Chapter 6 Rail Joint Inspections

CWR joint means: (a) any joint directly connected to CWR, and (b) any joint(s) in a segment of rail between CWR strings that are less than 195 feet apart, except joints located on jointed sections on bridges.

6.1 Class of Track

All CWR joints within the following classes must be inspected on foot:

- Class 2 on which passenger trains operate
  and
- Class 3 and higher

6.2 Frequency of Inspections

CWR joints shall be inspected on foot at the following minimum frequencies:

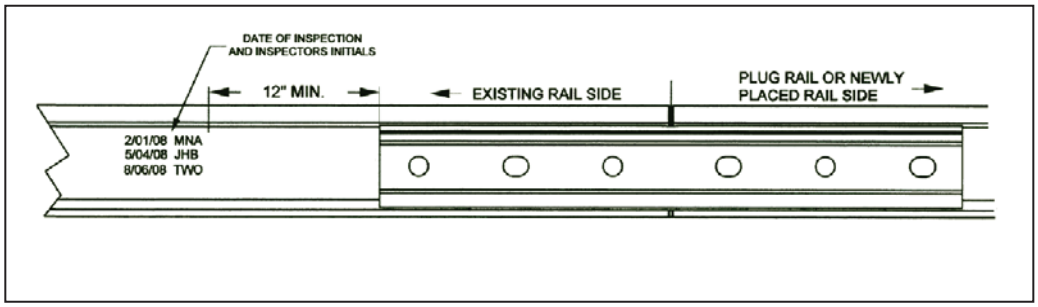
Minimum Number of Inspections Per Calendar Year[1]					
	Freight trains operating over track with an annual tonnage of:			**Passenger trains operating over track with an annual tonnage of:**	
	Less than 40 mgt	40 to 60 mgt	Greater than 60 mgt	Less than 20 mgt	Greater than or equal to 20 mgt
Class 5 & above	2x	3x[2]	4x[2]	3x[2]	3x[2]
Class 4	2x	3x[2]	4x[2]	2x	3x[2]
Class 3	1x	2x	2x	2x	2x
Class 2	0	0	0	1x	1x
Class 1	0	0	0	0	0
Excepted Track	0	0	0	n/a	n/a

4x = Four times per calendar 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. 3x = 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. 2x = 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. 1x = 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.

6.3 Identification of Joints

Each CWR joint requiring action as outlined in Chapter 6.5 of these CWR Procedures shall be identified in the field with a highly visible marking. In addition, such joints shall also be identified as to location by specifying the subdivision, mile post, track number, and rail (north, south, etc.) See Marking Rail Following Periodic Inspections of Rail Joints for additional instructions on marking joints (shown below).



6.4 Switches, Track Crossings, Lift Rail Assemblies, or Other Transition Devices on Moveable Bridges

Joints within or adjacent to switches, track crossings, lift rail assemblies, or other transition devices on moveable bridges are exempt from the periodic joint inspection requirements provided they are inspected monthly during the required monthly walking inspection of these devices.

Therefore, inspect these locations on a minimum monthly basis and include in the inspection and report on the following:

At switches:

- All joints from and including the insulated joints at the signals governing movement entering and leaving the control point or interlocking.
- If there are no signals at the switch location, include as a minimum all joints from the point of the switch to the heel of the frog.

At cross-overs:

- All joints in track between switches.

At track crossings:

- All joints from and including the insulated joints at the signals governing movement entering and leaving the control point or interlocking.
- If there are no signals at the track crossings, include as a minimum all joints that are between or connected to the crossing frogs.

At lift rail assembles or other transition devices on moveable bridges:

- All joints immediately attached to the rail assembly or transition device.

6.5 Rail Joint Conditions

When inspecting CWR joints on foot in track listed in Chapter 6.1 of these CWR Procedures, inspectors must watch for (but not be limited to) the following rail joint conditions outlined in the table below. When such conditions are found, the appropriate action must be taken as outlined.

