the authority for exclusive track occupancy to the roadway worker with the requisite level of accuracy.

An "authority" is the instrument that confirms trains and on-track equipment (OTE) movements have been withheld from the track(s) encompassing exclusive track occupancy. As required by the Rule, the authority must be a written or printed document and includes such instruments as a "NORAC Form D," "Track Bulletin Form B," "Track Warrant," "Track and Time," "OCS Clearance," etc. As required by §214.321(b)(2), the RWIC must maintain possession of the authority document while it is in effect.

It is a practice on many railroads to place the name of the specific RWIC at a work site on an authority. However, on some railroads a work crew designation system (e.g., number) is placed on the authority. A crew designation procedure may, in fact, reduce confusion if a railroad has multiple employees with the same or similar name. Therefore, FRA will accept procedures where a work crew designation system is used with authorities only if such procedures include precise communication protocols to ensure trains and OTE contact the proper RWIC to enter working limits.

The Federal Railroad Administration (FRA) has reviewed whether the record under this provision must be retained for an extended period. Section 214.321(b)(2) requires the written or printed document only be maintained by the roadway worker in charge while the authority for the working limits is in effect. With respect to the requirement of a dispatcher's written or electronic record, the Roadway Worker Protection regulation does not specify a required time for such records. Retention of dispatching records is governed by 49 C.F.R. Part 228.

Paragraph (c) and corresponding subparagraphs prescribe physical markers or features that may be used to indicate the extent of working limits established under this paragraph with the requisite level of precision.

As prescribed by §214.321 (c), the extent of working limits established through exclusive track occupancy must have a physical feature (delineation) at each working limits entrance that is clearly identifiable to approaching trains or OTE. In the case of "active" delineations, these features include either:

- Flagman or
- Fixed signal that conveys a "stop" indication.

  Note: Flagmen are included as a valid means of establishing exclusive track occupancy because they are effective, and they might be the only means available on short notice or at certain locations.

Acceptable "passive" delineations consist of a

- Station with a sign identified by name,
- Clearly identifiable milepost marker,
- Clearly identifiable physical location,
  - Any physical feature, such as a switch, whereby an employee operating a train or OTE has knowledge of its specific location through physical characteristic

qualifications. Red flags or signs may also be used but approaching movements must be informed of the exact location of these devices), or

- Provisions of a direct train control system,
    - Any method of operation, such as Direct Traffic Control (DTC), Track Warrant Control (TWC), Track Permit Control System (TPCS), Form D Control System (DCS), Occupancy Control System (OCS), and similar methods of operation that are derivatives of the former timetable/train order method of operation.

An authority that withholds movements from the working limits must first be obtained by the RWIC before "passive" delineations can be used. However, flagmen with the capability to withhold movement or wayside signals conveying a "stop" aspect through local control may be used to establish and delineate working limits).

When an authority is issued to establish an exclusive track occupancy [§214.321(a)(1)], precise communication between the train dispatcher (or control operator) and trains/OTE is imperative to assure movements approaching exclusive track occupancy limits are withheld. Any movements into exclusive track occupancy limits then may occur under the direction of the RWIC in accordance with §214.321(d). Any physical location that is used alone to delineate working limits must be clearly prescribed by the operating rules of the railroad whereby train engineers and OTE operators know, in advance, the exact location of these devices in advance. Procedures such as physical characteristic qualifications of employees and listing designated physical locations in special instructions are acceptable methods to assure safe use of physical locations to delineate exclusive track occupancy limits.

Paragraph (d) allows a railroad to permit the movement of trains and equipment in working limits under the control of the roadway worker in charge. This accommodates a need to move work trains and roadway machines into and within working limits in connection with the work being performed. It also accommodates a need to move trains and equipment through working limits after all roadway workers and machines are moved into the clear or otherwise protected. Such movements will be under the direct authority of the roadway worker in charge, who must take the necessary steps to properly direct the train movement as well as protecting the roadway workers and machines at the worksite.

The authorization of movement of either trains or roadway maintenance machines within working limits without the permission of the roadway worker in charge (RWIC) would constitute a violation of § 214.321(d). Thus, movements of trains and on-track equipment that are not under the direction of the RWIC within exclusive track occupancy limits, are not in compliance with section 214.321. However, the Federal Railroad Administration (FRA) recognizes that there may be times when the RWIC cannot be contacted for an extended period of time, due to emergency or unusual circumstances, and that in extraordinary circumstances trains must be authorized to move despite lack of permission from the RWIC. The present regulation does not address this irregular situation and thus, FRA's enforcement action under these circumstances will be determined on a case-by-case basis.

In addition to withholding movements that are approaching working limits, it is also imperative railroad rules prohibit train and OTE from entering the track between the delineations, e.g., a hi-rail vehicle occupying a track at a highway-rail grade crossing or other OTE from entering at a hand-operated switch.

Paragraph (d) also requires that trains and other equipment moving through working limits under the authority of the roadway worker in charge move at restricted speed unless higher speed is specifically authorized by the roadway worker in charge. This provision establishes a fail-safe default speed to apply in the absence of information to the contrary. It also establishes the sole authority of the roadway worker in charge to specify the speed of trains and equipment through the working limits.

Many different situations will arise in the application of this section. Where "passive" delineations are utilized, movements must be provided with advance notification of the type and exact location of these devices. For instance, a roadway worker in charge might wish to establish working limits between mileposts 15 and 16 on a single main track but the train dispatcher can only hold trains at controlled signals at mileposts 10 and 20. In that case, the rules of the railroad could permit the roadway worker to place flags or some recognized signal at the ends of the working limits, mileposts 15 and 16, and the roadway worker would only be in charge of the track between the flags.

Another roadway worker might establish working limits between mileposts 12 and 14 during the same time using the same method. The train dispatcher would still hold trains at the same controlled signals, but the working limits would not overlap.

An important point in the application of this section is that a train must be informed of the existence of working limits if it is permitted by signal indication or some other authority to approach the working limits. It is not sufficient to just place flags and go to work. However, a railroad may permit the flags to be moved as the work progresses, so long as all trains approaching the working limits are informed of their existence.

There are concerns regarding procedures on some railroads whereby trains and/or other OTE are admitted into the limits of an authority without the direction of the RWIC or without any information about the existence of working limits within the authority. One example is where the limits of an authority in centralized traffic control (CTC) territory would be at two Controlled Points located a significant distance from the actual work. With this type of procedure, protection is predicated on restricted speed and locomotive engineers or OTE operators looking out for flag(s) somewhere within the limits of the authority (in this case, between two Controlled Points). Where used, this procedure also raises the question regarding temporary speed restriction signs or other similar devices within the authority limits which may be misinterpreted as flags delineating working limits.

While the above procedures have been commonly used in the past, to a large extent they rely on trains operating at restricted speed to protect the roadway workers. This conflicts with one of the most important underpinnings of the Rule, which is the prohibition of restricted speed, or its functional equivalent, to protect roadway workers.

Overlapping Authorities/Multiple Groups

It is an established practice on some railroads for multiple uncoordinated roadway work groups to be located within the same authority limits. For example, a RWIC may obtain a track and time permit (authority) in CTC territory between Control Points 10 and 20. The RWIC would then place red flags somewhere between mileposts 12 and 13. Subsequently, one or more additional roadway work activities with the same or overlapping authority limits occupy the track and place their flags after the first RWIC placed his/her flags.

Consequently, there are multiple independent and uncoordinated work activities each with potentially overlapping working limits. Specifically, there is the potential for a train or OTE to receive radio instructions to pass a red flag when that communication is obtained from the incorrect RWIC. This is of particular concern if a RWIC were to place flags between/within another RWIC's flags. To eliminate the potential problem associated with multiple employees directing movements, §214.319 (b) states - "*Only one roadway worker shall have control over working limits for the purpose of establishing on-track safety*." This must prevail to fulfill the intent of exclusive track occupancy.

When multiple work groups use a common working limits, it is imperative that railroads have procedures in place to assure on-track safety when the RWIC releases the track to the train dispatcher or when he or she authorizes movements into the working limits. For example, the RWIC recording additional groups that occupy his or her working limits or the train dispatcher placing or "stacking" blocking devices for each additional work group. However, all movements within working limits must remain under the control of the RWIC.

Withholding Equipment

In addition to protection from trains, the Rule prescribes procedures to protect roadway workers from the dangers associated with the movement of OTE. Railroads that permit trains into the limits of an authority without the direction of the RWIC, or without information about the location of working limits, also allow other OTE to proceed with even less controls. Specifically, other OTE may not be informed of working limits that may be within an authority granted for movement (overlapping movement and work authorities). Certain railroad rules permit OTE to move at substantial speeds (up to 45 mph) proceeding prepared to stop within one half the range of vision.

While OTE may be able to stop in less distance than trains, the Rule was clearly crafted to protect workers from trains and OTE. Furthermore, the increasing complexity and size of OTE can at times result in risks regarding adequate stopping distances similar to trains. Therefore, the definition of exclusive track occupancy specifies that trains and OTE movements must be withheld from the track within exclusive track occupancy.

§ 214.323 Foul time.

Working limits established on controlled track through the use of foul time procedures shall comply with the following requirements:

(a) Foul time may be given orally or in writing by the train dispatcher or control operator only after that employee has withheld the authority of all trains to move into or within the working limits during the foul time period.

(b) Each roadway worker to whom foul time is transmitted orally shall repeat the track number, track limits and time limits of the foul time to the issuing employee for verification before the foul time becomes effective.

(c) The train dispatcher or control operator shall not permit the movement of trains or other on-track equipment onto the working limits protected by foul time until the roadway worker who obtained the foul time has reported clear of the track.

Guidance. Section 214.323 prescribes another form of on-track safety involving the establishment of working limits. This method of protection is called foul time and is only prescribed for use on controlled track. The definition of foul time should be referenced for a complete understanding of this concept. Foul time requires oral or written notification by the train dispatcher or control operator to the responsible roadway worker that no trains will be operating within a specific segment of track during a specific time period. The steps to obtain foul time are detailed in this section. Once foul time is given, a dispatcher or control operator may not permit the movement of trains onto the protected track segment until the responsible roadway worker reports clear.

Foul time is a simplified method of establishing working limits. It is distinguished from exclusive track occupancy by not requiring a written copy of the authorization, and by not permitting the movement of trains or other equipment within the working limits.

§ 214.325 Train coordination

Working limits established by a roadway worker through the use of train coordination shall comply with the following requirements:

(a) Working limits established by train coordination shall be within the segments of track or tracks upon which only one train holds exclusive authority to move.

(b) The roadway worker who establishes working limits by train coordination shall communicate with a member of the crew of the train holding the exclusive authority to move, and shall determine that:

(1) The train is visible to the roadway worker who is establishing the working limits,

(2) The train is stopped,

(3) Further movements of the train will be made only as permitted by the roadway worker in charge of the working limits while the working limits remain in effect, and

(4) The crew of the train will not give up its exclusive authority to move until the working limits have been released to the train crew by the roadway worker in charge of the working limits.

Discussion from Final Rule of December 16, 1996:

Emergency Procedures/Train Coordination

Commenters suggested that a provision be added to the rule permitting roadway workers to perform their duties on the track, in an emergency, without establishing one of the prescribed forms of on-track safety. For example, if an ice storm has caused trees to fall across the track and into the signal and communication wires, roadway workers would accompany trains to remove the trees and reestablish communications. Under the proposed rule, the roadway workers would be unable to establish working limits because of the presence of the train and the inability to immediately communicate with the dispatcher. The Advisory Committee discussed this question at the July 12 meeting. Various members clearly stated their need for such a provision, as well as their concerns regarding potential problems associated with it. The Advisory Committee did not reach consensus on the question.

However, FRA has considered the concerns expressed by the Advisory Committee. FRA believes that a form of on-track safety can be arranged whereby a roadway worker or a roadway work group would be protected by the movement authority of a train. The method prescribed by FRA, termed Train Coordination, incorporates all the safeguards necessary to protect the roadway workers from train movements, and addresses the concerns of the commenters as well. FRA independently expanded the concept discussed in the comments and by the Advisory Committee. FRA believes that, rather than restricting this provision to emergency situations, it should be crafted for use in any situation, including cleaning snow out of switches for a specific train, handling materials with a work train, or repairing track at a derailment site. The underlying principle is that a roadway worker should be assured that a train will not arrive unexpectedly at a work location. The provision for Train coordination provides that assurance.

§ 214.327 Inaccessible track.

(a) Working limits on non-controlled track shall be established by rendering the track within working limits physically inaccessible to trains at each possible point of entry by one of the following features:

(1) A flagman with instructions and capability to hold all trains and equipment clear of the working limits;

(2) A switch or derail aligned to prevent access to the working limits and secured with an effective securing device by the roadway worker in charge of the working limits;

(3) A discontinuity in the rail that precludes passage of trains or engines into the working limits;

(4) Working limits on controlled track that connects directly with the inaccessible track, established by the roadway worker in charge of the working limits on the inaccessible track; or

(5) A remotely controlled switch aligned to prevent access to the working limits and secured by the control operator of such remotely controlled switch by application of a locking or blocking device to the control of that switch, when:

(i) The control operator has secured the remotely controlled switch by applying a locking or blocking device to the control of the switch, and

(ii) The control operator has notified the roadway worker who has established the working limits that the requested protection has been provided, and

(iii) The control operator is not permitted to remove the locking or blocking device from the control of the switch until receiving permission to do so from the roadway worker who established the working limits.

(b) Trains and roadway maintenance machines within working limits established by means of inaccessible track shall move only under the direction of the roadway worker in charge of the working limits, and shall move at restricted speed.

(c) No operable locomotives or other items of on-track equipment, except those present or moving under the direction of the roadway worker in charge of the working limits, shall be located within working limits established by means of inaccessible track.

Guidance. Section 214.327 requires that working limits on non-controlled track be established by rendering the track physically inaccessible to trains and equipment. A reference to the definitions of non-controlled track and inaccessible track is useful to the understanding of this section. Trains and equipment can operate on non- controlled track without having first received specific authority to do so. Trains and equipment cannot be held clear of non-controlled track by simply withholding their movement authority. The roadway worker in charge of the working limits must therefore render non-controlled track within working limits physically inaccessible to trains and equipment, other than those operating under the authority of that roadway worker, by using one or more of the provisions of this section.

Typical examples of non-controlled track to which this section would apply include main tracks within yard limits where trains are authorized by an operating rule to move without further specific authority, yard tracks, and industrial side tracks. Sub-paragraphs (a)(1) through (a)(5) detail the physical features that may be used to block access to non-controlled track within working limits.

The term discontinuity in the rail in subparagraph (a)(3) refers to a rail that is removed from the track or purposely misaligned to serve as a derail, or it could be simply the end of a track. Of course, the rules of the railroad would specify the manner in which trains would be protected from derailing on a discontinuous rail.

Subparagraph (a)(4) essentially permits inaccessible track to be established as an extension of working limits on controlled track. For instance, if a roadway worker establishes working limits on a single main track between mileposts 10 and 20, the working limits could include all non-controlled tracks that connect only to that main track, provided no operable locomotives are located on those tracks.

Subparagraph (a)(4) might also be used by a railroad to establish working limits within a remotely controlled hump yard. If a control operator can block access to a track at the hump under subparagraph (a)(5) with a remotely controlled switch, a railroad could permit the establishment of inaccessible track by creating a form of controlled track at the pull-out end, away from the hump. In that case, a train or engine could not enter the pull-out end of a classification track without authority of the control operator. In that manner, both ends of the inaccessible track would be properly secured.

The exclusion of operable locomotives or other on-track equipment differs from the restriction on movement of trains and equipment within working limits on controlled track. On controlled track, those movements can be controlled, by definition. However, on non-controlled track, the presence of an operable locomotive represents a threat to roadway workers from the possibility of its operation and movement by someone unaware of the presence of the roadway workers.

A locomotive could be rendered inoperative by locking or removing controlling handles, or by tagging them in conformance with the rules of the railroad.

On a small railroad, the locomotive engineer might also be a roadway worker. If that person has the only reverser handle for the only locomotive in his possession, and no other railroad's crews are permitted to operate on the track, then that railroad's track is rendered inaccessible.

§ 214.329 Train approach warning provided by watchmen/lookouts.

