6 Rail

List of Figures

6.1 Rail Standards

6.1.1 Out-of-Face Relays

Out-of-face rail relay recommendations will be based on accumulated gross tonnage, annual defect rate per mile, and vertical head loss. Use Table 6-2 to determine the type of rail to install.

6.1.2 Curve Relay

Managers Roadway Planning will collect rail wear data through field inspections, Track Geometry Car measurements, and detector car reports. Curve relay recommendations will be based on defect rates, rail wear measurements, and observations that indicate heavy flow, crushing, corrugation, or spalling. Make recommendations as follows (see Table 6-1):

1. Take rail wear measurements at a minimum of three locations per curve, or use Track Geometry Car wear charts.
    a. If using Track Geometry Car wear charts, take actual wear measurements at a minimum of one location to verify accuracy of geometry car data.
    b. Determine gage face wear by measuring the width of the rail head at a point 5/8 inch below the top surface of the rail, or by using wear plots.
2. Project rail wear to what it would be on the anticipated date of relay.

Table 6-1. Rail Head and Side Wear Limits.

Rail Weight	Width of new rail / Height of new rail	Transpose or high to low rail when gage face loss equals:	Relay the rail before gage face loss exceeds:	Relay the rail before vertical head loss exceeds:
141 RE	3-1/16"	1/4" to 1/2"	5/8"	7/8"
	7-7/16"			
136 RE	2-15/16"	1/4" to 1/2"	5/8"	11/16"
	7-5/16"			
132 RE	2-31/32"	1/4" to 1/2"	5/8"	1/2"
	7-1/8"			
129 TR	2-9/16"	5/16" to 9/16"	9/16"	9/16"
	7-5/16"			
119 RE	2-5/8"	1/4" to 1/2"	5/8"	5/8"
	6-13/16"			
115 RE 112 RE	2-11/16"	1/4" to 1/2"	5/8"	7/16"
	6-5/8"			
112 TR	2-31/64"	1/4" to 1/2"	1/2"	1/2"
	6-3/4"			

3. Consult the roadway standard plan book for section dimensions of other rail sections. Estimate wear limits from this information.
4. Ensure that no rail is transposed on curves without approval of the Director Roadway Planning. No rail should be transposed on curves where the line carries more than 30 MGT annually.
5. Do not transpose rail when the lip on the field side of the low rail is greater than 1/8 inch.
6. Ensure that no rail is transposed on concrete ties.
7. Use Table 6-2 to determine the type of rail to install.

Note: Any exceptions to the wear limits in Table 6-1 must be approved by the Manager Roadway Planning.

Table 6-2. Rail Use Criteria.

Category	Tangent	Curves 0 to 1° 30'	Curves 1° 30' to 2° 30'	Curves 2° 30' and Up
65 MGT & up	New premium 141#	New premium 141#	New premium 141#	New premium 141#
35-65 MGT	New standard 136#	New premium 141#	New premium 141#	New premium 141#
20-35 MGT	New standard 136#	New standard 136#	New premium 141#	New premium 141#
5-20 MGT	New standard 136# or 115#	New standard 136# or 115#	New standard 136# or 115#	New premium 141# or 115#
Less than 5 MGT	New standard 136# or 115#, or SH 112# & heavier	New standard 136# or 115#, or SH 112# & heavier	New standard 136# or 115#, or SH 112# & heavier	New standard 136# or 115#, or SH 112# & heavier

6.1.3 Relay With Concrete Ties

Relay rail in conjunction with concrete tie renewal if the base of the rail is not 6 inches or if the vertical head loss is 3/8 inch or more in the year before the concrete tie program.

6.1.4 Rail Adjustments

When adjusting rail lengths greater than 85 feet, follow 6.2.6 Destressing CWR. When adjusting rail lengths of 85 feet or less, follow 6.7.5E Adjusting 85 Feet or Less of CWR or 6.2.6 Destressing CWR.

6.2 Laying Rail

6.2.1 Pre-Job Survey

Before a job starts, the Rail Gang Assistant Roadmaster and the Foreman should complete the pre-job survey on a hy-rail trip with the District Roadmaster or Track Supervisor.

The survey helps to ensure that the materials and site preparation work are complete and helps them to understand any extraordinary conditions about the job that need to be planned for in advance.

A. Rail

Use a track chart to build a map of the project. Use curve lengths and actual rail footage unloaded, if available. If sidings or back tracks are to be done, mark them on the track chart.

B. Road Crossings

Answer the following:

- Which road crossings will be tied into or laid through?
- Which need resurfacing?
- Who is the crossing support?