Rail Joint Condition	Action[1]
Visible cracks in joint bar	Replace bar
Loose bolts	Tighten bolts
Bent bolts	Replace bolts OR Re-inspect as per Chapter 6.2
Missing bolts[2]	Replace bolts
Broken or missing tie plate(s)	Replace tie plate(s) OR Conduct follow-up inspections every other week until repaired/replaced
Tie(s) not effectively supporting joint	Tamp tie(s) Replace or repair tie(s) OR Conduct follow-up inspections every other week until repaired / removed
Deteriorated insulated joint	Replace / repair joint OR Conduct follow-up inspections every other week until repaired / removed
Rail-end batter (More than 3/8" in depth and more than 6" in length measured with a 24" straight-edge)	Repair by welding the joint or removing rail OR Conduct follow-up inspections every other week until repaired / removed
Rail-end mismatch reaches limits specified by 49 FRA 213.115	Weld or grind
Longitudinal rail movement greater than 2"	Add or adjust rail anchors, tighten bolts, add or remove rail at appropriate time, OR Conduct follow-up inspections every other week until repaired / removed
Wide rail gap greater than 1.5"	Adjust rail gap and secure joint OR Conduct follow-up inspections every other week until repaired / removed
Joint vertical movement (profile) that exceeds 75% of the allowable threshold for the designated class of track[3]	Surface joint OR Conduct follow-up inspections every other week until repaired / removed
Fouled [4] ballast present in conjunction with joint vertical movement (profile) that exceeds 75% of the allowable threshold for the designated class of track	Surface joint and provide drainage OR Conduct follow-up inspections every other week until repaired / removed
Joint lateral movement (in a curve or spiral) that reaches 3/4" [3]	Correct lateral movement OR Conduct follow-up inspections every other week until repaired / removed

[1] Action may also consist of placing a speed restriction or removing the track from service.

[2] A minimum of 2 bolts per rail must be in place at each joint.

[3] Joint lateral and vertical movement is the apparent visible movement measured at the joint.

[4] Fouled ballast is defined as ballast that is so contaminated with fines that it is containing standing water within the track structure at joints.

6.6 Embedded Joints

Permanently Embedded Locations

Where such locations exist, it is not necessary to disassemble or remove the track structure (e.g., remove pavement or crossing pads) to conduct an inspection of CWR joints. Make every effort, to the extent practicable, to inspect the visible portion of joints in these structures.

Temporarily Buried Locations

Joints may sometimes be temporarily buried (e.g., where ballast or similar material is in the middle of the track and along the track) and therefore unavailable for inspection. Where CWR joints are buried (e.g., by ballast), wait for the completion of the track work before conducting joint bar inspections. Locations that have been buried for an extended period of time must still be inspected. Joints buried more than 5 months are no longer considered temporary.

6.7 Inspection Records

On-Foot Periodic and Follow-up Inspection Reports

Initial and date the web of the rail at the joint after each inspection. Document in ETRS each on-foot periodic and follow-up inspection on the date of the inspection by noting the following information:

- Date
- Limits of the inspection
- Location and nature of CWR joint conditions specified in Chapter 6.5 of these CWR Procedures
- Corrective or remedial action
- Name and signature of Inspector

G. Main Line and Siding Rail Joint

1. Reporting Rail Joints

Report all rail joints located in CWR territory. A CWR joint is either:

- Directly connected to CWR

OR

- In segment of rail in between CWR strings that are less than 195 feet apart, except joints located on jointed section of a bridge

When reporting a new or existing rail joint, all required information must be provided. If a rail joint is NONWELDABLE (for example, a fully bolted joint), place the capital letters "NW" in the comments field of the work request or work order. No other comments are required.

a. Electronic Reporting

The electronic reporting system allows for reporting new rail joints and for updating the condition of joints previously reported.

1) When a new rail joint is reported, an auto-generated Rail Joint Elimination Work Request will be created for the Roadmaster or designee to assign and prioritize.

2) Roadmasters must ensure that only one work order is created for each rail joint located in the defined track segments.

3) The electronic reporting system will identify Critical Rail Joint, Rail Joint Elimination Work Orders, and Work Requests by placing a letter C after the task name in the work request (for example: JTELIM-C).

4) Track Inspectors must maintain an accurate list of all CWR joint locations in the electronic reporting system.