Roadway workers in a roadway work group who foul any track outside of working limits shall be given warning of approaching trains by one or more watchmen/lookouts in accordance with the following provisions:

(a) Train approach warning shall be given in sufficient time to enable each roadway worker to move to and occupy a previously arranged place of safety not less than 15 seconds before a train moving at the maximum speed authorized on that track can pass the location of the roadway worker.

(b) Watchmen/lookouts assigned to provide train approach warning shall devote full attention to detecting the approach of trains and communicating a warning thereof, and shall not be assigned any other duties while functioning as watchmen/lookouts.

(c) The means used by a watchman/lookout to communicate a train approach warning shall be distinctive and shall clearly signify to all recipients of the warning that a train or other on-track equipment is approaching.

(d) *Every roadway worker who depends upon train approach warning for on-track safety shall maintain a position that will enable him or her to receive a train approach warning communicated by a watchman/ lookout at any time while on-track safety is provided by train approach warning.*

(e) *Watchmen/lookouts shall communicate train approach warnings by a means that does not require a warned employee to be looking in any particular direction at the time of the warning, and that can be detected by the warned employee regardless of noise or distraction of work.*

(f) *Every roadway worker who is assigned the duties of a watchman/ lookout shall first be trained, qualified and designated in writing by the employer to do so in accordance with the provisions of § 214.349.*

(g) *Every watchman/lookout shall be provided by the employer with the equipment necessary for compliance with the on-track safety duties which the watchman/lookout will perform.*

Guidance. Section 214.329 establishes the procedures for on-track safety of groups that utilize train approach warning. A reference to the definition of train approach warning would be useful to the understanding of this section. Section 214.329 specifies the circumstances and the manner in which roadway work groups may use this method of on-track safety. Prescribed here is the minimum amount of time for roadway workers to retreat to a previously arranged place of safety, the duties of the watchman/lookout and the fundamental characteristics of train approach warning communication.

It must be particularly noted that the 15-second train approach time does not include the time taken for a roadway worker to move clear of the track and into a place of safety. If that movement takes 10 seconds, then a train must be visible in time for a warning to be given 25 seconds before the train arrives.

Roadway workers, as indicated in the Rule, must have an acceptable "place of safety" to use to clear to upon the approach of trains when using train approach warning as a form of on-track safety. In normal circumstances, it is expected that workers will clear **all** tracks upon the approach of a train. Clearing onto another track where train approach warning is established may potentially trap workers if multiple train movements occur at the location in question. Regardless of the number of tracks at a work site, it is important to consider impediments to train approach warning at locations such as rock cuts or other locations with limited clearance.

It is also important to review §214.313(b) which states: "*A roadway worker shall not foul a track except when necessary for the performance of duty*." Therefore, workers must have a specific reason in order to move into another track upon the approach of a train (e.g., work activity). This practice is only then acceptable if train approach warning is provided for all tracks without interruption and the workers have absolutely no chance of being trapped if multiple train movements simultaneously occur. In all cases where train approach warning is used, it is critical that comprehensive instructions are provided to roadway workers about where to clear track(s) upon the approach of trains.

Paragraph (e) states that the warning method shall not require a warned employee to be looking in a particular direction to detect the warning. The warned employee is one who is fouling or near the track, and who is being protected by the watchman/lookout. The warned employee is not necessarily another watchman/lookout.

A railroad may elect to use a chain of watchmen/lookouts to relay the warning of an approaching train. Since a watchman/lookout is required to maintain a vigilant watch, it is possible that a clear visual signal may be used for communication among watchmen/lookouts.

Radio communication or a cell phone may also be used as a supplement to the equipment issued to the watchman/lookout, but extreme care must be taken to guard against non-communication in the event of a radio failure. In particular, the portable radios commonly used for such purposes might suffer battery failure with no warning, thus breaking a vital communication link. A radio and/or cell phone shall not be considered proper equipment to provide sole auditory warning by a Watchman/Lookout, in compliance with §214.329.

This section further imposes a duty upon the employer to provide the watchman/lookout employee with the requisite equipment necessary to carry out his on-track safety duties. It is intended that a railroad's on-track safety program would specify the means to be used by watchmen/ lookouts to communicate a warning, and that they be equipped according to that provision.

The rule does not include a provision for train approach warning by any means other than the use of watchmen/lookouts. FRA is not aware of any other means of effectively performing this function with the requisite reliability, and will not place requirements for an untried system in this rule. However, the Advisory Committee report states that ``FRA will incorporate a near-term time-specific requirement to utilize on-track personal warning systems for roadway workers working alone under any conditions not requiring positive protection.'' FRA realizes that the technological advancements incorporated in ATCS, PTC or PTS might in the future provide another method of establishing on-track safety in compliance with this subpart. Although such technology is not specifically provided for in the current rule. Opportunities to employ advancements in this area will be handled pursuant to the waiver process. FRA will therefore be most interested in knowing when such systems are developed, tested, and proven reliable.

§ 214.331 Definite train location.

A roadway worker may establish on-track safety by using definite train location only where permitted by and in accordance with the following provisions:

(a) A Class I railroad or a commuter railroad may only use definite train location to establish on-track safety at points where such procedures were in use on January 15, 1997.

(b) Each Class I or commuter railroad shall include in its on-track safety program for approval by FRA in accordance with § 214.307 of this part a schedule for phase-out of the use of definite train location to establish on-track safety.

(c) A railroad other than a Class I or commuter railroad may use definite train location to establish on-track safety on subdivisions only where:

(1) Such procedures were in use on January 15, 1997, or

(2) The number of trains operated on the subdivision does not exceed:

(i) Three during any nine-hour period in which roadway workers are on duty, and

(ii) Four during any twelve-hour period in which roadway workers are on duty.

(d) Definite train location shall only be used to establish on-track safety according to the following provisions:

(1) Definite train location information shall be issued only by the one train dispatcher who is designated to authorize train movements over the track for which the information is provided.

(2) A definite train location list shall indicate all trains to be operated on the track for which the list is provided, during the time for which the list is effective.

(3) Trains not shown on the definite train location list shall not be operated on the track for which the list is provided, during the time for which the list is effective, until each roadway worker to whom the list has been issued has been notified of the train movement, has acknowledged the notification to the train dispatcher, and has canceled the list. A list thus canceled shall then be invalid for on-track safety.

(4) Definite train location shall not be used to establish on-track safety within the limits of a manual interlocking, or on track over which train movements are governed by a Traffic Control System or by a Manual Block System.

(5) Roadway workers using definite train location for on-track safety shall not foul a track within ten minutes before the earliest time that a train is due to depart the last station at which time is shown in approach to the roadway worker's location nor until that train has passed the location of the roadway worker.

(6) A railroad shall not permit a train to depart a location designated in a definite train location list before the time shown therein.

(7) Each roadway worker who uses definite train location to establish on-track safety must be qualified on the relevant physical characteristics of the territory for which the train location information is provided.

Guidance. Section 214.331 describes a system of on-track safety which provides roadway workers with information as to the earliest times at which trains may leave certain stations, having been restricted at those stations by the train dispatcher or control operator. This form of on-track safety is called Definite Train Location. A reference to its definition is helpful to distinguish it from an informational lineup of trains, which is addressed in § 214.333.

Paragraph (a) limits the use of definite train location for on- track safety by Class I railroads to track where such a system was already in use on the effective date of this rule.

Paragraph (b) requires that a Class I railroad using a definite train location system must phase it out according to a schedule submitted to FRA with that railroad's on-track safety program.

Paragraph (c) establishes that definite train location can be used on certain subdivisions owned by railroads other than Class I railroads under certain specified conditions. These conditions include whether the system was in use before the effective date of this rule, or whether the subdivision has railroad traffic density below certain levels specified in that section during periods when roadway workers are normally on and about the track. Advisory Committee members felt that the amount and frequency of the traffic on a particular track dictated whether this form of on-track safety was feasible. FRA therefore proposes to incorporate this factor into the rule to allow some short lines and regional railroads to utilize this system.
Paragraph (d) and corresponding subparagraphs (1) through (6) set forth the requirements for a definite train location system and the qualifications that a roadway worker must have before using this system as a form of on-track safety.

§ 214.333 Informational line-ups of trains.

(a) A railroad is permitted to include informational line-ups of trains in its on-track safety program for use only on subdivisions of that railroad upon which such procedure was in effect on March 14, 1996.

(b) Each procedure for the use of informational line-ups of trains found in an on-track safety program shall include all provisions necessary to protect roadway workers using the procedure against being struck by trains or other on-track equipment.

(c) Each on-track safety program that provides for the use of informational line-ups shall include a schedule for discontinuance of the procedure by a definite date.

Guidance. Section 214.333 specifies conditions for the use of informational line-ups of trains. Some railroads have used a form of informational line-ups to provide on-track safety for roadway workers for many years. Such a procedure requires the roadway worker to have a full understanding of the particular procedure in use, and the physical characteristics of the territory in which they are working. The Advisory Committee addressed this issue with the following specific recommendation:

The Committee realizes that line-ups are being used less as a form of protection in the industry and recommends that line-up use be further reduced, eventually discontinued and replaced with Positive Protection as quickly as feasible, grand fathering line-up systems presently in use.

Line-ups as used in this section differ from lists of trains in § 214.329 in that line-ups need not include definite restriction as to the earliest times at which trains may depart stations. FRA therefore follows the Advisory Committee recommendation by allowing railroads presently using line-ups to continue doing so under conditions presently in effect, provided that their on-track safety programs that are reviewed and approved by FRA contain adequate provisions for safety, and a definite date for completion of phase-out.

This will be an item of particular concern when FRA reviews the roadway worker protection program of any railroad that includes a provision for informational line-ups. The program must include adequate provisions to ensure that roadway workers will not be surprised by trains while working. It must also include a realistic date for phase-out.

§ 214.335 On-track safety procedures for roadway work groups.

(a) No employer subject to the provisions of this part shall require or permit a roadway worker who is a member of a roadway work group to foul a track unless on-track safety is provided by either working limits, train approach warning, or definite train location in accordance with the applicable provisions of §§ 214.319, 214.321, 213.323, 214.325, 214.327, 214.329 and 214.331 of this part.

(b) No roadway worker who is a member of a roadway work group shall foul a track without having been informed by the roadway worker responsible for the on-track safety of the roadway work group that on-track safety is provided.

(c) Roadway work groups engaged in large-scale maintenance or construction shall be provided with train approach warning in accordance with § 214.329 (§ 214.327 in original, to be corrected) for movements on adjacent tracks that are not included within working limits.

Guidance. Section 214.335 specifies requirements for on-track safety to be provided for roadway work groups. Other sections of the regulation discuss matters affecting the group such as the different types of on- track safety protection available to a group and the job briefing necessary for a group, but this section prescribes what procedures are required to fully comply with this subpart. The definition of roadway work group enables the distinction between general methods of providing on-track safety for groups and for individuals working alone. Examples of roadway work groups are a large or small track gang, a pair of signal maintainers, a welder and welder helper, and a survey party.

Paragraph (a) indicates that employers shall not require or permit roadway work groups to foul a track unless they have established on-track safety through working limits, train approach warning, or definite train location.

The reciprocal responsibility for the roadway worker is expressed in Paragraph (b). He should not foul a track without having been informed by the roadway worker in charge that on-track safety is being provided.

The concept of protecting roadway workers from the hazards of trains and other on-track equipment on adjacent tracks is also important in this rule. A reference to the definition of adjacent tracks will clarify the meaning of paragraph (c) which details the conditions under which train approach warning must be used on adjacent tracks that are not within working limits. These are conditions in which the risk of distraction is significant, and which require measures to provide on-track safety on adjacent tracks. *Note: Paragraph (c) will be deleted from the regulation effective July 1, 2014 and replaced by § 214.336 On-track Safety Procedures for Certain Roadway Work Groups and Adjacent Tracks.)*

The principle behind the reference to large-scale maintenance or construction is the potential for distraction, or the possibility that a roadway worker or roadway maintenance machine might foul the adjacent track and be struck by an approaching or passing train. This issue was addressed in the report of the Advisory Committee with the recommendation:

Before performing any work that requires Fouling the track or Adjacent Track(s), Positive Protection must be obtained and verified to be in effect by the roadway worker assigned responsibility for the work. Large scale track maintenance and/or renovations, such as but not limited to, rail and tie gangs, production in-track welding, ballast distribution, and undercutting, must have protection (Working Limits or Train Approach Warning) on Adjacent Tracks as well. FRA will consider the provisions made for this situation when reviewing each railroad's on-track safety program.

The spacing of less than 25 feet between track centers, which defines adjacent tracks for the purpose of this rule, represents a consensus decision of the Advisory Committee. Several railroads have recently extended their lateral track spacing to 25 feet. Tracks spaced at that distance may not cause a hazard to employees in one track from trains and equipment moving on the other track. FRA believes that no purpose would be served by requiring these tracks to be again spaced at a slightly greater distance. Therefore, tracks spaced at 25 feet are not defined as adjacent tracks, but tracks spaced at a lesser distance will be so defined. Tracks that converge or cross will be considered as adjacent tracks in the zone through which their centers are less than 25 feet apart.

As a practical matter, FRA will apply a rule of reason to the precision used in measuring track centers, so that minor alignment deviations within the limits of the Federal Track Safety Standards (49 CFR 213) would not themselves place such short segments of track within the definition of adjacent tracks.

§ 214.337 On-track safety procedures for lone workers.

(a) A lone worker who fouls a track while performing routine inspection or minor correction may use individual train detection to establish on-track safety only where permitted by this section and the on-track safety program of the railroad.

(b) A lone worker retains an absolute right to use on-track safety procedures other than individual train detection if he or she deems it necessary, and to occupy a place of safety until such other form of on-track safety can be established.

(c) Individual train detection may be used to establish on-track safety only:

(1) By a lone worker who has been trained, qualified, and designated to do so by the employer in accordance with § 214.347 of this subpart;

(2) While performing routine inspection and minor correction work;

(3) On track outside the limits of a manual interlocking, a controlled point, or a remotely controlled hump yard facility;

(4) Where the lone worker is able to visually detect the approach of a train moving at the maximum speed authorized on that track, and move to a previously determined place of safety, not less than 15 seconds before the train would arrive at the location of the lone worker;

(5) Where no power-operated tools or roadway maintenance machines are in use within the hearing of the lone worker; and

(6) Where the ability of the lone worker to hear and see approaching trains and other on-track equipment is not impaired by background noise, lights, precipitation, fog, passing trains, or any other physical conditions.

(d) The place of safety to be occupied by a lone worker upon the approach of a train may not be on a track, unless working limits are established on that track.

(e) A lone worker using individual train detection for on-track safety while fouling a track may not occupy a position or engage in any activity that would interfere with that worker's ability to maintain a vigilant lookout for, and detect the approach of, a train moving in either direction as prescribed in this section.

(f) A lone worker who uses individual train detection to establish on-track safety shall first complete a written Statement of On-track Safety. The Statement shall designate the limits of the track for which it is prepared and the date and time for which it is valid. The statement shall show the maximum authorized speed of trains within the limits for which it is prepared, and the sight distance that provides the required warning of approaching trains. The lone worker using individual train detection to establish on-track safety shall produce the Statement of On-track Safety when requested by a representative of the Federal Railroad Administrator.

Guidance. Section 214.337 establishes specific on-track safety procedures for the lone worker. Paragraph (a) sets forth the general requirement that restricts the use of individual train detection to circumstances prescribed in this section and the corresponding on-track safety program of the railroad.

Concern has been raised about roadway workers who must foul the track in order to make the track inaccessible (49 C.F.R. §214.327). The specific concern is whether these workers need to have on-track safety protection while in the process of establishing on-track safety for the work to be performed and fouling the track. This type of activity is typically found with lone workers who may need to install a portable derail or to secure a switch, in order to establish on-track safety.

When looking at the individual roadway worker's responsibility, found at §214.313, roadway workers are not to foul the track unless necessary for the performance of their duties and they are responsible to determine that on-track safety is being provided prior to fouling the track. When fouling the track to make the track inaccessible, roadway workers are fouling in performance of their duties and should make sure they are protected. In many cases, roadway workers are able to use individual train detection in accordance with §214.337(c). However, §214.337(c)(3) prohibits the use of individual train detection within the limits of a manual interlocking, a controlled point, or a remotely controlled hump yard facility. Of course, as §214.327 makes clear, inaccessible track may be used as a method of protection only on non-controlled track (see definition of “controlled track” in §214.7), §214.327 so the factors that would preclude using individual train detection will not ordinarily be present where inaccessible track is being established.