C. Bridges

Establish if bridges need fall protection and arrange as needed. Answer the following:

- Do guard rails need to be removed?
- Is material arranged on the bridges appropriately?

D. Rail Distribution

Answer the following:

- Is the rail unloaded in the right locations and is it the correct length?
- Is the old rail marked properly for replacement?
- Are insulated plugs or transition rails required? If so, are proper sizes available?

E. Tie-Up Locations

Answer the following:

- Are they long enough for the consist and is there access for fuel, machine maintenance, tool trailers, parking?
- Will sidings and/or main tracks between switches be available for tie-up?

F. Spikes/OTM

Note rail change sizes on the track chart. Answer the following:

- Has material been properly distributed?
- Are there derailment sites that require extra tie plates?
- What is the allocation of spikes? Is it sufficient for the job?
- Are angle bars and bolts as well as correct-sized compromise bars distributed?

G. Other Issues

Answer the following:

- What kind of track conditions (heavy ballast, poor tie condition, muddy track, gage problems, Pandrol plate locations, chronic surface problems) exist, and what is your plan for dealing with them?
- What road crossings require flag protection?
- What is the location of extra materials?
- Who is the signal support team and what kind of locations (hot box, dragging equipment, and slide detectors) need special measures?
- What are the travel times from lodging to different tie-up locations?
- What are support personnel names, numbers, and HQ points?
- Where are fuel and oil distributors located?
- What are the emergency contact phone numbers (police, fire, hospital, etc.)?

6.2.2 Production Execution

A. Time Tracking

Accurate time tracking of gang activity is critical for factual time reporting and troubleshooting below-standard production. Field Production Books are available with templates for tracking daily gang activity as it happens.

Two pages of the book are used for tracking each day of the gang's activity. Fill in the critical events during the day along with the time the event occurred and its duration in minutes.

Ten distinct categories of delay are described in an appendix of the Field Production Book. Miscellaneous delay categories are also listed in an appendix of the book.

B. Ramp-Up/Ramp-Down

Ramp-up and ramp-down are additional times that are important to track. Ramp-up is the time required from pulling the first spike to driving the first spike for both rail and tie gangs. This measurement represents how fast the gang opens up to full production.

Ramp-down is the time from threading the last rail to driving the last spike. This represents the time to close down the gang at the end of the day.

C. Daily Goals

Expected production for the different types of gangs are compiled in tabular format in the appendix of the Field Production Book. These levels represent daily goals for all gangs and are based on observed BNSF performance for best practice gangs. Once the window hours are known for the day and rail travel is estimated, the gang management (ARM and Foreman) can establish what the daily goal for the gang is, which is based on the expected production tables.

D. Start-Up

Prior to the gang's work day, communicate with the Dispatcher to find out when the window will open up. Use a daily checklist to make sure there are no loose ends hanging out that might hinder the gang's ramp-up.

Use a job briefing to communicate performance expectations. Use the job survey (track chart) to discuss any special circumstances and job requirements the gang will encounter that day. For example, discuss any special material hauling, switches, road crossings, or changes to the gang's support crews.

Man the gang's equipment prior to the track window opening. Have an Assistant Foreman monitor the machines' movement out of the tie-up track to ensure promptness and minimize any delays. The Foreman should be out at the job site to make sure each work station begins work promptly.

The shortest ramp-up and ramp-down times give the gang more time to be fully productive.

E. Productive Rate

The potential productive rate of the gang can vary depending on the type and amount of equipment in the gang consist. The gang supervision in conjunction with the Work Equipment Supervisor should determine what that rate should be.

Establish the gang's actual productive rate by timing the various work stations on the gang. The slowest operation (bottleneck) paces the gang.

F. Bottleneck Management

Seek out the bottlenecks on the gang and exercise problem-solving techniques to eliminate them or minimize their impact on the gang's production. The goal should be for each work station to achieve its potential productive rate.

Maintaining a smooth flow to the gang's work activities and effectively managing bottlenecks will reduce the negative accordion effects on the gang.

G. Shutdown

Know the time it takes the gang to ramp down. This will enable the gang to take full advantage of available track windows.

H. Tie-Up Locations

Measure the length of the equipment consist to determine if there is enough room to tie up in the shorter back tracks. If a tie-up track is inaccessible for fuel, you may have to fuel up your equipment on line.

The best time to fuel up on line is for the front end of the gang to fuel at a crossing while the back of the gang is ramping down. The back of the gang could be fueled as the front end of the gang ramps up the following day.

I. Daily Checklist

Maintain and refer to a daily checklist as a reminder of important things to do. A checklist is provided in the appendix of the Field Production Book.