2. Critical Rail Joints

a. Critical Rail Joint Criteria

Designation of Critical Joints in Continuous Welded Rail (CWR) Only. A joint is considered critical if it is on CWR, on a subdivision with greater than 5 MGT annually (see Table 2-1 notes), and it meets any of the criteria listed below:

- In main track or in a single main track siding and is located on or within 500 feet of a bridge, tunnel, snow shed, or railroad/road overpass
- Within a curve on main track or within a curve on a single main track siding

- Within turnout Dead Zone
- Uses compromise bars (including joining two like-sections of rail)

Note: An insulated joint may be a critical joint if it is not a bonded or hybrid bonded insulated joint.

b. Containment Plan for Critical Joints

1) If a critical joint is located within a turnout Dead Zone and has not been eliminated within 180 days, reduce the speed by one track class, but not less than Class 2, unless other conditions warrant a slower speed.

2) A compromise joint not eliminated within 60 days must have the speed reduced to no greater than 25 MPH.

3) Compromise joints on concrete ties must either be welded immediately or be protected with a maximum 25 MPH slow order, and inspected on foot daily.

   - Compromise joints on concrete not welded within 48 hours of creation must be protected with a 10 MPH slow order, and inspected on foot daily.

c. Frequency of Inspections for Critical Joints

If the speed over the joint has been reduced due to time frame and/or joint condition, or if the critical joint has not been removed within 180 days, inspect weekly until the joint is eliminated.

Employees can download a flow chart that defines how to identify critical joints from the following Website:

http://depot.bnsf.com/team/ebi/enginstructions/default.aspx

3. Marking Rail Following Periodic Inspections of Rail Joints

FRA Track Safety Standard 213.119(g) requires that joints in CWR (including bonded insulated joints) be inspected on foot periodically according to intervals described in the regulation. To document the inspection:

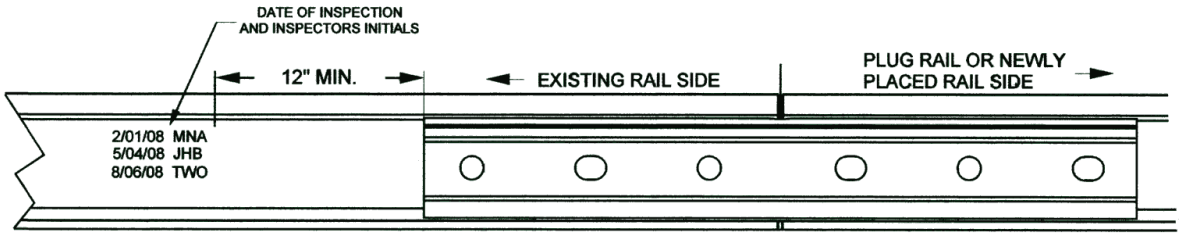
a. Mark the date and initials of the Track Inspector on the field side of the non-plug portion in the web of the rail, using a paint marker.

b. For subsequent periodic inspections write the date and initials of the Track Inspector underneath the first date and set of initials (see drawing below).

c. Joints inspected as part of the monthly turnout inspection do not require the Inspector's initials and date.

d. For inspections in subsequent years, either scrape off the previous year's information or paint over it with black paint.

e. Joints requiring action as defined by the CWR Procedures section 6.5 (Rail Joint Conditions) should be marked as follows: Paint the complete joint bar on the gage side with highly visible orange paint until the condition is repaired. Once the condition is repaired paint the joint bar black.



H. Main Line Curves

Perform a walking inspection of all main line curves at least once per year. Local conditions may require more frequent inspections as directed by the Division Engineer.

Only FRA-qualified employees must perform these inspections, paying particular attention to:

- Tie condition
- Lateral rail movement or rail rotation associated with rail seat abrasion
- Signs of plate movement
- Worn or broken tie plates
- Deficient spike and fastener conditions
- Lubrication effectiveness
- High rail gage face loss
- Geometry Car data
- Low rail center ball spalling and head loss

1. Walking Inspections of Curves

a. Wood tie curves should be inspected between September and December, or as required by the Division Engineer, in areas where the track structure has a history of being frozen for several weeks. Problems with broken spikes are more common in curves and turnouts where the track structure is frozen for several weeks. However, broken spikes can occur at locations that are not subject to freezing weather.