Based on the foregoing, lone workers need protection when fouling the track, even if only to establish on-track safety and the Roadway Worker Protection regulation strictly prohibits a lone worker from using individual train detection while performing any type of associated work activities in a manual interlocking, controlled point, or remote hump yard facility.

Paragraph (b) represents the clear consensus of the Advisory Committee that a decision to not use individual train detection should rest solely with the lone worker, and may not be reversed by any other person. On the other hand, improper use of individual train detection where this rule or the on-track safety program of the railroad prohibits it would be subject to review. This provision was stated by the Advisory Committee as part of its Specific Recommendation 3, which part reads, ``All roadway workers have the absolute right to obtain positive protection at any time and under any circumstances if they deem it necessary, or to be clear of the track if adequate protection is not provided.''

Paragraph (c)(3) states individual train detection may be used to establish on-track safety only on track outside the limits of a manual interlocking, a controlled point, or a remotely controlled hump yard facility. The Federal Railroad Administration (FRA) is frequently asked about signal installations in dark territory that convey switch position. Specifically, these installations appear to be an interlocking, but are operated by a train crew to manipulate a switch. This type of signal installation is neither defined nor addressed in the Roadway Worker Protection regulation. FRA is frequently asked whether such locations are considered manual interlockings or simply power operated switches, and whether Individual Train Detection (ITD) is permissible at these locations.

49 C.F.R. §214.7 does not include a definition of the term manual interlocking. However, FRA has concluded that the installations in question which may have some physical resemblance to interlockings, but are operated by train crews manipulating the switch, electronically or by hand, are considered “hand/power operated switches.” FRA has determined the following:

- The signals at these installations do not convey train movement authority, nor do they meet the basic requirements of §236.750, Interlocking automatic and §236.751, Interlocking manual; and
- The hand/power switches at these installations are not controlled by a train dispatcher or control operator; and are not part of a manual interlocking or controlled point.

Accordingly, the use of ITD, (§214.337), is permissible as the minimum form of on-track safety at these hand/power installations, although not allowed at true interlockings and controlled points. When using ITD, at these installations, or any other locations where such use is permitted, the lone worker may determine that a more restrictive form of on-track safety is required, and this decision cannot be reversed by any other person.

Aside from hand/power operated switches, switches that can be manipulated by hand as well as by a train dispatcher/operator are considered "dual control switches." These switches are located within manual interlockings and controlled points and the use of ITD within these installations is prohibited.

Paragraph (c)(4) establishes a method of on-track safety for the lone worker, in which the roadway worker is capable of visually detecting the approach of a train and moving to a previously determined location of safety at least 15 seconds before the train arrives.

As in the discussion of train approach warning, it must be particularly noted that the 15-second train approach time does not include the time taken for a roadway worker to move clear of the track and into a place of safety. If that movement takes 10 seconds, then a train must be visible in time for a warning to be given 25 seconds before the train arrives.

It is important to note that the Advisory Committee decided that the use of individual train detection is appropriate only in limited circumstances. FRA has therefore drafted this section to prescribe strictly limited circumstances in which an individual may foul a track outside of working limits while definitely able to detect the approach of a train or other on-track equipment in ample time to move to a place of safety. This safety method requires the lone worker to be in a state of heightened awareness, since no other protection system will be in place to prevent one from being struck by a train or other on-track equipment. The corresponding subparagraphs to paragraph (c) provide detailed requirements for the use of this form of on-track safety.

Paragraph (a) sets forth the general requirement that restricts the use of individual train detection to circumstances prescribed in this section and the corresponding on-track safety program of the railroad. Paragraph (c) establishes a method of on-track safety for the lone worker, in which the roadway worker is capable of visually detecting the approach of a train and moving to a previously determined location of safety at least 15 seconds before the train arrives. Only if all of the elements of §214.337 are met, is it acceptable for a roadway worker to use individual train detection to place a highway/rail vehicle on a non-controlled track. Once on the track, movements may be conducted under the provisions of the railroad operating rules [§214.301(c)].

Section §214.337 (c)(5) is explicitly clear that no power operated tools or roadway maintenance machines can be in use within the hearing range of lone worker using individual train detection. Accordingly, even though power tools can be made quiet so that they won't impair an individual's hearing ability, they still are defined as a power tool. Power operated tools shall not be utilized by a lone worker using individual train detection. Although a "quiet" tool might not impair the hearing, the level of concentration required to operate such a device could have an impact on the individual's ability to detect approaching trains.

Paragraph (d) clearly states that a lone worker may not clear onto a track unless working limits are established on that track. The only exception is that a lone worker may clear into a track as long as working limits are established on that track in accordance with §214.319 (Working Limits, Generally). To establish working limits by becoming a flagman would require:

1) Lone Worker be equipped with the proper equipment and
2) Lone Worker has the capability to stop trains in both directions.

Therefore, unless both of these requirements are met, it is not acceptable for a lone worker to clear onto a track upon the approach of a train and establish his or her own flagging type working limits.

Paragraph (f) prescribes the concept of a written Statement of On-track safety, prepared by the lone roadway worker. The reasoning behind this requirement is to assist the roadway worker in focusing on the nature of the task, the risks associated with the task, and the form of on-track safety necessary to safely carry out assigned duties.

The regulation does not specify the maximum area which an on-track safety statement can encompass. However, the statement of on-track safety must always apply to the current task and conditions.

§ 214.339 Audible warning from trains.

Each railroad shall require that the locomotive whistle be sounded, and the locomotive bell be rung, by trains approaching roadway workers on or about the track. Such audible warning shall not substitute for on-track safety procedures prescribed in this part.

Guidance. Section 214.339 requires audible warning from locomotives before trains approach roadway workers. The implementation of this requirement will necessitate railroad rules regarding notification to trains that roadway workers are on or about the track. This notification could take the form of portable whistle posts, train movement authorities, or highly visible clothing to identify roadway workers and increase their visibility. This section is not optional with a railroad, and FRA intends that it will preempt any local restrictions on the sounding of locomotive whistles.

The only mention of highly visible clothing in the regulation is found in the section analysis related to this provision. The type of clothing or other visible indication of the presence of roadway workers in left to the option of the railroad. The method to be used by the railroad should be practical and effective, considering the varying situations on different railroads. It should be an item of particular interest in the FRA review of a railroad's program.

As trains approach each roadway worker or roadway work group located within a large-scale maintenance project that is being conducted, the locomotive whistle shall be sounded and the locomotive bell rung. Electric multiple unit trains are generally not equipped with bells and FRA inspection activity will account for this mechanical characteristic. In addition, when railroads are conducting reverse movements, it is expected that the locomotive whistle will be sounded and the bell rung in accordance with §214.337 when approaching roadway workers. The practice of sounding the locomotive whistle and ringing the locomotive bell only one time on the approach to a large-scale roadway work group does not meet the intent of the regulation. The specific sequence and duration of whistle blasts to be sounded approaching roadway workers shall be established by each railroad's operating rules to sufficiently warn roadway workers who may be on or about the track.

Both historically and today, roadway workers commonly acknowledge an approaching train that is sounding an audible warning and the train crew stops sounding the warning. The Federal Railroad Administration (FRA) is frequently asked whether a roadway worker's acknowledgment and the engineer's subsequent decision to stop sounding the whistle are in compliance with the regulation. The concern is determining when the length or duration of the audible warning is sufficient.

If a railroad does not provide guidance, since the regulation does not specify the duration of the warning, the engineer must exercise discretion predicated on his or her best judgment for effectively warning roadway workers on or about the track. This discretion only applies to the duration of the audible warning, since the warning itself is clearly required. Compliance with the responsible carrier's rules and institutional knowledge should help the engineer/operator arrive at the appropriate duration of audible warning. These instructions do not in any way or manner relieve the requirement to sound the horn and ring the bell of locomotives approaching roadway workers.

There is concern regarding the locomotive whistle sounding requirement during shoving moves. In addition, what is Federal Railroad Administration's enforcement position with respect to multiple unit (MU) passenger trains that do not have bells? There are no exceptions to the requirement of affording roadway workers with an audible warning. It is incumbent on the railroad to determine how to provide the warning under all circumstances. MU equipment without bells can't ring the bell. There is no requirement that MUs be equipped with bells. MU equipment not equipped with bells is in compliance with the rule when the horn is sounded.

Locomotive engineers and inspectors must determine at what point is it necessary to sound a warning when roadway workers are not on the track occupied by the train. How many feet or number of tracks away must the workers be to excuse the engineer from sounding a warning? Trains must provide an audible warning to any roadway worker near enough to the track to have the potential to foul the track prior to the arrival of the train. When citing defects or violations for failure to give an audible warning, inspectors should be able to describe the relative position of the roadway workers with the approaching train, and why there was a potential to foul that track.

§ 214.341 Roadway maintenance machines.

(a) Each employer shall include in its on-track safety program specific provisions for the safety of roadway workers who operate or work near roadway maintenance machines. Those provisions shall address:

(1) Training and qualification of operators of roadway maintenance machines.

(2) Establishment and issuance of safety procedures both for general application and for specific types of machines.

(3) Communication between machine operators and roadway workers assigned to work near or on roadway maintenance machines.

(4) Spacing between machines to prevent collisions.

(5) Space between machines and roadway workers to prevent personal injury.

(6) Maximum working and travel speeds for machines dependent upon weather, visibility, and stopping capabilities.

(b) Instructions for the safe operation of each roadway machine shall be provided and maintained with each machine large enough to carry the instruction document.

(1) No roadway worker shall operate a roadway maintenance machine without having been trained in accordance with § 214.355.

(2) No roadway worker shall operate a roadway maintenance machine without having complete knowledge of the safety instructions applicable to that machine.

(3) No employer shall assign roadway workers to work near roadway machines unless the roadway worker has been informed of the safety procedures applicable to persons working near the roadway machines and has acknowledged full understanding.

(c) Components of roadway maintenance machines shall be kept clear of trains passing on adjacent tracks. Where operating conditions permit roadway maintenance machines to be less than four feet from the rail of an adjacent track, the on-track safety program of the railroad shall include the procedural instructions necessary to provide adequate clearance between the machine and passing trains.

Guidance. Section 214.341 addresses specific issues concerning roadway maintenance machines that need to be included in individual railroad program submissions. FRA decided to address the hazards associated with these machines separately from those associated with trains, as the nature of the hazard is different. Referencing the definition of this term is a good place to start to understand this section. Roadway maintenance machines are devices, the characteristics or use of which are unique to the railroad environment. The term includes both on-track and off-track machines. A roadway maintenance machine need not have a position for the operator on the machine nor need it have an operator at all; it could operate automatically, or semi-automatically.

This provision excludes hand-powered devices in order to distinguish between hand tools which are essentially portable, and devices which either are larger, move faster, or produce more noise than hand tools. Hand-held power tools are not included in the definition, but because of the noise they produce, and because of the attention that must be paid to their safe operation they are addressed specifically in § 214.337, On-track safety for lone workers.

Examples of devices covered by this section include, but are not limited to, crawler and wheel tractors operated near railroad tracks, track motor cars, ballast regulators, self-propelled tampers, hand-carried tampers with remote power units, powered cranes of all types, highway-rail cars and trucks while on or near tracks, snow plows-self-propelled and pushed by locomotives, spreader-ditcher cars, locomotive cranes, electric welders, electric generators, air compressors--on- track and off-track.

Roadway maintenance machines have a wide variety of configurations and characteristics, and new types are being developed regularly. Each type presents unique hazards and necessitates unique accident prevention measures. Despite the wide diversity of the subject matter, FRA attempted to provide some guidance for the establishment of on-track safety when using roadway maintenance machines.

FRA believes that it is most effective to promulgate a general requirement for on-track safety around roadway maintenance machines, and require that the details be provided by railroad management, conferring with their employees, and industry suppliers. Several railroads have adopted comprehensive rules that accommodate present and future machine types, as well as their own operating requirements. FRA has seen the text of such rules, as well as witnessed their application and believes that they can set examples for other railroads. The requirement for issuance of on-track safety procedures for various types of roadway maintenance machines may be met by general procedures that apply to a group of various machines, supplemented wherever necessary by any specific requirements associated with particular types or models of machines.

§ 214.343 Training and qualification, general.

(a) No employer shall assign an employee to perform the duties of a roadway worker, and no employee shall accept such assignment, unless that employee has received training in the on-track safety procedures associated with the assignment to be performed, and that employee has demonstrated the ability to fulfill the responsibilities for on-track safety that are required of an individual roadway worker performing that assignment.

(b) Each employer shall provide to all roadway workers in its employ initial or recurrent training once every calendar year on the on-track safety rules and procedures that they are required to follow.

(c) Railroad employees other than roadway workers, who are associated with on-track safety procedures, and whose primary duties are concerned with the movement and protection of trains, shall be trained to perform their functions related to on-track safety through the training and qualification procedures prescribed by the operating railroad for the primary position of the employee, including maintenance of records and frequency of training.

(d) Each employer of roadway workers shall maintain written or electronic records of each roadway worker qualification in effect. Each record shall include the name of the employee, the type of qualification made, and the most recent date of qualification. These records shall be kept available for inspection and photocopying by the Federal Railroad Administrator during regular business hours.

Guidance. Section 214.343 requires that each roadway worker be given on-track safety training once every calendar year. Adequate training is integral to any safety program. Hazards exist along a railroad, not all of which are obvious through the application of common sense without experience or training. An employee who has not been trained to protect against those hazards presents a significant risk to both himself and others.

Roadway workers can be qualified to perform various duties based on their training and demonstrated knowledge. Training will vary depending on the designation of a roadway worker. Furthermore, roadway workers should generally know the designations of others in their group, so that proper on-track safety protection arrangements can be made. Written or electronic records must be kept of these qualifications, available for inspection and copying by the Administrator.

The term “demonstrated proficiency" is used in this and other sections relative to employee qualification in a broad sense to mean that the employee being qualified would show to the employer sufficient understanding of the subject that the employee can perform the duties for which qualification is conferred in a safe manner. Proficiency may be demonstrated by successful completion of a written or oral examination, an interactive training program using a computer, a practical demonstration of understanding and ability, or an appropriate combination of these in accordance with the requirements of this subpart.

The training and qualification of roadway workers and other employees who are associated with on-track safety, but are not roadway workers, is a critical element of any roadway worker protection program. There are various levels of training based on the function of the worker in relation to on-track safety. Regardless of the roadway worker’s function, it is essential that he or she and others associated with on-track safety have sufficient knowledge to assure that protection is properly applied.

A number of railroads utilize transportation employees, whose primary function is the movement and protection of trains, to provide on-track safety to contractors or fulfill the role of a flagman (withhold trains under the direction of a RWIC). These employees are not roadway workers but are sometimes directly involved with on-track safety in accordance with the roadway worker safety regulation. For example, conductors may provide on-track safety to contractors engaged by a railroad to perform work covered under the roadway worker protection regulation. The concern addressed is the frequency of training of individuals whose primary duty is not that of roadway worker. The pertinent section of the regulation that deals with such employees is 49 C.F.R. §214.343 (c) - Training and qualification, general.

The above employees must, of course, be capable of performing their functions correctly and safely. Accordingly, if a conductor is to provide on-track safety for a roadway work group, it is incumbent on that employee to have the capability to fulfill the obligations of a roadway worker who provides on-track safety, §214.353 (c). The regulation requires that the training and qualification for their primary function, under the railroad's program related to that function, will also include the means by which they will fulfill their responsibilities to roadway workers for on-track safety. For instance, a train dispatcher would not be considered a roadway worker, but would have to be capable of applying the railroad's operating rules when establishing working limits for roadway workers.

Since the regulation does not specify the interval of such training, it can be less frequent than that of a roadway worker. A conductor, who provides on-track safety for a roadway maintenance machine, or a contractor working on railroad property, would not be considered a roadway worker. That individual would receive periodic training on functions related to on-track safety as part of the training and qualification of a conductor and would need to be proficient on the elements stipulated under §214.353 (c). Table 1 provides a list of required training and qualification elements for employees other than roadway workers based on specific activities.