J. Job Debriefing

Perform a basic end-of-gang-day job debriefing. The people in attendance should be the Gang Roadmaster, Foreman, and Assistant Foreman of both the rail gang and any support gangs on the project.

At least one representative of the work equipment support team and one from any contractor that may be a part of the project should also be in attendance.

The purpose of the debriefing is to provide a quick recap of the day and to help the principals establish what went wrong and what went right. It is a time to compile and confirm any information needed to accurately report the gang's activities.

By referring to a daily checklist and a pre-job survey, the debriefing will also:

- Remind everyone of what remains to be done for the following day's work.
- Set priorities for work equipment repairs and work site preparation.
- Help set an agenda for the next day's job debriefing.

K. Manpower Planning

The following guidelines are appropriate for managing gang manpower:

1. Determine how many people of each skill type you can afford to be without for each day of the season and develop the vacation schedule around these requirements.

2. Set up a telephone number for people to call to contact their Supervisor.

3. Have an ongoing training program for Machine Operators. Cross train Machine Operators and trackmen on multiple machines.

L. Setting On or Removing Rubber-Tired Equipment

Due to the danger of loose rail rollover while setting on or removing rubber-tired equipment from track, during the rail relay process, make every effort to avoid traversing over loose rail. When setting on or taking off rubber-tired speed swings, gallions, loaders, graders, and grove cranes that must traverse over old or new rail on the shoulder, rail with fastenings removed in the track, or rail threaded into the center of the track, follow these guidelines:

1. **Notification**—Notify all employees working in the length of rail when boom equipment will be traversing over the loose rail. A ground man, when available, will help notify workers.
2. **Signal**—The Machine Operator will give a signal to clear employees away from the loose rail to prevent injury if rail rolls over. *The signal can be similar to the process for pulling rail*.
3. **Observation**—The Operator will visually look for anyone close to the loose rail prior to movement. If the entire string of rail is not visible, the Operator will use the radio to communicate with the Foreman to ensure that all employees are clear of loose rail. A ground man will assist, when available, to observe and clear workers.
4. **Movement**—Movement over the rail can be made at this time, and when machinery has set on, the Operator will advise the Foreman so other employees can return to work.
5. **Removal of hazard**—At points where machines are set on and off, lay short pieces of rail on their side, turned ball out, to prevent rail rollover.

Use this same process to remove rubber-tired equipment from the track if it is necessary to traverse over loose rail.

M. Longitudinal Positioning of CWR

Follow these positioning requirements:

1. **Pre-Job Risk Assessment**

   Conduct a pre-job risk assessment that considers the following:

   - Track geometry—curve, grade, superelevation
   - Length of rail to be pulled
   - Length of pull
   - Equipment available for positioning rail
   - Accessibility of work area
   - Identification of safe zones
   - Experience of personnel, particularly operators of machines used to position rail

   Communicate risk assessment findings during job safety briefings.

2. **Safe Zones**

   a. **Rail Relay Gangs—Replacement Rail Is in Center of Track**

      1) Ground personnel must be beyond the toe of ballast.

      2) Personnel may remain on machines in designated riding positions.

   b. **Other Rail Positioning Operations—Curve**

      All personnel must be beyond the ends of the pull, or on the high side of the track, beyond the toe of ballast.

      EXCEPTION: Where highway flaggers need to be located at grade crossings in curves, a flagger on the low side must be at least 25 feet from the rail being positioned. Where practical, at crossings with anchored signal apparatus, a highway flagger on the low side is to establish a flagging position that is further protected from unexpected rail movement by the apparatus.

   c. **Other Rail Positioning Operations—Tangent**

      All personnel must be beyond the ends of the pull, or beyond the toe of ballast.

   Note: When establishing safe zones based on distance from the rail being positioned, consider hazards associated with high fill locations and the crossing of tracks. In all cases, when tracks must be crossed to reach a safe zone, expect movement at any time, on any track, in either direction.

   Note: Safe zone parameters do not apply to final precision placement activities.

   Note: ***Expect movement of unsecured CWR at any time.***

3. **Rail Positioning Operations**

   Roadway equipment used to position rail longitudinally will be equipped with a siren or air horn to warn employees of rail movement.

   a. Before initiating rail positioning activities, have the Machine Operator sound two warning blasts of the horn or siren and then make sure all personnel are in the designated safe zone.

   b. Establish and use clear and direct communications. A ground person must be assigned to direct the movement of the Operator positioning the rail.

c. Inspect and use chains, cables, pulling blocks, and other rail handling accessories that are designed and engineered for rail positioning operations.

   1) According to section 6.13, do not use rail tongs for rail pulling operations.