- A track spike will typically break about 1-1/2 inches below the spike head. A visual inspection alone does not necessarily detect the failed spike; use the spike testing tool to check spikes for integrity.
- Do not use the tool for pulling spikes, or lag screws.

b. Concrete tie curves must be inspected when the rail seats are not hidden from view by snow, ice, coal dust, or other debris. The Inspector(s) will walk on the field side of each rail in the curve watching out for signs of lateral rail movement, broken or ineffective fasteners, worn insulators or pads, and signs of rail seat abrasion. Review Geometry/STAR Car rail cant readings for each curve prior to the inspection, paying particular attention to these locations during inspection.

c. Enter records of walking curve inspections into the electronic reporting system.

Refer to Table 2-1 for minimum inspection frequencies. Additional inspections may be required by division management.

Table 2-1. Minimum Inspection Requirements

Type of Track	Class of Track	Inspection Frequencies
Main Track	1, 2, 3	Inspect weekly with at least three calendar days between inspections.
		Inspect twice weekly with at least one calendar day between inspections if track carries passenger trains or carried more than 10 MGT of traffic during the previous calendar year.
Main Track*	4, 5	Inspect twice weekly with at least one calendar day between inspections.
Siding	1, 2, 3	Inspect weekly with at least one calendar day between inspections.
Siding	4, 5, 6	Inspect twice weekly with at least one calendar day between inspections.
Sidings	All	Inspect weekly. If a siding carries more than 10 MGT of traffic during the previous calendar year, or the siding carries regularly scheduled passenger trains or is adjacent to a main track that does, inspect twice weekly with at least one calendar day between inspections.

Hump Crest and Pull-Back Area**		Track Inspector performs inspection of area from the hump crest through the group retarders and pull-back area at least twice weekly with no more than three calendar days between inspections. Roadmaster performs inspection of area from the hump crest through the group retarders and pull-back area quarterly. Pull-back areas are site-specific lengths.
Yard Tracks and Back Tracks		Perform an inspection monthly with at least 20 calendar days between inspections.
Critical Yard Tracks and Back Tracks		Perform an inspection twice a month. These inspections will include *all* turnouts and derails within these tracks.
Turnouts and Derails, Track Crossings, Moveable Lift Rail Assemblies, and Other Transitional Devices on Moveable Bridges		Perform a walking inspection monthly.
Non-BNSF Owned Track	All	Inspect yearly.
Joint Turnout Inspection		On signaled territory, utilizing the Turnout Reliability Model, perform joint inspection of the worst performing turnouts quarterly.
Joints		Perform walking inspection of standard joints and insulated joints per 6.2 of the CWR Procedures. (Document inspection per section 2.3.1G(3)). Perform walking inspection of insulated joints with Signal Maintainer annually.

Curves		Perform walking inspection once a year. If local conditions warrant, more inspections may be required as directed by the Division Engineer or as a result of Geometry/STAR Car inspections.
Critical Joints	2, 3, 4, 5	Perform walking inspections weekly with at least one calendar day between inspections if the speed over joint has been reduced due to timeframe and/or joint conditions.
Compromise Joints on Concrete Ties	All	Perform walking inspections daily until welded.
		* Includes other than main track and siding. **Hump crest and pull-back areas already meet frequency requirements for critical track.

Note:

Critical Track Link

http://topudspd1001.iss.bnr.com/cgi-bin/enme/enmeDYNAM.cgi?DIRECTORY=/Rail_Group/Rail_Detection/Yard%20Maps&root_dir=/Rail_Group/Rail_Detection

MGT Link

http://engesst.bnsf.com/bnsfeng/engserv/maprec/density/denstathome.htm

Turnout Reliability Link

https://dataviz.bnsf.com/#/site/engIT/views/TurnoutReliabilityDashboard/TurnoutSummaryDashboard

Note: Failure to meet FRA frequency will require that track or segment of track be removed from service. Trains may be moved off of tracks removed from service under this section only under the authority of a Tier III qualified employee at restricted speed per GCOR 15.4. An FRA-compliant track inspection must be performed before that track or segment of track can be re-occupied by a train.