Enforcement of training provisions of this regulation will use the provisions of § 214.343. The following sections related to training, §§ 214.345 through 214.355, provide specific training requirements for various classes of roadway worker employees, but the enforceable provisions are found in § 214.343.

§ 214.345 Training for all roadway workers.

The training of all roadway workers shall include, as a minimum, the following:

(a) Recognition of railroad tracks and understanding of the space around them within which on-track safety is required.

(b) The functions and responsibilities of various persons involved with on-track safety procedures.

(c) Proper compliance with on-track safety instructions given by persons performing or responsible for on-track safety functions.

(d) Signals given by watchmen/lookouts, and the proper procedures upon receiving a train approach warning from a lookout.

(e) The hazards associated with working on or near railroad tracks, including review of on-track safety rules and procedures.

Guidance. Section 214.345 represents the basic level of training required of all roadway workers who work around moving railroad trains and on-track equipment. All persons subject to this rule must have this training. This basic level of training is required in addition to any specialized training required for particular functions called for in sections 214.347 through 214.355. Any testing required to demonstrate qualification need not be written, because the requirements can be fulfilled by a practical demonstration of ability and understanding.

Often, contractors are engaged by railroads to conduct engineering type work. Accordingly, it is necessary to provide guidelines for contractors regarding on-track safety training and record keeping.

The roadway worker protection regulation indicates that the employer of roadway workers shall maintain records of employees who have been trained and qualified on the on-track safety rules of the railroad. Each record shall include the name of the employee, the type of qualification made, and the most recent date of qualification.

Title 49 CFR 214, Subpart A establishes responsibility for compliance with all of Part 214 under §214.5, Responsibility for Compliance. Sec. 214.5 clearly references, among a host of other entities, "any independent contractor providing goods or services to a railroad." As such, railroad contractors and their employees performing roadway worker functions are held to the identical standards and requirements as railroads and railroad employee roadway workers. The nature of the work is identical, the nature of the risks are identical, and therefore, the training, record keeping, monitoring and other provisions should also remain identical (§214.5).

The safety of railroad operations and the safety of those performing work regulated under Part 214 is contingent upon the uniform and consistent application of operating rules, safety rules, and regulatory requirements.

The regulation clearly states that all roadway workers will receive initial training. This training must be performed prior to the commencement of work. The regulation does not specify that this training must be performed in a classroom environment. This initial training could be performed at the job site prior to the worker fouling the track. This training must include at a minimum the five basic elements defined in §214.345. Any employee who is promoted from a "basic worker" to a higher form of roadway worker qualification must demonstrate proficiency or take the recorded examination before assuming such duties.

§ 214.347 Training and qualification for lone workers.

Each lone worker shall be trained and qualified by the employer to establish on-track safety in accordance with the requirements of this section, and must be authorized to do so by the railroad that conducts train operations on those tracks.

(a) The training and qualification for lone workers shall include, as a minimum, consideration of the following factors:

(1) Detection of approaching trains and prompt movement to a place of safety upon their approach.

(2) Determination of the distance along the track at which trains must be visible in order to provide the prescribed warning time.

(3) Rules and procedures prescribed by the railroad for individual train detection, establishment of working limits, and definite train location.

(4) On-track safety procedures to be used in the territory on which the employee is to be qualified and permitted to work alone.

(b) Initial and periodic qualification of a lone worker shall be evidenced by demonstrated proficiency.

Guidance. Section 214.347 requires a higher degree of qualification, as the lone worker is fully responsible for his or her own protection. A primary consideration is that the lone worker should never be influenced to use individual train detection by a lack of qualification to establish a more positive form of on-track safety. The lone worker should be qualified to use all available options for on-track safety.

Unlike §214.353 (qualification of workers who provide on-track safety for roadway work groups), §214.347 does not specify physical characteristic qualifications or a recorded examination for lone workers. However, the regulation does require that the lone worker must demonstrate proficiency. It is incumbent on each railroad to assure that lone workers have the capability to properly use any form of on-track safety that a lone worker would use to provide on-track safety.

Employees who are lone workers are required to demonstrate proficiency on a periodic basis, in addition to annual training. Inquiries about training indicate there is confusion regarding annual training and periodic qualification. The term “periodic qualification” as used in this regulation refers to employees who perform specific duties such as lone workers, watchman/lookouts, flagmen, RWICs, and roadway maintenance machine operators. FRA requires that employees receive “initial and periodic qualification” for each of the duties listed above. The required time frame for the qualification differs from the required annual training.

Although the term “periodic qualification” is not defined in the rule, each railroad should specify in its program the interval at which their periodic qualification will take place.

When an employee (with only basic training) is promoted to perform duties such as lone workers, that employee must receive additional training and be qualified as required. The qualification of the lone worker is based on their demonstrated proficiency, but the qualification of the RWIC is based on a recorded examination.

Note: Any employee who is promoted from a “basic worker” to a higher form of roadway worker qualification must demonstrate proficiency before assuming such duties.

In addition, §214.337(b) states that “A lone worker retains an absolute right to use on-track safety procedures other than individual train detection if he or she deems it necessary, and to occupy a place of safety until such other form of on-track safety can be established.” A lone worker should have sufficient knowledge of the characteristics of the railroad to be able to obtain, understand and use the information that he or she needs to perform as a lone worker. It is necessary that the lone worker know the speed limits of any segment of track, and to be able to identify his or her location along the railroad by station, mile post or other physical location.

It is also important to note that a lone worker who would provide on-track safety for others during the course of a tour of duty would then be subject to the qualification requirements of §214.353.

§ 214.349 Training and qualification of watchmen/lookouts.

(a) The training and qualification for roadway workers assigned the duties of watchmen/lookouts shall include, as a minimum, consideration of the following factors:

(1) Detection and recognition of approaching trains.

(2) Effective warning of roadway workers of the approach of trains.

(3) Determination of the distance along the track at which trains must be visible in order to provide the prescribed warning time.

(4) Rules and procedures of the railroad to be used for train approach warning.

(b) Initial and periodic qualification of a watchman/lookout shall be evidenced by demonstrated proficiency.

Guidance. Section 214.349 details the standards for qualification of a lookout, who by definition, is responsible for the protection of others. The definition of watchman/lookout is useful to understand the functions of roadway workers discussed in this section. Watchmen/ lookouts must be able to perform the proper actions in the most timely manner without any chance of error in order to provide proper protection for those who are placed in their care.

Employees who are watchmen/lookouts are required to demonstrate proficiency on a periodic basis. Inquiries about training indicate there is confusion regarding annual training and periodic qualification. The term “periodic qualification” as used in this regulation refers to employees who perform specific duties such as lone workers, watchman/lookouts, flagmen, RWICs, and roadway maintenance machine operators. FRA requires that employees receive “initial and periodic qualification” for each of the duties listed above. The required time frame for the qualification differs from the required annual training.

Although the term “periodic qualification” is not defined in the rule, each railroad should specify in its program the interval at which their periodic qualification will take place.

When an employee (with only basic training) is promoted to perform duties such as watchman/lookout, that employee must receive additional training and be qualified as required. The qualification of the watchman/lookout is based on his/her demonstrated proficiency.

Note: Any employee who is promoted from a “basic worker” to a higher form of roadway worker qualification must demonstrate proficiency or take the recorded examination before assuming such duties.

§ 214.351 Training and qualification of flagmen.

(a) The training and qualification for roadway workers assigned the duties of flagmen shall include, as a minimum, the content and application of the operating rules of the railroad pertaining to giving proper stop signals to trains and holding trains clear of working limits.

(b) Initial and periodic qualification of a flagman shall be evidenced by demonstrated proficiency.

Guidance. Section 214.351 requires that flagmen be qualified on the operating rules of the railroad on which they are working. Referencing the definition of flagman would be useful to identify the class of roadway workers discussed in this section. Generally, flagmen are already required to be qualified on the operating rules that apply to their work. Flagging is an exacting procedure, and a flagman must be ready to act properly at all times in order to provide proper protection for those under his care. The distinction between flagmen and watchmen/ lookouts should be noted, in that flagmen function to restrict or stop the movement of trains, while watchmen/lookouts detect the approach of trains and provide warning thereof to other roadway workers.

When working limits are established to provide on-track safety, all movements of trains and equipment within working limits shall be made only under the direction of the RWIC. If a conductor/flagman is assigned to withhold movements, that employee may authorize moments under the direction of the RWIC. If a qualified roadway worker is not assigned to provide on-track safety for the work group, a conductor/flagman may perform this function but must have received the relevant training to assume those responsibilities (see Table 1). This would also be true of any employee that would be protecting a contractor to a railroad engaged in roadway worker functions.

The Rule does not apply to employers, or their employees, if they are not engaged by or under contract to a railroad. Personnel, who might work near railroad tracks on projects for others, such as cable installation for a telephone company or bridge construction for a highway agency, come under the jurisdiction of other Federal agencies with regard to occupational safety. However, FRA encourages on-track safety for those personnel as well.

Employees who are flagmen are required to demonstrate proficiency on a periodic basis. Inquiries about training indicate there is confusion regarding annual training and periodic qualification. The term "periodic qualification" as used in this regulation refers to employees who perform specific duties such as lone workers, watchman/lookouts, flagmen, RWICs, and roadway maintenance machine operators. FRA requires that employees receive "initial and periodic qualification" for each of the duties listed above. The required time frame for the qualification differs from the required annual training.

Although the term "periodic qualification" is not defined in the rule, each railroad should specify in its program the interval at which their periodic qualification will take place.

When an employee (with only basic training) is promoted to perform duties such as a flagman, that employee must receive additional training and be qualified as required. The qualification of the flagman is based on their demonstrated proficiency.

Note: Any employee who is promoted from a "basic worker" to a higher form of roadway worker qualification must demonstrate proficiency or take the recorded examination before assuming such duties.

§ 214.353 Training and qualification of roadway workers who provide on-track safety for roadway work groups.

(a) The training and qualification of roadway workers who provide for the on-track safety of groups of roadway workers through establishment of working limits or the assignment and supervision of watchmen/lookouts or flagmen shall include, as a minimum:

(1) All the on-track safety training and qualification required of the roadway workers to be supervised and protected.

(2) The content and application of the operating rules of the railroad pertaining to the establishment of working limits.

(3) The content and application of the rules of the railroad pertaining to the establishment or train approach warning.

(4) The relevant physical characteristics of the territory of the railroad upon which the roadway worker is qualified.

(b) Initial and periodic qualification of a roadway worker to provide on track safety for groups shall be evidenced by a recorded examination.

Guidance. Section 214.353 details training standards applicable to the roadway worker who is qualified to provide on-track safety for roadway work groups. This roadway worker has the most critical responsibilities under this subpart. This individual must be able to apply the proper on-track safety rules and procedures in various circumstances, to communicate with other railroad employees regarding on-track safety procedures, and to supervise other roadway workers in the performance of their on-track safety responsibilities.

If a conductor/flagman is assigned to withhold movements, that employee may authorize moments under the direction of the RWIC. If a qualified roadway worker is not assigned to provide on-track safety for the work group, a conductor/flagman may perform this function but must have received the relevant training to assume those responsibilities (see Table 1). This would also be true of any employee that would be protecting a contractor to a railroad engaged in roadway worker functions.

The Rule does not apply to employers, or their employees, if they are not engaged by or under contract to a railroad. Personnel, who might work near railroad tracks on projects for others, such as cable installation for a telephone company or bridge construction for a highway agency, come under the jurisdiction of other Federal agencies with regard to occupational safety. However, FRA encourages on-track safety for those personnel as well.

§214.353 (Qualification of workers who provide on-track safety for roadway work groups), specifies physical characteristic qualifications. The regulation requires that the roadway worker providing on-track safety must demonstrate proficiency. It is incumbent on each railroad to assure that the roadway workers providing on-track safety have the capability to properly use any form of on-track safety that a roadway worker providing on-track safety would use.

This section is unique in this subpart in requiring a recorded examination as part of the qualification process. This requirement reflects the additional responsibility of this position. The recorded examination might be written, or it might be, for example, a computer file with the results of an interactive training course.

Employees who are roadway workers providing on-track safety are required to demonstrate proficiency on a periodic basis. Inquiries about training indicate there is confusion regarding annual training and periodic qualification. The term “periodic qualification” as used in this regulation refers to employees who perform specific duties such as lone workers, watchman/lookouts, flagmen, RWICs, and roadway maintenance machine operators. FRA requires that employees receive “initial and periodic qualification” for each of the duties listed above. The required time frame for the qualification differs from the required annual training.

Although the term “periodic qualification” is not defined in the rule, each railroad should specify in its program the interval at which their periodic qualification will take place.

When an employee (with only basic training) is promoted to perform duties such as roadway worker providing on-track safety, that employee must receive additional training and be qualified as required.

Note: Any employee who is promoted from a “basic worker” to a higher form of roadway worker qualification must demonstrate proficiency or take the recorded examination before assuming such duties.

Table 1 provides a list of required training and qualification elements for employees other than roadway workers based on specific activities.

§ 214.355 Training and qualification in on-track safety for operators of roadway maintenance machines.

(a) The training and qualification of roadway workers who operate roadway maintenance machines shall include, as a minimum:

(1) Procedures to prevent a person from being struck by the machine when the machine is in motion or operation.

(2) Procedures to prevent any part of the machine from being struck by a train or other equipment on another track.

(3) Procedures to provide for stopping the machine short of other machines or obstructions on the track.

(4) Methods to determine safe operating procedures for each machine that the operator is expected to operate.

(b) Initial and periodic qualification of a roadway worker to operate roadway maintenance machines shall be evidenced by demonstrated proficiency.

Guidance. Section 214.355 requires training for those roadway workers operating roadway maintenance machines. As noted earlier, there is a wide variety of equipment requiring specific knowledge. However, FRA determined that establishing minimum qualifications closely associated with the type of machine to be operated, and the circumstances and conditions under which it is to be operated, was necessary.

Employees who are roadway workers operating roadway maintenance machines are required to demonstrate proficiency on a periodic basis. Inquiries about training indicate there is confusion regarding annual training and periodic qualification. The term “periodic qualification” as used in this regulation refers to employees who perform specific duties such as lone workers, watchman/lookouts, flagmen, RWICs, and roadway maintenance machine operators. FRA requires that employees receive “initial and periodic qualification” for each of the duties listed above. The required time frame for the qualification differs from the required annual training.

Although the term “periodic qualification” is not defined in the rule, each railroad should specify in its program the interval at which their periodic qualification will take place.

When an employee (with only basic training) is promoted to perform duties such as roadway worker operating roadway maintenance machines, that employee must receive additional training and be qualified as required. The qualification of the roadway worker operating roadway maintenance machines is based on his/her demonstrated proficiency.

Note: Any employee who is promoted from a “basic worker” to a higher form of roadway worker qualification must demonstrate proficiency or take the recorded examination before assuming such duties.

Table 1 - Training and Qualification of Employees Associated with Roadway Worker Protection

Section	Description	Dispatcher	Engineer	Conductor	Conductor providing on-track safety (1)
309	Each RWIC shall maintain a copy of the program document				A
311	Good faith challenge and written procedure				A
315	On-track safety briefing				A
321	Exclusive track occupancy	D	D	D	D
323	Foul time	D			A
325	Train coordination		R	R	R
327	Inaccessible track			2	A
329	Train approach warning				A
335	Train approach warning large scale (adjacent track)				A
339	Audible train warning		R		A
341	Roadway maintenance machines				3
351	Flagmen	D	D	D	D
353	Physical characteristics	D	D	D	D

D Default training received through craft training.

R On-track training received in addition to craft qualification as required by 214.343.

A Additional qualification of employee providing on-track safety for roadway workers. Qualifications may be limited to those required for a specific situation. For example, a conductor providing on-track safety for a contractor working on a single controlled main track with exclusive track occupancy without roadway maintenance machines will not need to be qualified on roadway maintenance machine on-track safety, train approach warning, or inaccessible track. Only the elements that are utilized are applicable.

1. On-track safety qualification elements may be split between a conductor and roadway worker. For example, a conductor who is qualified to obtain a track permit but not on-track safety, a roadway worker may fulfill the other elements such as the on-track safety briefing, etc.