   2) Use chains or cables of a sufficient capacity and length—minimum of 4 feet—to minimize the elevating of rail to be positioned.

d. Establish a "circle of safety" at each end of the rail positioning operation. No one is to enter the "circle of safety" without first communicating with the Machine Operator.

   When establishing the diameter of the "circle of safety," consider:

   1) Boom/arm swing
   2) Unexpected equipment or rail movement
   3) Rigging failure

   Communicate the diameter of the "circle of safety" to all personnel involved in the operation.

e. When a rail positioning operation is complete, have the Machine Operator sound one blast of the siren.

6.2.3 Proper Longitudinal Stresses in Continuous Welded Rail (CWR)

Rail expands (lengthens) when heated and contracts (shortens) when cooled. The temperature of rail in track exposed to weather can vary from as high as 145° F to as low as minus 35° F. When restrained from moving during temperature changes, rail develops longitudinal (lengthwise) compressive or tensile forces.

Using the following practices when working with CWR will minimize longitudinal forces in the rail and protect the integrity of the track structure.

A. Rail Maintained at Target Neutral Temperature (TNT)

As the rail temperature varies, CWR in track is in compression some of the time and in tension some of the time because the rail wants to lengthen or shorten but is restrained from doing so. (Compression means the rail is "pushing" against itself; tension means the rail is "pulling" against itself.)

When the rail is at its neutral temperature, it is in neither compression nor tension. There are no longitudinal forces in the rail.

If the rail is never allowed to lengthen or shorten, the temperature at which the longitudinal forces will be neutral will always be the same. The neutral temperature of the rail changes because the rail moves, not because the rail temperature changes.

BNSF requires that CWR be laid and maintained at the Target Neutral Temperature (TNT) shown in Figure 6-1. To prevent high compressive forces, this TNT is several degrees higher than the midpoint of the range of temperatures of rail in track across the BNSF system. Track can withstand more tensile force than compressive force before it sustains damage.

When rail is laid and maintained at the TNT, it will not be in compression until the rail temperature is greater than the TNT. Well-maintained track can withstand compressive forces in the rail up to the maximum temperature the rail will attain.