2.3.2 Track Inspection Schedule

A. Track Inspectors

In addition to performing regular inspections per Table 2-1, Track Inspectors must also ride a train from the lead locomotive over entire territory at least quarterly.

B. Roadmasters

Roadmasters must:

1. Make a hy-rail inspection over the entire territory, or over 200 miles of a territory with more than 200 miles of main line, at least monthly.
    a. Audit MW vehicles for housekeeping, material/tool storage, and required safety equipment.
    b. Audit and educate all employees on critical operating rules and instructions, especially compliance with Maintenance of Way. Operating Rule 6.0 (Movement of Trains, Engines, and On-Track Equipment).
    c. Audit the quality of communication between all work groups and other employees, including the Dispatcher.
    d. Audit work practices and all work performed of other work groups encountered on inspection trips.
2. At least quarterly:
    a. Ride a train on all territory where the maximum authorized speed is 49 MPH or more.
    b. Record the results in the electronic record keeping system, selecting "train" as the mode of traversal.
3. At least twice yearly:
    a. Ride a train on territories where the maximum authorized speed is more than 30 MPH and less than 49 MPH.
    b. Record the results in the electronic record keeping system, selecting "train" as the mode of traversal.
    c. Perform a walking inspection of tunnels and snowsheds.

C. Division Engineers

Division Engineers must make an annual inspection over the entire territory. When possible, include the appropriate Roadmaster or Track Inspector.

Division Engineers are responsible for establishing territory inspection guidelines greater than the minimum for the following:

- Non-key routes per section 2.3.1A
- Main line curves per section 2.3.1C
- Hot weather inspection requirements per sections 2.8.1 and 4.8.1
- Flood critical areas per section 2.8.3
- Rail detector car inspection on other than main tracks and sidings per section 6.7.2
- Critical track identification per section 25.9
- Track conditions or assets as necessary

At least monthly, Division Engineers must audit their territory for compliance with the BNSF track inspection requirements, Geometry Car frequency, defect reporting by BNSF and FRA Inspectors and Geometry Cars, Track Inspector Evaluation results, etc.

2.3.3 Items to Consider When Inspecting Track

Roadmasters and Track Inspectors should consider the following when making inspections:

1. Inspect for the specific items and conditions in Table 2-2 below.
2. Notify the Roadmaster of any dumping by outsiders on the right-of-way.
3. Remove scrap, debris, and dead animals from walkways and along the right-of-way. If it cannot be removed notify the Roadmaster and Section Foreman for handling.
4. Notify the appropriate authority of unauthorized trespassers on railroad property.
5. At highway crossings inspect all signs, including the whistle posts. Verify that each sign is present, located properly, in good condition, and visible to the highway user or railroad user, as appropriate.
6. Pay special attention to all assets along the track up to and including:
   - Bridge walkways
   - All handrail systems

Table 2-2. Inspection Items to Consider
(Refer to appropriate EI or Standard Plan)

Item Inspected	Specific Items and Conditions
Anchor	Missing, loose, not set against tie
Ballast	Pumping, hanging ties, churning, fouled
Ballast section	Cribs not full, low shoulder, narrow shoulder
Bars	Broken, bent, cracked
Bolts	Loose, missing, bent
Clearances	Vertical and horizontal restricted clearances
Curved Track	Inward alignment shifts as defined in EI 8 following out of face work activities involving tie renewal, undercutting, or surfacing **Note: Closely monitor locations with a history of shifting track due to temperature changes, unstable subgrade, elevation changes, or other conditions.** Curves may not display distorted alignment, but can be identified by voids at the end of the ties on the high side, as well as by mounded ballast at the end of the ties on the low side. Use curve reviews from Geometry Car data for areas of concern.
Derails	Improper size, not installed according to manufacturer's specifications, missing lock, derail not in proper position, not visible, improper signage
Drainage, slides	Ditches or culverts obstructed or broken apart, sliding embankment or backslope
Encroachment	• Unauthorized use of railroad property • Dumping discharge of drainage effluents • Alterations to watershed or drainage channels (Pay particular attention to contractors working on or about the tracks.)
Fasteners	High, missing, bent, broken, and concentrated loads
Fencing	Damaged fences, open gates
Frogs	• Casting cracked or broken • Improper gage • Lateral movement due to inadequate fasteners • Bolts loose or missing • Improper flangeway depth or width, or obstructions • Improper clearance on horn and hold-down housing, spring wing rail not tight against point rail • Signage
Gage	Wide or tight gage