2. Railroad operating rule that would prohibit conductor from pulling spike in switch used to make track inaccessible.

3. An employee providing on-track safety is not required to be fully qualified to operate every roadway maintenance machine but must have knowledge of the general and specific on-track safety procedures for each machine.

Appendix A – Defect Codes

Note:

1) All codes correspond to the rule text. For example, 0303(a) corresponds to 214.303(a) and 0315(e)(iii) corresponds to 214.315(e)(iii).
2) For penalty schedule, please refer 49 CFR Part 214.
3) Defect code descriptions are not exact regulatory language. They are subject to change as needed.

Code	Description
0303A	FAILURE OF A RAILROAD TO IMPLEMENT AN ON-TRACK SAFETY PROGRAM.
0303B	ON-TRACK SAFETY PROGRAM OF A RAILROAD INCLUDES NO INTERNAL MONITORING PROCEDURE.
0305	FAILURE OF A RAILROAD TO COMPLY BY THE SPECIFIED DATES
0307Ai	FAILURE TO NOTIFY FRA OF ADOPTION OF ON-TRACK SAFETY PROGRAM
0307Aii	FAILURE TO DESIGNATE PRIMARY PERSON TO CONTACT FOR PROGRAM REVIEW
0309A1	ON-TRACK SAFETY MANUAL NOT PROVIDED TO PRESCRIBED EMPLOYEES
0309A2	ON-TRACK SAFETY PROGRAM DOCUMENTS ISSUED IN FRAGMENTS
0309A3	FAILURE OF ROADWAY WORKER TO MAKE ON-TRACK SAFETY MANUAL AVAILABLE
0311B	ROADWAY WORKER REQUIRED BY EMPLOYER TO FOUL A TRACK DURING AN UNRESOLVED CHALLENGE
0311C	ROADWAY WORKERS NOT PROVIDED WITH WRITTEN PROCEDURE TO RESOLVE CHALLENGES OF ON-TRACK SAFETY PROCEDURES
0313A	FAILURE OF ROADWAY WORKER TO FOLLOW RAILROADS ON-TRACK SAFETY RULES WHERE ROADWAY WORKER IS LOCATED
0313B	ROADWAY WORKER FOULING A TRACK WHEN NOT NECESSARY IN THE PERFORMANCE OF DUTY
0313C	ROADWAY WORKER FOULING A TRACK WITHOUT ASCERTAINING THAT PROVISION IS MADE FOR ON-TRACK SAFETY
0313D	ROADWAY WORKER FAILING TO NOTIFY EMPLOYER OF DETERMINATION OF IMPROPER ON-TRACK SAFETY

	PROVISIONS
0315A	FAILURE OF EMPLOYER TO PROVIDE JOB BRIEFING
0315B	INCOMPLETE JOB BRIEFING
0315Ci	FAILURE TO DESIGNATE ROADWAY WORKER IN CHARGE OF ROADWAY WORK GROUP
0315Cii	DESIGNATION OF MORE THAN ONE ROADWAY WORKER IN CHARGE OF ONE ROADWAY WORK GROUP.
0315Ciii	DESIGNATION OF NON-QUALIFIED ROADWAY WORKER IN CHARGE OF ROADWAY WORK GROUP
0315Di	FAILURE TO NOTIFY ROADWAY WORKERS OF ON-TRACK SAFETY PROCEDURES IN EFFECT.
0315Dii	INCORRECT INFORMATION PROVIDED TO ROADWAY WORKERS REGARDING ON-TRACK SAFETY PROCEDURES IN EFFECT.
0315Diii	FAILURE TO NOTIFY ROADWAY WORKERS OF CHANGE IN ON-TRACK SAFETY PROCEDURES.
0315Ei	FAILURE OF LONE WORKER TO COMMUNICATE WITH DESIGNATED EMPLOYEE FOR DAILY JOB BRIEFING.
0315Eii	FAILURE OF EMPLOYER TO PROVIDE MEANS FOR LONE WORKER TO RECEIVE DAILY JOB BRIEFING
0317A	EMPLOYER FAILED TO COMPLY WITH ON-TRACK SAFETY PROGRAM PROVISIONS FOR PROTECTING ROADWAY WORKERS
0317B	ON-TRACK SAFETY RULES CONFLICT WITH THIS PART
0319A	NON-QUALIFIED ROADWAY WORKER IN CHARGE OF WORKING LIMITS
0319B	MORE THAN ONE ROADWAY WORKER IN CHARGE OF WORKING LIMITS ON THE SAME TRACK SEGMENT
0319C1	WORKING LIMITS RELEASED WITHOUT NOTIFYING ALL AFFECTED ROADWAY WORKERS
0319C2	WORKING LIMITS RELEASED BEFORE ALL AFFECTED ROADWAY WORKERS ARE OTHERWISE PROTECTED
0321B	IMPROPER TRANSMISSION OF AUTHORITY FOR EXCLUSIVE TRACK OCCUPANCY.
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Federal Railroad Administration

Track and Rail and Infrastructure Integrity Compliance Manual

Volume III Railroad Workplace Safety
Chapter 4 On-Track Roadway Maintenance Machines and Hi-Rail Vehicles

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Text in italic font of this manual is regulatory language, whereas indented paragraphs provide field guidance for FRA inspectors. Indented paragraphs are not to be construed as regulatory language in any manner.

CHAPTER 4
On-Track Roadway Maintenance Machines and Hi-Rail Vehicles

Introduction

This chapter of the Railroad Workplace Safety Compliance Manual provides guidance for Federal Railroad Administration (FRA) and State personnel to ensure railroads and contractors comply with the federal regulations concerning Part 214 of Title 49 of the Code of Federal Regulations (CFR), specifically, Subpart D, On-Track Roadway Maintenance Machines and Hi-Rail Vehicles. Roadway Maintenance Machine Safety (RMMS) will be used throughout this document to refer to all of Subpart D, including those provisions that relate to hi-rail vehicles, as well as Subpart A and any applicable definitions found in 49 CFR 214.7. This manual is not to be construed as a modification, alteration, or revision of the published RMMS Rule.

Any legal proceeding instituted against a railroad must be based on the official regulations found in the Code of Federal Regulations, Title 49, Part 214, Subpart D, published annually by the Government Printing Office. However, inspectors should refer to this manual to understand the intent of any particular section, thereby assuring to the extent practicable, the nationally uniform application of these rules as intended by the Federal Railroad Administration. The Final Rule, published July 28, 2003, became effective September 26, 2003.

The defect codes shown in Appendix A are important analytical tools for FRA's data collection. However, defect codes do not determine the existence of a violation unless they mirror the CFR rule text. If an inspector finds no defect code corresponding to a violation of the RMMS regulation, the inspector may still submit a violation describing the unsafe condition cited and referencing the CFR section that is applicable.

Section and Guidance

§ 214.7 Definitions

Designated official *means any person(s) designated by the employer to receive notification of non-complying conditions on on-track roadway maintenance machines and hi-rail vehicles.*

Hi-rail vehicle *means a roadway maintenance machine that is manufactured to meet Federal Motor Vehicle Safety Standards and is equipped with retractable flanged wheels so that the vehicle may travel over the highway or on railroad tracks.*

Hi-rail vehicle, new *means a hi-rail vehicle that is ordered after December 26, 2003 or completed after September 27, 2004.*

On-track roadway maintenance machine *means a self-propelled, rail-mounted, non-highway, maintenance machine whose light weight is in excess of 7,500 pounds, and whose purpose is not for the inspection of railroad track.*

On-track roadway maintenance machine, existing *means any on-track roadway maintenance machine that does not meet the definition of a "new on-track roadway* *maintenance machine."*

On-track roadway maintenance machine, new *means an on-track roadway maintenance machine that is ordered after December 26, 2003, and completed after September 27, 2004.*

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§ 214.501 Purpose and scope

(a) *The purpose of this subpart is to prevent accidents and casualties caused by the lawful operation of on-track roadway maintenance machines and hi-rail vehicles.*

(b) *This subpart prescribes minimum safety standards for on-track roadway maintenance machines and hi-rail vehicles. An employer may prescribe additional or more stringent standards that are consistent with this subpart.*

(c) *Any working condition that involves the protection of employees engaged in roadway maintenance duties covered by this subpart but is not within the subject matter addressed by this subpart, including employee exposure to noise, shall be governed by the regulations of the U.S. Department of Labor, Occupational Safety and Health Administration.*

Guidance. Purpose and Scope provides an introduction into the regulation, which governs Roadway Maintenance Machines and the basis of authority for enforcement by Federal and State personnel.

This section, which includes (a), (b), & (c), is designed to prevent accidents and casualties involving on-track maintenance machines and hi-rail vehicles and delineates protection for employees against other dangers such as, but not limited to, exposure to noise via the regulations of the U. S. Department of Labor, Occupational Safety and Health Administration.

It is important to note that the RMMS regulation prescribes physical attribute and inspection requirements for certain roadway maintenance machines. However, railroads and contractors must also comply with the Roadway Worker Protection regulation, 49 CFR Part 214, Subpart C, which prescribes operational and training requirements for roadway maintenance machines.

§ 214.503 Good-faith challenges; procedures for notification and resolution

(a) An employee operating an on-track roadway maintenance machine or hi-rail vehicle shall inform the employer whenever the employee makes a good-faith determination that the machine or vehicle does not comply with FRA regulations or has a condition that inhibits its safe operation.

Guidance. Each employee operating an on-track roadway maintenance machine is responsible for informing the employer whenever the employee makes a good-faith determination that an on-track roadway maintenance machine or hi-rail vehicle does not comply with FRA regulations or it has a condition that inhibits its safe operation.

The employee should consider the general requirements specified in 214.341 of Subpart C, which also addresses the safety of roadway workers who operate or work near roadway maintenance machines. For example, a roadway maintenance machine covered in Subpart C, but not in Subpart D, would be a track motor car. The inspector should consult the RWP regulation (49 CFR 214, Subpart C) concerning roadway maintenance machines as an additional resource for information with respect to operational safety.

For example, a roadway maintenance machine with no secondary brake system available and no other machine available for coupling may be moved to a clearance or repair point. If there is doubt that the machine can be moved safely, a good-faith challenge would be appropriate.

(b) Any employee charged with operating an on-track roadway maintenance machine or hi- rail vehicle covered by this subpart may refuse to operate the machine or vehicle if the employee makes a good-faith determination that it does not comply with the requirements of this subpart or has a condition that inhibits its safe operation. The employer shall not require the employee to operate the machine or vehicle until the challenge resulting from the good-faith determination is resolved.

(c) Each employer shall have in place and follow written procedures to assure prompt and equitable resolution of challenges resulting from good-faith determinations made in accordance with this section. The procedures shall also include the title and location of the employer's designated official.

Guidance. This paragraph requires that the good-faith challenge procedure be in writing in order to provide a prompt and equitable solution for any concern. The written procedure shall also include the title and location of the employer's designated official, who is defined by the rule as any person(s) designated by the employer to receive notification of non-complying conditions on on-track roadway maintenance and hi-rail vehicles. It is incumbent upon the employer to explain to all employees how the procedure is to function. FRA field inspectors should ask the employer how the information concerning the good-faith challenge is disseminated to the workforce.

§ 214.505 Required environmental control and protection systems for new on-track roadway maintenance machines with enclosed cabs

(a) *The following new on-track roadway maintenance machines shall be equipped with enclosed cabs with operative heating systems, operative air conditioning systems, and operative positive pressurized ventilation systems:*

(1) Ballast regulators;

(2) *Tampers;*

(3) Mechanical brooms;

(4) *Rotary scarifiers;*

(5) *Undercutters; and*

(6) *Functional equivalents of any of the machines identified in paragraphs (a)(1) through (a)(5) of this section.*

Guidance. This regulation does not cover air contaminants outside an enclosed cab of new on-track roadway maintenance machines under paragraphs (a)(1) through (a)(6). A new machine, as defined by the rule, is one which is ordered after December 26, 2003, and completed after September 27, 2004.

If an inspector observes what may be a cloud of dust at the work site outside the cab of a machine that is required to have environmental controls, the inspector should ask the carrier's representative about the railroad's respiratory program. If the carrier's representative cannot explain or enforce the railroad's respiratory program, then the inspector and/or specialist should contact Headquarters for assistance. Headquarters, in turn, will contact OSHA in an effort to address the concerns of the field inspector.

A functionally equivalent machine is an on-track maintenance machine that has the ability to operate in any combination as either a ballast regulator, tamper, mechanical broom, rotary scarifier, or undercutter that creates air contaminants, such as silica dust.

(b) New on-track roadway maintenance machines, and existing on-track roadway maintenance machines specifically designated by the employer, of the types identified in paragraphs (a)(1) through (a)(5) of this section, or functionally equivalent thereto, shall be capable of protecting employees in the cabs of the machines from exposure to air contaminants, in accordance with 29 CFR 1910.1000.

Guidance. FRA is referencing OSHA's regulations already in effect. FRA will address failure to comply with working condition requirements. The section includes the detection of all air contaminants, not only silica.

(c) An employer shall maintain a list of new and designated existing on-track roadway maintenance machines of the types identified in paragraphs (a)(1) through (a)(5) of this section, or functionally equivalent thereto. The list shall be kept current and made available to the Federal Railroad Administration and other Federal and State agencies upon request.

Guidance. Employers must maintain a roster of roadway maintenance machines, under FRA's jurisdiction, for purposes of this regulation. The employer is required to list new roadway maintenance machines as defined by the regulation as well as equipment "designated" by the employer in accordance with 49 CFR 214.505(d). The inspector must have this information so they may determine if a roadway maintenance machine is new or designated existing. Conceivably, the employer could have only one roster. All other equipment would be considered existing in reference to this section of the regulation.

Note that equipment "designated" in accordance with 49 CFR 214.505(d) will be subject to the requirements to protect employees from air contaminants, as set forth in paragraph (b) of this section. Other requirements in 49 CFR 214.505 do not apply to "designated" equipment, only to "new" equipment.

The roster of roadway maintenance machines may be kept manually or electronically, but must be available upon request to FRA and other state or federal agencies that have responsibility for air contaminant standards and respiratory-related regulations for roadway maintenance machines. Roadway maintenance machines not covered by FRA under the provisions of § 214.505 are covered by OSHA regulations that are often enforced by state agencies and OSHA itself.

(d) An existing roadway maintenance machine of the type identified in paragraphs (a)(1) through (a)(5) of this section, or functionally equivalent thereto, becomes "designated" when the employer adds the machine to the list required in paragraph (c) of this section. The designation is irrevocable, and the designated existing roadway maintenance machine

remains subject to paragraph (b) of this section until it is retired or sold.

Guidance. Employers may elect to include, on this roster, existing roadway maintenance machines that are equipped with engineering controls for air quality. These machines once added to the list will be treated the same as new machines and are then required to meet the requirements of section 505. The roster, which may be electronic, must be readily available upon request to FRA and other Federal and State agencies that have responsibility for air contaminant standards and respiratory-related regulations for roadway maintenance machines.

(e) If the ventilation system on a new on-track roadway maintenance machine or a designated existing on-track roadway maintenance machine of the type identified in paragraphs (a)(1) through (a)(5) of this section, or functionally equivalent, becomes incapable of protecting an employee in the cab of the machine from exposure to air contaminants in accordance with 29 CFR 1910.1000, personal respiratory protective equipment shall be provided for each such employee until the machine is repaired in accordance with § 214.531.

Guidance. This paragraph will be enforced by FRA and State "qualified individuals" who are capable of determining whether the exposure is in violation of the environmental standards contained in 29 CFR 1910.1000. Air contaminates are particles added to the air, which are produced by a physical process. An example is silica dust created by placing ballast.

(f) Personal respiratory protective equipment provided under paragraph (e) of this section shall comply with 29 CFR 1910.134.

Guidance. Paragraphs (a) (e) and (f) require FRA and Sate personnel to be able to identify the employer's personal respiratory protective equipment that must be operative and comply with OSHA 29 CFR 1910.134. These standards require employers to use respirators certified by the National Institute for Occupational Safety and Health (NIOSH). FRA and State field personnel must also determine if the employers have in place a respiratory protection program that includes procedures for proper inspection and maintenance of respirators and medical evaluation of personnel designated to use the respirators.

(g) New on-track roadway maintenance machines with enclosed cabs, other than the types identified in paragraphs (a)(1) through (a)(5) of this section or functionally equivalent thereto, shall be equipped with operative heating and ventilation systems.

(h) When new on-track roadway maintenance machines require operation from non- enclosed stations outside of the main cab, the non-enclosed stations shall be equipped, where feasible from an engineering standpoint, with a permanent or temporary roof, canopy, or umbrella designed to provide cover from normal rainfall and midday sun.

§ 214.507 Required safety equipment for new on-track roadway maintenance machines

(a) Each new on-track roadway maintenance machine shall be equipped with:

(1) *A seat for each operator, except as provided in paragraph (b) of this section;*

Guidance. This section requires each new on-track roadway maintenance machine be equipped with a seat for each operator, unless the machine is designed to be operated by an operator in the standing position.

(2) A safe and secure position with handholds, handrails, or a secure seat for each roadway worker transported on the machine. Each position shall be protected from moving parts of the machine;

Guidance. The intent is to provide handholds, handrails, or secure seating and to protect riders from the moving parts of roadway maintenance machines.

(3) A positive method of securement for turntables, on machines equipped with a turntable, through engagement of pins and hooks that block the descent of turntable devices below the rail head when not in use;

(4) A windshield with safety glass, or other material with similar properties, if the machine is designed with a windshield. Each new on-track roadway maintenance machine designed with a windshield shall also have power windshield wipers or suitable alternatives that provide the machine operator an equivalent level of vision if windshield wipers are incompatible with the windshield material:

Guidance. The Federal Register Vol. 69, No. 38, Thursday, February 26, 2004, amends the Railroad Maintenance Machine Rule, which became effective September 26, 2004.

The amended 214.507 (a)(4) emphasizes that not all new on-track roadway maintenance machines require windshields. Machines such as but not limited to anchor spreaders, rail heater cars, and spike driving machines may not be designed for windshields. When machines are equipped with new windshields, power windshield wipers or an equivalent such as a “chemical treatment water repellent” would be acceptable.

The amended section became effective April 26, 2004.

(5) A machine braking system capable of effectively controlling the movement of the machine under normal operating conditions;

Guidance. The FRA track inspector should review Subpart C, 214.341(b), which requires the employer to provide and maintain instructions for the safe operation of each roadway maintenance machine with each machine large enough to carry the instruction document.

(6) A first-aid kit that is readily accessible and complies with 29 CFR 1926.50(d)(2); and

Guidance. First aid kits required for new on-track roadway maintenance machines must comply with 29 CFR 1926.50 (d)(2). The regulation “recommends”, as an example, the description of the contents of a generic first aid kit described in American National Standard Institute (ANSI) standard Z 308.1 – 1978.

(7) An operative and properly charged fire extinguisher of 5 BC rating or higher which is securely mounted and readily accessible to the operator from the operator’s work station.

Guidance. Fire extinguishers required by 214.507 (a)(7) must be operative, properly charged, securely mounted near the operator's work station, and shall be rated 5 BC or higher.

(b) Each new on-track roadway maintenance machine designed to be operated and transported by the operator in a standing position shall be equipped with handholds and handrails to provide the operator with a safe and secure position.

(c) Each new on-track roadway maintenance machine that weighs more than 32,500 pounds light weight and is operated in excess of 20 mph shall be equipped with a speed indicator that is accurate within ± 5 mph of the actual speed at speeds of 10 mph and above.

Guidance. Inspectors need to refer to (d) if the light weight for vehicles noted in Section (c) is not displayed and for the definition of light weight.

(d) Each new on-track roadway maintenance machine shall have its as-built light weight displayed in a conspicuous location on the machine.

Guidance. The light weight of a machine is calculated when a machine is not loaded with passengers or extraneous equipment not part of the machine itself. The light weight will also provide essential information to crane operators in the event the machines are lifted onto or loaded off of a flat bed truck or rail car for movement to another work site.

§ 214.509 Required visual illumination and reflective devices for new on-track roadway maintenance machines

Each new on-track roadway maintenance machine shall be equipped with the following visual illumination and reflective devices:

(a) An illumination device, such as a headlight, capable of illuminating obstructions on the track ahead in the direction of travel for a distance of 300 feet under normal weather and atmospheric conditions;

Guidance. This section requires illumination devices, such as headlights to provide visibility in normal weather conditions and atmospheric conditions for a minimal distance of 300 feet. This measure is to be considered under generally clement weather and atmospheric conditions. FRA understands that during periods of rain, fog, snow and other occurrences that are common in normal weather patterns, the lighting capability of the illumination devices may temporarily be unable to reach a full 300 feet. These temporary instances when full illumination is not possible will not be considered a violation of this regulation.

(b) Work lights, if the machine is operated during the period between one-half hour after sunset and one-half hour before sunrise or in dark areas such as tunnels, unless equivalent lighting is otherwise provided;

(c) An operative 360-degree intermittent warning light or beacon mounted on the roof of the machine. New roadway maintenance machines that are not equipped with fixed roofs and have a light weight less than 17,500 pounds are exempt from this requirement;

Guidance. The light or beacon required by the paragraph must emit light in a 360 degree field, but does not have to rotate to do so.

(d) *A brake light activated by the application of the machine braking system, and designed to be visible for a distance of 300 feet under normal weather and atmospheric conditions; and*

Guidance. New on-track maintenance machines must be equipped with brake lights. The new machines that operate in both directions need to have brake lights on both ends of the machines, even if a machine is wired so that the brake lights apply on both ends at the same time.

(e) *Rearward viewing devices, such as rearview mirrors.*

Guidance. New RMMs must be equipped with operative rearward viewing devices or a functional equivalent to enable machine operators to see other machines, personnel, and obstructions. Vision must be established in both directions. Video cameras and monitors may be used to comply with this section.

§ 214.511 Required audible warning devices for new on-track roadway maintenance machines

Each new on-track roadway maintenance machine shall be equipped with:

(a) *A horn or other audible warning device that produces a sound loud enough to be heard by roadway workers and other machine operators within the immediate work area. The triggering mechanism for the device shall be clearly identifiable and within easy reach of the machine operator; and*

(b) *An automatic change-of-direction alarm which provides an audible signal that is at least three seconds long and is distinguishable from the surrounding noise. Change of direction alarms may be interrupted by the machine operator when operating the machine in the work mode if the function of the machine would result in a constant, or almost constant, sounding of the device. In any action brought by FRA to enforce the change-of-direction alarm requirement, the employer shall have the burden of proving that use of the change-of-direction alarm in a particular work function would cause a constant, or almost constant, sounding of the device.*

Guidance. The regulation does not include a decibel standard in regard to audible warning devices under Section 511 for new on-track roadway maintenance machines. However, a horn or warning system must be loud enough to be heard by roadway workers and other machine operators within the immediate work area.

§ 214.513 Retrofitting of existing on-track roadway maintenance machines; general

(a) *Each existing on-track roadway maintenance machine shall have a safe and secure position with handholds, handrails, or a secure seat or bench position for each roadway worker transported on the machine. Each position shall be protected from moving parts of the machine.*

Guidance. Paragraph (a) was effective September 26, 2003. The intent is to provide handholds, handrails, or secure seating and to protect riders from the moving parts of roadway maintenance machines.

Existing machines, as identified in this section, means a roadway maintenance machine in existence or ordered on or before December 26, 2003, and completed on or before September 27, 2004.

(b) *By March 28, 2005, each existing on-track roadway maintenance machine shall be equipped with a permanent or portable horn or other audible warning device that produces a sound loud enough to be heard by roadway workers and other machine operators within the immediate work area. The triggering mechanism for the device shall be clearly identifiable and within easy reach of the machine operator.*

(c) *By March 28, 2005, each existing on-track roadway maintenance machine shall be equipped with a permanent illumination device or a portable light that is securely placed and not hand-held. The illumination device or portable light shall be capable of illuminating obstructions on the track ahead for a distance of 300 feet under normal weather and atmospheric conditions when the machine is operated during the period between one-half hour after sunset and one-half hour before sunrise or in dark areas such as tunnels.*

Guidance. Paragraphs (b) & (c) have an effective date of March 28, 2005. Illumination devices noted in Paragraph (c) must be visible for a distance of 300 feet under normal atmospheric conditions.

§ 214.515 Overhead covers for existing on-track roadway maintenance machines

(a) For those existing on-track roadway maintenance machines either currently or previously equipped with overhead covers for the operator's position, defective covers shall be repaired, and missing covers shall be reinstalled, by March 28, 2005, and thereafter maintained in accordance with the provisions of § 214.531.

(b) For those existing on-track roadway maintenance machines that are not already equipped with overhead covers for the operator's position, the employer shall evaluate the feasibility of providing an overhead cover on such a machine if requested in writing by the operator assigned to operate the machine or by the operator's designated representative. The employer shall provide the operator a written response to each request within 60 days. When the employer finds the addition of an overhead cover is not feasible, the response shall include an explanation of the reasoning used by the employer to reach that conclusion.

Guidance. In Paragraph (b), the employer must respond to a request to provide an overhead cover for machines that have not had a previous existing overhead cover in writing within 60 days. This section became effective September 26, 2003. This is not a retrofitting item and the employer is not required to supply an overhead cover if the employer can demonstrate that it is not feasible to install a cover. There may be no room on the machine to install an effective cover or canopy to protect the operator's position, or the machine may not provide a safe place on which a cover may be mounted or attached.

(c) For purposes of this section, overhead covers shall provide the operator's position with

cover from normal rainfall and midday sun.

§ 214.517 Retrofitting of existing on-track roadway maintenance machines manufactured on or after January 1, 1991

In addition to meeting the requirements of § 214.513, after March 28, 2005 each existing on-track roadway maintenance machine manufactured on or after January 1, 1991, shall have the following:

(a) A change-of-direction alarm or rearview mirror or other rearward viewing device, if either device is feasible, given the machine's design, and if either device adds operational safety value, given the machine's function. In any action brought by FRA to enforce this requirement, the employer shall have the burden of proving that neither device is feasible or adds operational safety value, or both, given the machine's design or work function.

Guidance. An employer does not have to retrofit an existing on-track roadway maintenance machine with either a change-of-direction alarm or a rearward viewing device if a machine's design or function is such that a retrofit of this nature would provide no safety value. The employer who reaches the conclusion that there is no safety value in adding a change of direction alarm or rearward-viewing device will be required to demonstrate, if asked by FRA, why their conclusion is correct.

(b) An operative heater, when the machine is operated at an ambient temperature less than 50 degrees Fahrenheit and is equipped with, or has been equipped with, a heater installed by the manufacturer or the railroad.

Guidance. This section specifies requirements for existing on-track roadway maintenance machines manufactured on or after January 1, 1991. Consequently, on-track roadway maintenance machines manufactured prior to 1991 are exempt from the requirements contained in this section.

It should be emphasized that heaters previously installed by employees do not have to be re-installed; only heaters installed by either the manufacturer or the railroad apply to this paragraph.

(c) The light weight of the machine stenciled or otherwise clearly displayed on the machine, if the light weight is known.

Guidance. This paragraph requires the light weight of the machine to be stenciled or otherwise noted if known; if the information is unknown, that would not be a defect.

It should be remembered that on-track roadway maintenance machines manufactured prior to 1991 are exempt from this section and all retrofitting requirements of this section.

The light weight of a machine is calculated when the machine is not loaded with passengers, fuel, or extraneous equipment not part of the machine itself.

(d) Reflective material, or a reflective device, or operable brake lights.

(e) Safety glass when its glass is normally replaced, except that replacement glass that is specifically intended for on-track roadway maintenance machines and is in the employer's

inventory as of September 26, 2003, may be utilized until exhausted.

Guidance. Inspectors should be aware that not all roadway maintenance machines have the structural strength to accommodate safety glass as it is defined under *49 CFR Part 223*. Thus, equivalent safety glass may be used.

(f) A turntable restraint device, on machines equipped with a turntable, to prevent undesired lowering or a warning light indicating that the turntable is not in the normal travel position.

Guidance. It must be emphasized that this paragraph only applies to a machine equipped with a turntable. If a machine is not equipped with a turntable, an employer cannot be cited for non-compliance with this paragraph.

§ 214.518 Safe and secure positions for riders

On or after March 1, 2004, a roadway worker, other than the machine operator(s), is prohibited from riding on any on-track roadway maintenance machine unless a safe and secure position for each roadway worker on the machine is clearly identified by stenciling, marking, or other written notice.

Guidance. Any employer who allows its roadway workers to ride on a roadway maintenance machine that has neither stenciling, marking, or other written notice identifying safe and secure riding positions will be deemed in violation of the regulation.

Decals should be considered as marking. If riders are not present on roadway maintenance machines, a defect cannot be written for allowing roadway workers to ride on an RMM that does not properly identify a safe and secure position, for non-operators of the equipment. (Inspectors should inquire if roadway workers have been allowed to ride on a machine they suspect of transporting roadway workers; if there is no stenciling, marking, or other written notice, it could be that the employer does not permit non-operators to ride that particular machine. If confirmed that riding has occurred, advise the operator and railroad official that until the machine is properly stenciled, marked, or has written documentation, it may not be used to transport roadway workers.)

§ 214.519 Floors, decks, stairs, and ladders for on-track roadway maintenance machines

Floors, decks, stairs, and ladders of on-track roadway maintenance machines shall be of appropriate design and maintained to provide secure access and footing, and shall be free of oil, grease, or any obstruction which creates a slipping, falling, or fire hazard.

Guidance. This section does not describe what a floor or deck must have to be of appropriate design. Diamond plate, rubber tile, or other slip-resistant material designs are desirable but not required.

The Preamble to the Final Rule states that accumulations of oil, grease, or other obstructions that could create a slipping, falling, or fire hazard must be “properly removed”, but does not define the term or provide an example of prompt removal.

Inspectors must exercise discretion when submitting this section for violation action. Photographs depicting this condition are essential. Inspectors should determine if the RMM operator advised the employer's designated official and the roadway worker in charge (RWIC) during the last job briefing of any type of hazard covered in this section. This may indicate a new defect such as a leaking hose or a lack of concern for an ongoing problem. The amount of accumulation may be a definitive factor in determining the length of time the defect has been in existence.

§ 214.521 Flagging equipment for on-track roadway maintenance machines and hi-rail vehicles

Each on-track roadway maintenance machine and hi-rail vehicle shall have on board a flagging kit that complies with the operating rules of the railroad if:

(a) The equipment is operated over trackage subject to a railroad operating rule requiring flagging; and

(b) (1) The equipment is not part of a roadway work group; or

(2) The equipment is the lead or trailing piece of equipment in a roadway work group operating under the same occupancy authority.

Guidance. This section states that flagging kits required under the regulation are for operating rule purposes only and do not relate to any requirements under the Roadway Worker Protection regulations in Subpart C. If the railroad does not have an operating rule requiring flagging kits, this section is not applicable and cannot be written as a defect or violation.

Inspectors should review carefully the operating rules of the railroad to determine whether or not flagging kits are required in the carrier's operating rules. Also, FRA inspectors should remember that contractors are governed by the operating rules of the railroad they are working on.

If flagging kits are required by the railroad's operating rules, then the kits must be on each roadway maintenance machine and hi-rail that is operated alone (not part of a group) and on the trailing and lead equipment in a roadway work group.

§ 214.523 Hi-rail vehicles

(a) The hi-rail gear of all hi-rail vehicles shall be inspected for safety at least annually and with no more than 14 months between inspections. Tram, wheel wear, and gage shall be measured and, if necessary, adjusted to allow the vehicle to be safely operated.

Guidance. Paragraph (a) requires the tram (alignment), wheel wear, and gage to be checked and adjusted on an annual basis. All existing hi-rail vehicle inspections are due within one year from the (September 26, 2003) effective date of the Final Rule.

Thereafter, inspection of existing hi-rail vehicles are due each year on the anniversary date of its first inspection. However, employers are allowed a "two month" window beyond the due date in which to perform the inspection once it becomes due.

As “new” hi-rail vehicles enter service, the inspection is due within one year of the date the vehicle entered service. Again, employers are allowed a “two month” window beyond the due date to comply.