F. Joining Continuous Rail Strings

Within 60 days of the date a joint is created in CWR, all joints must comply with one of the following:

1. Welded
2. Bolted with 6 bolts
   or
3. All ties box anchored in both directions for a length of 195 feet

Note: Rail removed during the relay process is subject to the same thermal stresses as the newly laid rail. To prevent the removed rail from buckling and possibly fouling the track, adhere to the following practice: Anytime a joint is made in the rail being installed (either joint bars or welded), a cut *must* **be made in the rail just removed, unless a cut has been made within 200 feet of this joint.** *This cut must be made the same day the relay occurs!* **The rail ends then must be offset and a board, car stake, tie butt, or other material placed between rail ends to prevent strings from running together and buckling from thermal expansion.**

G. Setting Out Rail for Later Recovery or Scrapping

When rail being removed is set out of track for later recovery or scrapping, separate and offset rail ends of adjoining strings and place a board, car stake, tie butt, or other material between rail ends to prevent strings from running together and buckling from thermal expansion. If the rail will be recovered for rehab by BNSF equipment, place the rail removed no more than 12 feet from the nearest rail in track, either ball up or ball out on the same side as the position rail was removed (ie. north rail is set out on north side of track). If rail must be set out on opposite side, place it either ball up or ball out and no more than 12 feet from nearest rail in track.

Rail removed from road crossings (including those out of service), bridges, and other similar locations should be cut and removed from these locations. At failed equipment detectors, wayside lubricators, and similar locations, the rail should be cut to prevent damage to these facilities during the rail loading process.

H. Field Welded Joints in CWR Near Bridges

Do not create permanent thermite welded rail joints in CWR track on the approach to a bridge within 25 feet from the face/front of the parapet wall or on the deck of a bridge within 5 feet from the face/front of the parapet wall (see Figure 6-7).

Cut and reuse existing rails if practical. If new rail is installed, use a transition rail between the existing rail and the new rail if the amount of head wear on the existing rail would result in a compromise weld. Transition rails can be ordered to required length and taper.

5.6 Vehicle Track Interaction (VTI)

Vehicle Track Interaction (VTI) is a locomotive-mounted technology that evaluates how a vehicle interacts with the track structure. This tool is used to:

- Detect vehicle and track interaction anomalies.
- Provide a proactive approach to reducing damage to vehicles and track.
- Supplement the current track inspection process.
- Quantify and prioritize the exceptions.
- Prevent costly service and equipment failures.

VTI is a real-time system that continuously evaluates the track for exceptions. When exceptions are found, they are labeled with milepost, GPS coordinates, speed, date, and time.

5.6.1 Hardware Used for VTI System

The system uses accelerometers to find exceptions:

- Two accelerometers are mounted in the locomotive. They measure exceptions for car body lateral (CBL) and car body vertical (CBV).
- Accelerometers that measure axle vertical (AV) are mounted on each side of the front axle.

The VTI unit uploads the exception information through wireless communication to a central server. When an exception is found and processed, the information being furnished is in real time, except when the unit is out of cellular range. In these cases, the system will keep trying to send the exception until it is successful.

5.6.2 VTI Thresholds

VTI Thresholds have been established to prioritize the exceptions. Thresholds have been set for car body vehicle accelerations, car body lateral accelerations, and axle vertical force.

Exception	High Priority
CB Vertical	1.3 G
CB Lateral	0.8 G
Axle Vertical	140 kips

Axle verticals are measured as a force.

- 1 Kip (=1,000 pounds) are used for this measurement.

Car body vertical and car body lateral exceptions are measured in terms of acceleration.

- The units of measures for acceleration are Gs.
- An acceleration of 1 G is the same as the force due to gravity.