There is no specific requirement as to who may conduct an inspection of the hi-rail vehicle safety-critical components, such as tram (alignment), wheel wear, and gage measurements per the RMMS rule. The employer will determine who is qualified to perform proper annual inspections. The employer shall use the manufacturer’s specifications that will ensure the hi-rail can be operated in a safe manner. If there are no criteria provided to measure the tram (alignment), wheel wear, and gage of a hi-rail vehicle, then the inspection would not be in compliance with this section.

(b) Each employer shall keep records pertaining to compliance with paragraph (a) of this section. Records may be kept on forms provided by the employer or by electronic means. The employer shall retain the record of each inspection until the next required inspection is performed. The records shall be made available for inspection and copying during normal business hours by representatives of FRA and States participating under Part 212 of this chapter. The records may be kept on the hi-rail vehicle or at a location designated by the employer.

(c) A new hi-rail vehicle shall be equipped with:

(1) An automatic change-of-direction alarm or backup alarm that provides an audible signal at least three seconds long and distinguishable from the surrounding noise; and

(2) An operable 360-degree intermittent warning light or beacon mounted on the outside of the vehicle.

(d) (1) The operator of a hi-rail vehicle shall check the vehicle for compliance with this subpart, prior to using the vehicle at the start of the operator’s work shift.

Guidance. In Paragraph (d)(1), the regulation requires the operator of a hi-rail vehicle to “check” the vehicle for compliance with this subpart prior to using the vehicle at the start of the operator’s work shift.

The word “check” is used. It should be considered to mean to inspect or test for satisfactory conditions; however, there is no required checklist or inspection form required. The employer may maintain a logbook or inspection record of the hi-rail inspections and/or defects if they choose to do so.

If FRA finds a hi-rail vehicle operating with a non-complying condition that has not been properly tagged or reported, FRA will presume that the hi-rail has not received a proper inspection prior to operation of that shift, unless the operator or employer can show that the defect developed after the inspection was performed. If multiple employees use the same equipment during the same work shift, it is expected that only the first employee will inspect the equipment for that shift.

(2) A non-complying condition that cannot be repaired immediately shall be tagged and dated in a manner prescribed by the employer and reported to the designated official.

(3) Non-complying automatic change-of-direction alarms, backup alarms, and 360-degree intermittent warning lights or beacons shall be repaired or replaced as soon as practicable within seven calendar days.

§ 214.525 Towing with on-track roadway maintenance machines or hi-rail vehicles

(a) When used to tow pushcars or other maintenance-of-way equipment, each on-track roadway maintenance machine or hi-rail vehicle shall be equipped with a towing bar or other coupling device that provides a safe and secure attachment.

(b) An on-track roadway maintenance machine or hi-rail vehicle shall not be used to tow pushcars or other maintenance-of-way equipment if the towing would cause the machine or hi-rail vehicle to exceed the capabilities of its braking system. In determining the limit of the braking system, the employer must consider the track grade (slope), as well as the number and weight of pushcars or other equipment to be towed.

Guidance. Paragraph (b) addresses the issue of exceeding the capability of the braking system for an on-track roadway maintenance machine or hi-rail vehicle.

If information is not available concerning the braking capacity of the equipment, a "good-faith" challenge, as noted in 214.503 (a), should be initiated by an employee. Inspectors should be prepared to enforce this section if an employer does not follow the railroad's written procedures for resolving the good-faith challenge.

Also, it may be helpful to determine if the instructions for the safe operation of a roadway maintenance machine, noted in *Subpart C 214.341 (b),* are understood by all concerned.

As used in §214.525(b), "maintenance-of-way equipment" or "equipment" means another RMM or hi-rail vehicle.

§ 214.527 On-track roadway maintenance machines; inspection for compliance and schedule for repairs

(a) The operator of an on-track roadway maintenance machine shall check the machine components for compliance with this subpart, prior to using the machine at the start of the operator's work shift.

Guidance. If FRA finds an on-track roadway maintenance machine operating with a non-complying condition that has not been properly tagged or reported, FRA will presume that the on-track roadway maintenance machine has not received a proper inspection prior to operation of that shift, unless the operator or employer can show that the defect could have developed after the inspection was performed. If multiple employees use the same equipment during the same work shift, it is expected that only the first employee will inspect the equipment for that shift.

(b) Any non-complying condition that cannot be repaired immediately shall be tagged and dated in a manner prescribed by the employer and reported to the designated official.

Guidance. In Paragraph (b) any non-complying condition that cannot be immediately repaired must be tagged and dated in a manner prescribed by the employer and reported to the designated official. This does not inhibit the employee's right to make a good-faith challenge.

The designated official is any person(s) designated by the employer to receive notification of non-complying conditions on on-track roadway maintenance machines and hi-rail vehicles as noted in 214.503 (c) (good faith challenge).

It is permissible for the employer to use one tag to indicate that more than one defect exists on a roadway maintenance machine or hi-rail. The tag must be clearly visible and used only for the purpose of identifying a non-complying condition. The tag may also contain the instructions to look at the logbook for additional details concerning a non-complying condition.

Maintaining a logbook alone does not comply with the regulation. The defective condition must be tagged and reported. A logbook or other form of documentation may be used by the employer in conjunction with tagging.

(c) The operation of an on-track roadway maintenance machine with a non-complying condition shall be governed by the following requirements:

(1) *An on-track roadway maintenance machine with headlights or work lights that are not in compliance may be operated for a period not exceeding seven calendar days and only during the period between one-half hour before sunrise and one-half hour after sunset.*

Guidance: When on-track roadway maintenance machines are operated during the period between one-half hour after sunset and one-half hour before sunrise, or in dimly lit areas such as tunnels, they are required to be equipped with operating work lights unless equivalent lighting is otherwise provided, for example, by portable wayside lighting. See 214.509 (b).

(2) A portable horn may be substituted for a non-complying or missing horn for a period not exceeding seven calendar days;

(3) A fire extinguisher readily available for use may temporarily replace a missing, defective or discharged fire extinguisher on a new on-track roadway maintenance machine for a period not exceeding seven calendar days, pending the permanent replacement or repair of the missing, defective or used fire extinguisher;

Guidance. Fire extinguisher, as addressed in this rule, applies only to new equipment. See 214.507 (a)(7) for detailed information regarding the type of fire extinguisher required. Fire extinguishers must be accessible to the operator from the operator’s workstation; however, the paragraph does not require the fire extinguisher to be in the cab of the on-track roadway maintenance machine. Temporary fire extinguishers must be readily accessible, but do not have to be mounted on the equipment.

(4) Non-complying automatic change-of-direction alarms, backup alarms, and 360-degree intermittent warning lights or beacons shall be repaired or replaced as soon as practicable within seven calendar days; and

(5) A structurally defective or missing operator’s seat shall be replaced or repaired within 24 hours or by the start of the machine’s next tour of duty, whichever is later. The machine may be operated for the remainder of the operator’s tour of duty if the defective or missing operator’s seat does not prevent its safe operation.

§ 214.529 In-service failure of primary braking system

(a) In the event of a total in-service failure of its primary braking system, an on-track roadway maintenance machine may be operated for the remainder of its tour of duty with the use of a secondary braking system or by coupling to another machine, if such operations may be done safely.

(b) If the total in-service failure of an on-track roadway maintenance machine's primary braking system occurs where other equipment is not available for coupling, the machine may, if it is safe to do so, travel to a clearance or repair point where it shall be placed out of service until repaired.

Guidance. Both paragraphs need to be considered in conjunction with 214.503 (a). When deeming it is safe to move an on-track maintenance machine after a total in-service failure of the primary braking system, if there is a question regarding safety, a "good-faith" challenge would be appropriate.

If there is no doubt regarding safety, then it is permissible to move the equipment, which has had a total in-service failure of its primary braking system.

§ 214.531 Schedule of repairs; general

Except as provided in §§ 214.527(c)(5), 214.529, and 214.533, an on-track roadway maintenance machine or hi-rail vehicle that does not meet all the requirements of this subpart shall be brought into compliance as soon as practicable within seven calendar days. If repairs are not made within seven calendar days, the on-track roadway maintenance machine or hi-rail vehicle shall be placed out of on-track service.

Guidance. This section applies to both new and existing hi-rail vehicles.

§ 214.533 Schedule of repairs subject to availability of parts

(a) The employer shall order a part necessary to repair a non-complying condition on an on-track roadway maintenance machine or a hi-rail vehicle by the end of the next business day following the report of the defect.

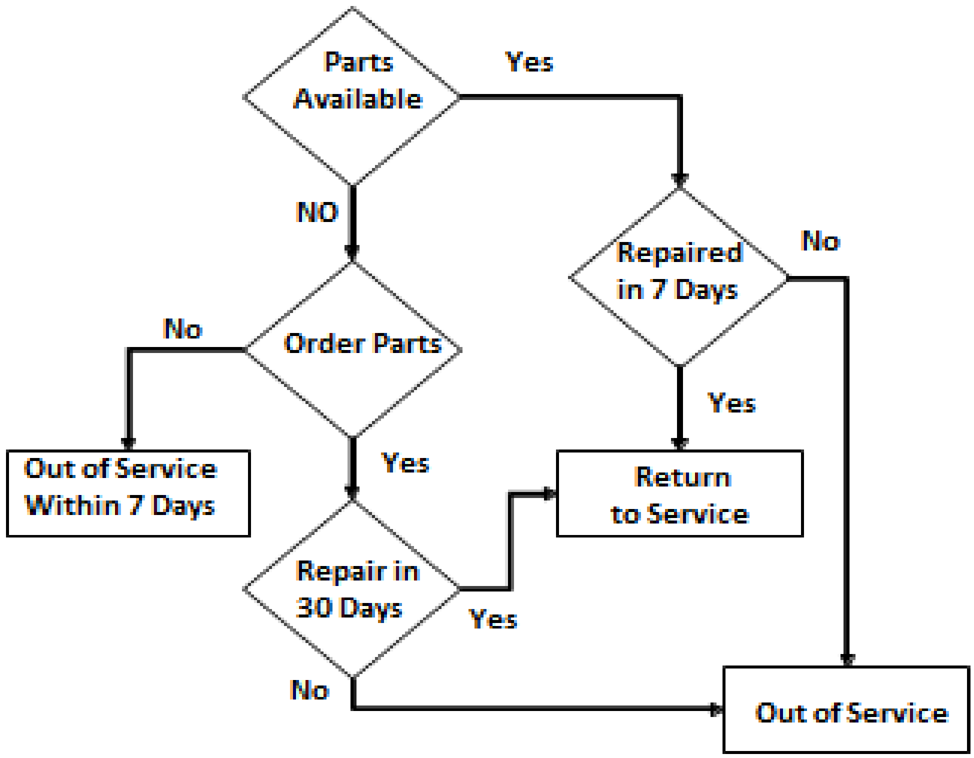
(b) When the employer cannot repair a non-complying condition as required by § 214.531 because of the temporary unavailability of a necessary part, the employer shall repair the on-track roadway maintenance machine or hi-rail vehicle within seven calendar days after receiving the necessary part. The employer may continue to use the on-track roadway maintenance machine or hi-rail vehicle with a non-complying condition until receiving the necessary part(s) for repair, subject to the requirements of § 214.503. However, if a non-complying condition is not repaired within 30 days following the report of the defect, the employer shall remove the on-track roadway maintenance machine or hi-rail vehicle from on-track service until it is brought into compliance with this subpart.

(c) If the employer fails to order a part necessary to repair the reported non-complying condition, or if it fails to install an available part within the required seven calendar days, the on-track roadway maintenance machine or hi-rail vehicle shall be removed from on-track

service until brought into compliance with this subpart.

(d) *Each employer shall maintain records pertaining to compliance with this section. Records may be kept on forms provided by the employer or by electronic means. The employer shall retain each record for at least one year, and the records shall be made available for inspection and copying during normal business hours by representatives of FRA and States participating under part 212 of this chapter. The records may be kept on the on-track roadway maintenance machine or hi-rail vehicle or at a location designated by the employer.*

Guidance.



Appendix A – Defect Codes

Note:

1) All codes correspond to the rule text. For example, 0507A1 corresponds to 214.507(a)(1) and 0531A2 corresponds to 214.531(a)(2).
2) For penalty schedule, please refer 49 CFR Part 214.
3) Defect code descriptions are not exact regulatory language. They are subject to change as needed.

CODE	DESCRIPTION
0503A	FAILURE OF EMPLOYEE TO NOTIFY EMPLOYER THAT THE MACHINE OR VEHICLE DOES NOT COMPLY WITH FRA REGULATIONS OR HAS A CONDITION INHIBITING SAFE OPERATION.
0503B	ROADWAY WORKER REQUIRED TO OPERATE ROADWAY MAINTENANCE MACHINE DURING AN UNRESOLVED GOOD-FAITH CHALLENGE.
0503C	EMPLOYER FAILED TO HAVE OR FOLLOW WRITTEN PROCEDURES TO RESOLVE GOOD-FAITH CHALLENGES OF ROADWAY MAINTENANCE MACHINES OR HI-RAIL VEHICLES THAT DO NOT COMPLY WITH FRA REGULATIONS OR THAT ARE NOT SAFE TO OPERATE.
0505A	FAILURE TO EQUIP NEW ON-TRACK ROADWAY MAINTENANCE MACHINES OR FUNCTIONAL EQUIVALENTS WITH ENCLOSED CABS WITH OPERATIVE REQUIRED SYSTEMS.
0505B	FAILURE OF NEW OR "DESIGNATED" EXISTING ON-TRACK MAINTENANCE MACHINES TO PROTECT EMPLOYEES FROM EXPOSURE TO AIR CONTAMINANTS IN ACCORDANCE WITH 29 CFR 1910.1000.
0505C	FAILURE OF EMPLOYER TO MAINTAIN REQUIRED LIST OF MACHINES OR MAKE LIST AVAILABLE FOR COPYING BY FRA.
0505D	REMOVAL OF "DESIGNATED" MACHINE FROM LIST BEFORE RETIRED OR SOLD.
0505E	PERSONAL PROTECTIVE RESPIRATORY EQUIPMENT NOT PROVIDED BY EMPLOYER FOR EACH EMPLOYEE IN THE CAB OF NEW OR "DESIGNATED" EXISTING ON-TRACK MAINTENANCE MACHINES WITH FAILED VENTILATION SYSTEM.
0505F	PROVIDED PERSONAL RESPIRATORY PROTECTIVE EQUIPMENT FAILS TO MEET REQUIRED STANDARDS.
0505G	NEW ON-TRACK MAINTENANCE MACHINES WITH ENCLOSED CABS NOT EQUIPPED WITH OPERABLE HEATING OR VENTILATION SYSTEMS.

0505H	NON-ENCLOSED STATION NOT EQUIPPED WITH COVERING, WHERE FEASIBLE.
0507A1	FAILURE TO EQUIP NEW MACHINE WITH A SEAT FOR EACH OPERATOR.
0507A2	FAILURE TO EQUIP NEW MACHINE WITH HANDHOLDS, HANDRAILS, OR A SECURE SEAT & CAB PROTECTION FROM MOVING MACHINE PARTS.
0507A3	FAILURE TO EQUIP NEW MACHINE WITH POSITIVE SECUREMENT FOR TURNTABLE.
0507A4	FAILURE TO EQUIP NEW MACHINE WITH WINDSHIELD, POWER WINDSHIELD WIPERS OR SUITABLE ALTERNATIVE PROVIDING EQUIVALENT LEVEL OF VISION.
0507A5	FAILURE TO EQUIP NEW MACHINE WITH REQUIRED EFFECTIVE BRAKING SYSTEM.
0507A6	FAILURE TO EQUIP NEW MACHINE WITH READILY ACCESSIBLE FIRST AID KIT AS REQUIRED.
0507A7	FAILURE TO EQUIP NEW MACHINE WITH OPERATIVE AND CHARGED FIRE EXTINGUISHER.
0507B	POSITION FOR OPERATOR TO STAND NOT EQUIPPED WITH HANDHOLDS AND HANDRAILS TO PROVIDE SAFE AND SECURE POSITION.
0507C	NEW MACHINE WEIGHING MORE THAN 32,500 POUNDS, OPERATING MORE THAN 20MPH, NOT EQUIPPED WITH ACCURATE SPEED INDICATOR.
0507D	NEW MACHINE WITHOUT CONSPICUOUS DISPLAY OF AS-BUILT LIGHT WEIGHT.
0509A	ILLUMINATION DEVICE MISSING, INOPERABLE, OR FAILS TO ILLUMINATE FOR 300 FEET.
0509B	WORK LIGHTS MISSING,OR INOPERABLE DURING REQUIRED TIMES OR IN DARK AREAS.
0509C	360-DEGREE INTERMITTENT WARNING LIGHT OR BEACON MISSING, IMPROPERLY MOUNTED, OR INOPERABLE.
0509D	BRAKE LIGHT FAILS TO ACTIVATE BY BRAKING SYSTEM, IS MISSING OR FAILS TO ILLUMINATE FOR 300 FEET.
0509E	VISUAL REFLECTIVE DEVICE THAT AIDS IN REARWARD VIEWING, SUCH AS REARVIEW MIRRORS, MISSING OR BROKEN.
0511A	HORN OR AUDIBLE DEVICE IS MISSING OR FAILS TO PRODUCE ENOUGH SOUND WITHIN THE WORK AREA TO PROVIDE WARNING OR HAS A TRIGGERING MECHANISM NOT CLEARLY IDENTIFIABLE AND WITHIN EASY REACH OF THE OPERATOR.
0511B	AUTOMATIC CHANGE-OF-DIRECTION ALARM IS MISSING OR FAILS TO PROVIDE DISTINGUISHABLE, 3-SECOND AUDIBLE SIGNAL.

0513A1	SAFE AND SECURE POSITION AND PROTECTION FROM MOVING PARTS INSIDE CAB NOT PROVIDED TO ROADWAY WORKER RIDING MACHINE.
0513B	MACHINE NOT RETROFITTED WITH HORN OR AUDIBLE WARNING DEVICE, OR DEVICE IS INOPERABLE OR HAS TRIGGERING DEVICE THAT IS NOT CLEARLY IDENTIFIABLE AND WITHIN EASY REACH OF THE OPERATOR.
0513C	ILLUMINATION DEVICE OR PORTABLE LIGHT MISSING, INOPERABLE, OR IMPROPERLY SECURED, OR FAILS TO ILLUMINATE FOR 300 FEET.
0515A	FAILURE TO REPAIR OVERHEAD COVER WITHIN 18-MONTH ALLOTTED TIME OR MAINTAIN COVER.
0515B	EMPLOYER FAILED TO PROVIDE WRITTEN RESPONSE WITH EXPLANATION TO THE OPERATOR REQUESTING COVER WITHIN 60 DAYS OF REQUEST.
0517A	FAILURE TO RETROFIT WITH CHANGE-OF-DIRECTION ALARM, REARVIEW MIRROR, OR OTHER REARWARD VIEWING DEVICE.
0517B	FAILURE TO RETROFIT WITH AN OPERATIVE HEATER.
0517C	FAILURE TO CLEARLY DISPLAY KNOWN LIGHT WEIGHT OF MACHINE.
0517D	FAILURE TO RETROFIT WITH REFLECTIVE MATERIAL, REFLECTIVE DEVICE, OR OPERABLE BRAKE LIGHTS.
0517E	FAILURE TO INSTALL SAFETY GLASS OR REPLACE WHEN DEFECTIVE.
0517F	FAILURE TO RETROFIT WITH A TURNTABLE RESTRAINT DEVICE OR WARNING LIGHT.
0518A	A SAFE AND SECURE POSITION FOR EACH ROADWAY WORKER RIDING ON THE MACHINE, OTHER THAN THE MACHINE OPERATOR(S), IS NOT CLEARLY IDENTIFIED BY STENCILING, MARKING, OR OTHER WRITTEN NOTICE.
0519A	FLOORS, DECKS, STAIRS, AND LADDERS IMPROPERLY DESIGNED OR NOT MAINTAINED TO PROVIDE SECURE ACCESS AND FOOTING.
0521A	FLAGGING KIT DOES NOT COMPLY WITH OPERATING RULES OF THE RAILROAD THAT OWNS THE TRACKAGE ON WHICH THE EQUIPMENT IS BEING OPERATED.
0521B1	FLAGGING KIT NOT PROVIDED FOR REQUIRED MACHINE OR HI-RAIL THAT IS NOT PART OF A ROADWAY WORK GROUP.
0521B2	FAILURE TO PROVIDE FLAGGING KIT TO LEAD OR TRAILING MACHINES IN A ROADWAY WORK GROUP.
0523A	FAILURE TO ANNUALLY INSPECT HI-RAIL GEAR.

0523B	FAILURE TO KEEP HI-RAIL INSPECTION RECORD UNTIL THE NEXT ANNUAL INSPECTION IS PERFORMED OR FAILURE TO MAKE THE RECORD AVAILABLE TO FRA FOR INSPECTION AND COPYING.
0523C1	NEW HI-RAIL CHANGE-OF-DIRECTION OR BACKUP ALARM MISSING OR FAILS TO PROVIDE DISTINGUISHABLE 3-SECOND AUDIBLE SIGNAL.
0523C2	NEW HI-RAIL 360-DEGREE INTERMITTENT WARNING LIGHT OR BEACON MISSING, IMPROPERLY MOUNTED, OR INOPERABLE.
0523D1	FAILURE OF OPERATOR TO CHECK HI-RAIL FOR COMPLIANCE WITH THIS SUBPART PRIOR TO USING VEHICLE AT START OF WORK SHIFT.
0523D2	FAILURE OF OPERATOR TO TAG, DATE, OR REPORT NON-COMPLYING HI-RAIL CONDITION IN PRESCRIBED MANNER.
0523D3	NON-COMPLYING ALARMS AND WARNING LIGHTS/BEACONS NOT REPAIRED OR REPLACED IN 7 CALENDAR DAYS.
0525A	TOWING WHEN TOW BAR OR OTHER COUPLING DEVICE IS MISSING OR DOES NOT PROVIDE SAFE AND SECURE ATTACHMENT
0525B	MACHINE OR HI-RAIL VEHICLE USED FOR TOWING THAT EXCEEDED BRAKING SYSTEM CAPABILITIES.
0527A	FAILURE OF OPERATOR TO CHECK MACHINE FOR COMPLIANCE WITH THIS SUBPART PRIOR TO USING IT AT START OF WORK SHIFT.
0527B	FAILURE OF OPERATOR TO TAG, DATE, OR REPORT NON-COMPLYING MACHINE CONDITION IN PRESCRIBED MANNER.
0527C1	SEVEN CALENDAR DAY OPERATING PERIOD EXCEEDED FOR DEFECTIVE HEADLIGHTS OR WORK LIGHTS, OR OPERATED DURING PROHIBITED TIMES.
0527C2	SEVEN-CALENDAR-DAY OPERATING PERIOD EXCEEDED FOR NON-COMPLYING OR MISSING HORN.
0527C3	TEMPORARY REPLACEMENT FIRE EXTINGUISHER NOT READILY AVAILABLE FOR USE OR FAILURE TO PERMANENTLY REPLACE MISSING, DEFECTIVE, OR DISCHARGED FIRE EXTINGUISHER WITHIN SEVEN CALENDAR DAYS.
0527C4	SEVEN-CALENDAR-DAY PERIOD EXCEEDED FOR NON-COMPLYING AUTOMATIC CHANGE-OF- DIRECTION ALARMS, BACKUP ALARMS, OR 360-DEGREE INTERMITTENT WARNING LIGHTS OR BEACONS.
0527C5	TIME PERIOD EXCEEDED FOR DEFECTIVE OR MISSING OPERATOR'S SEAT.

0529A	OPERATING MACHINE AFTER FAILURE OF PRIMARY BRAKING SYSTEM FOR LONGER PERIOD THAN PERMITTED, WITHOUT USING SECONDARY BRAKING SYSTEM OR COUPLING TO ANOTHER MACHINE, OR WHEN UNSAFE TO DO SO.
0529B	MOVING MACHINE WITH FAILED BRAKING SYSTEM TO CLEARANCE OR REPAIR POINT WHEN UNSAFE TO DO SO, OR MOVED MACHINE SAFELY, BUT FAILED TO REMOVE IT FROM SERVICE AT CLEARANCE OR REPAIR POINT.
0531A1	FAILURE TO EFFECT MACHINE OR HI-RAIL REPAIRS WITHIN SEVEN CALENDAR DAYS.
0531A2	FAILURE TO REMOVE MACHINE OR HI-RAIL FROM SERVICE AFTER FAILURE TO REPAIR WITHIN SEVEN CALENDAR DAYS.
0533A	FAILURE OF EMPLOYER TO ORDER NECESSARY PART BY THE END OF THE NEXT BUSINESS DAY.
0533B	FAILURE OF EMPLOYER TO EFFECT REPAIRS WITHIN SEVEN DAYS OF RECEIVING PART OR FAILURE OF EMPLOYER TO REMOVE FROM SERVICE WITHIN 30 DAYS ANY MACHINE OR HI-RAIL WITH A NON-COMPLYING CONDITION.
0533C	FAILURE TO IMMEDIATELY REMOVE A NON-COMPLIANT MACHINE OR HI-RAIL FROM SERVICE AFTER EMPLOYER FAILED TO ORDER NECESSARY PART OR INSTALL AVAILABLE PART WITHIN SEVEN-CALENDAR-DAYS.
0533D	FAILURE TO MAINTAIN RECORD FOR ONE YEAR OR FAILURE TO MAKE RECORD AVAILABLE TO FRA FOR INSPECTION AND COPYING.

Appendix B - Quick Reference Table

Requirement	On-track RMMS - non-highway and light weight greater than 7,500 lbs. and not used exclusively for inspection of track			Hi-rail - highway vehicles meeting Federal Motor Vehicle Safety Standards	
	Pre 1/1/91	Existing - post 1/1/91	New - ordered after 12/26/03 and completed after 9/27/04	Existing	New - ordered after 12/26/03 or completed after 9/27/04
Beacon (360-degree warning light)	Not Required*	Not Required*	509 (c) (RMM without fixed roof and less than 17,500 lbs. exempt)	[Motor Vehicle]	523 (c)(2)
Brake light (or reflective material, or reflective device)	Not Required*	517 (d) - retrofit - brake light or reflective material, or reflective device	509 (d) - brake light	[Motor Vehicle]	[Motor Vehicle]
Braking system	Not Required*	Not Required*	507 (a)(5)	[Motor Vehicle]	[Motor Vehicle]
Change-of-direction alarm (or backup alarm for new hi-rails)	Not Required*	517 (a) - retrofit	511 (b)	Not Required*	523 (c)(1)
Daily inspection	527 (a)	527 (a)	527 (a)	523 (d)(1)	523 (d)(1)
Environmental control and protection	505 (d) [designated only - otherwise OSHA]	505 (d) [designated only - otherwise OSHA]	505 (a)-(b) regulators, tampers, etc.	Not Required*	Not Required*
Environmental personal protective respiratory equipment	505 (e) only when environmental control is not working on designated equipment	505 (e) only when environmental control is not working on designated equipment	505 (e) only when environmental control is not working (a)(1)-(5) type equipment	[Motor Vehicle]	[Motor Vehicle]
Fire extinguisher	Not Required*	Not Required*	507 (a)(7)	[Motor Vehicle]	[Motor Vehicle]
First aid kit	Not Required*	Not Required*	507 (a)(6)	[Motor Vehicle]	[Motor Vehicle]

Requirement	On-track RMMS - non-highway and light weight greater than 7,500 lbs. and not used exclusively for inspection of track			Hi-rail - highway vehicles meeting Federal Motor Vehicle Safety Standards	
	Pre 1/1/91	Existing - post 1/1/91	New - ordered after 12/26/03 and completed after 9/27/04	Existing	New - ordered after 12/26/03 or completed after 9/27/04
Flagging equipment	521 (lone, or lead and trailing piece in roadway group if RR rules require flagging equipment)	521 (lone, or lead and trailing piece in roadway group if RR rules require flagging equipment)	521 (lone, or lead and trailing piece in roadway group if RR rules require flagging equipment)	521 (lone, or lead and trailing piece in roadway group if RR rules require flagging equipment)	521 (lone, or lead and trailing piece in roadway group if RR rules require flagging equipment)
Headlight	513 (c)	513 (c)	509 (a)	[Motor Vehicle]	[Motor Vehicle]
Heating and ventilation	Not Required*	517 (b) - retrofit (required if operated at temp. less than 50 deg. and equipped or has been equipped)	505 (g) for RMM other than 505 (a)(1)-(5), regulators, etc. with enclosed cabs	[Motor Vehicle]	[Motor Vehicle]
Hi-rail gear inspection	Not Applicable	Not Applicable	Not Applicable	523 (a) Annually	523 (a) Annually
Horn	513 (b) permanent or portable	513 (b) permanent or portable	511 (a) permanent	[Motor Vehicle]	[Motor Vehicle]
Light weight display	Not Required*	517 (c) - retrofit	507 (d)	[Motor Vehicle]	[Motor Vehicle]
Operator seat	527 (c)(5)	527 (c)(5)	507 (a)(1) except as required under (b); operator standing	[Motor Vehicle]	[Motor Vehicle]
Overhead cover for operator	515 (a) - missing/repair; (b) feasibility	515 (a) - missing/repair; (b) feasibility	515 applies if no cab (i.e., RMM not requiring environmental cab)	[Motor Vehicle]	[Motor Vehicle]
Overhead for non-enclosed stations outside main cab	Not Required*	Not Required*	505 (h) where feasible	[Motor Vehicle]	[Motor Vehicle]

Requirement	On-track RMMS - non-highway and light weight greater than 7,500 lbs. and not used exclusively for inspection of track			Hi-rail - highway vehicles meeting Federal Motor Vehicle Safety Standards	
	Pre 1/1/91	Existing - post 1/1/91	New - ordered after 12/26/03 and completed after 9/27/04	Existing	New - ordered after 12/26/03 or completed after 9/27/04
Record of defective conditions	533(d)	533(d)	533(d)	533(d)	533(d)
Record of hi-rail inspection	Not Applicable	Not Applicable	Not Applicable	523(b)	523(b)
Rearward viewing devices	Not Required*	Not Required*	509 (e)	[Motor Vehicle]	[Motor Vehicle]
Safe and secure position with seat for workers transported on machine	513 (a) - retrofit	513 (a) - retrofit	507 (a)(2)	[Motor Vehicle]	[Motor Vehicle]
Safe and secure position for riders - identification by stenciling or other written notice (if used)	518	518	518	[Motor Vehicle]	[Motor Vehicle]
Safety glass & wipers	Not Required*	517 (e) - retrofit/replace	507 (a)(4)	[Motor Vehicle]	[Motor Vehicle]
Secure footing for floors, decks, stairs, and ladders	519	519	519	[Motor Vehicle]	[Motor Vehicle]
Speed indicator	Not Required*	Not Required*	507 (c) - more than 32,500 lbs and speed greater than 20 mph	[Motor Vehicle]	[Motor Vehicle]
Tag defective item(s)	527(b)	527(b)	527(b)	523(d)(2)	523(d)(2)
Towing	525	525	525	525	525
Turntable securement	Not Required*	517 (f) - retrofit; lock or warning light	507 (a)(3) – lock	[Motor Vehicle]	[Motor Vehicle]

Requirement	On-track RMMS - non-highway and light weight greater than 7,500 lbs. and not used exclusively for inspection of track			Hi-rail - highway vehicles meeting Federal Motor Vehicle Safety Standards	
	Pre 1/1/91	Existing - post 1/1/91	New - ordered after 12/26/03 and completed after 9/27/04	Existing	New - ordered after 12/26/03 or completed after 9/27/04
Work lights	Not Required*	Not Required*	509 (b)	[Motor Vehicle]	[Motor Vehicle]

* NOTE on "not required": If an existing on-track RMM is equipped with a device only required on new equipment, the device should be in proper working condition. If Inspectors encounter a broken or inoperable Note required" device, they should write a comment to the railroad describing the defective condition and indicating that a machine with "a condition that inhibits its safe operation" is subject to a good faith challenge, especially where roadway workers working on or near the machine may be relying in part on such a device to alert them to a machine's presence or proximity. FRA expects that any such inoperable device shall be discussed in the job briefing.