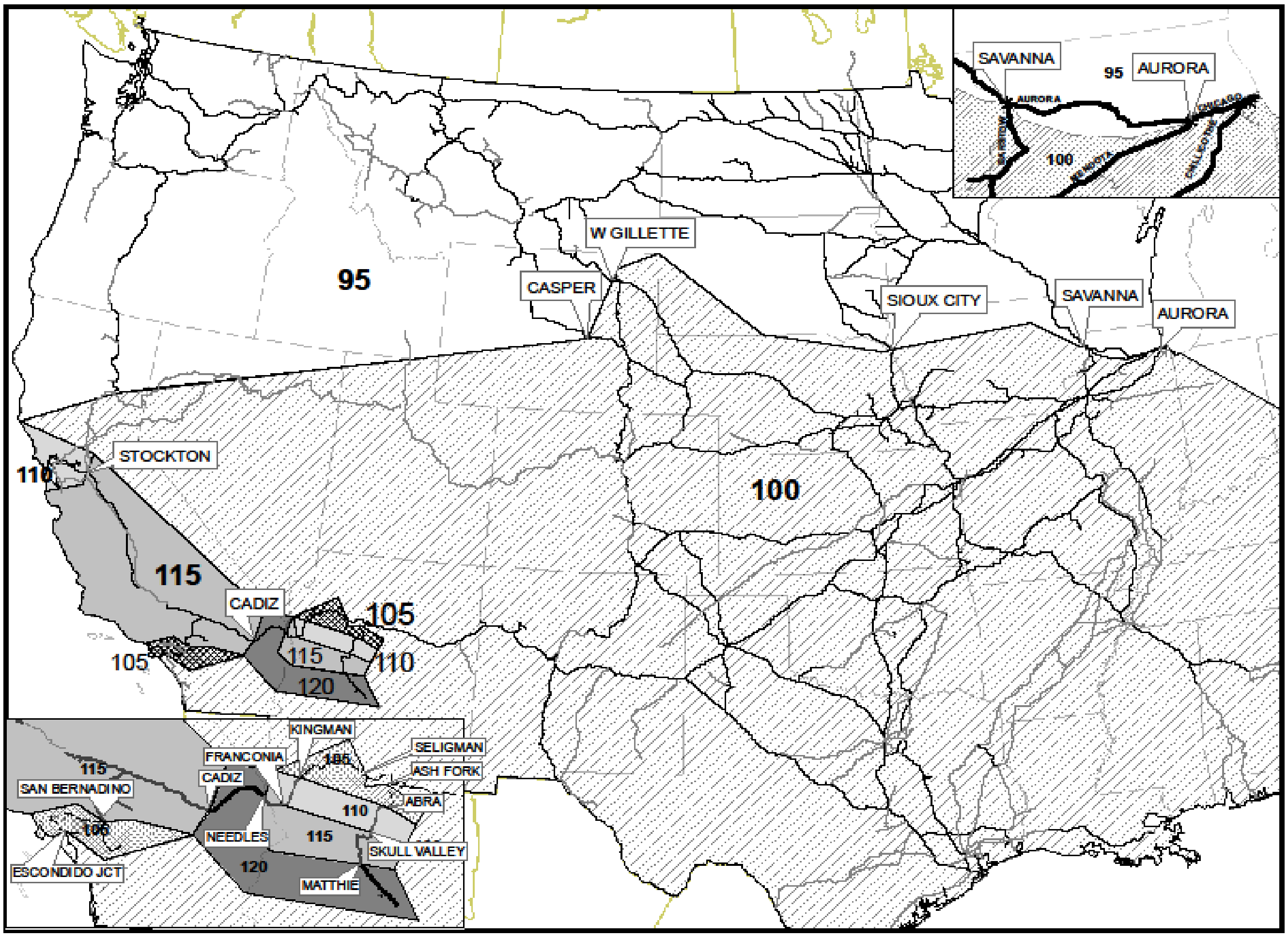


Figure 6-1. Target Rail Laying Temperatures

B. Amount of Rail Length Adjustment to Change in Temperature

There is a property of unrestrained steel that causes it to change in length when its temperature change is measurable. This property can be used to compute how much a given length of unrestrained steel will lengthen or shorten for a given temperature change. The results of computations for various temperature changes and lengths of rail are tabulated in Table 6-3.

Table 6-3 calculates the change in rail length for a given amount of temperature change from the formula 0.0000065 x TD x L x 12 where:

0.0000065	=	Coefficient of expansion of steel
TD	=	Temperature differential (TNT minus existing neutral temp.)
L	=	Total length of unrestrained (unanchored or unclipped) rail

Table 6-3. Change in Length of Welded Rail to Change Neutral Temperature.

Temp. Diff. (°F)	Length of Unrestrained Rail							
	200'	400'	600'	800'	1,000'	1,200'	1,400'	1,600'
5°	1/8"	1/4"	1/4"	1/4"	1/2"	1/2"	1/2"	1/2"
10°	1/8"	1/4"	1/2"	1/2"	3/4"	1"	1"	1-1/4"
15°	1/4"	1/2"	3/4"	1"	1-1/4"	1-1/2"	1-3/4"	1-3/4"
20°	1/4"	1/2"	1"	1-1/4"	1-1/2"	1-3/4"	2-1/4"	2-1/2"
25°	3/8"	3/4"	1-1/4"	1-1/2"	2"	2-1/4"	2-3/4"	3"
30°	1/2"	1"	1-1/2"	1-3/4"	2-1/4"	2-3/4"	3-1/4"	3-3/4"
35°	1/2"	1"	1-3/4"	2-1/4"	2-3/4"	3-1/4"	3-3/4"	4-1/4"
40°	5/8"	1-1/4"	1-3/4"	2-1/2"	3"	3-3/4"	4-1/4"	5"
45°	3/4"	1-1/2"	2"	2-3/4"	3-1/2"	4-1/4"	5"	5-1/2"
50°	3/4"	1-1/2"	2-1/4"	3"	4"	4-3/4"	5-1/2"	6-1/4"
55°	7/8"	1-3/4"	2-1/2"	3-1/2"	4-1/4"	5-1/4"	6"	6-3/4"
60°	7/8"	1-3/4"	2-3/4"	3-3/4"	4-3/4"	5-1/2"	6-1/2"	7-1/2"
65°	1"	2"	3"	4"	5"	6"	7"	8"
70°	1-1/8"	2-1/4"	3-1/4"	4-1/4"	5-1/2"	6-1/2"	7-3/4"	8-3/4"
75°	1-1/8"	2-1/4"	3-1/2"	4-3/4"	5-3/4"	7"	8-1/4"	9-1/4"
80°	1-1/4"	2-1/2"	3-3/4"	5"	6-1/4"	7-1/2"	8-3/4"	10"
85°	1-3/8"	2-3/4"	4"	5-1/4"	6-3/4"	8"	9-1/4"	10-1/2"
90°	1-3/8"	2-3/4"	4-1/4"	5-1/2"	7"	8-1/2"	9-3/4"	11-1/4"
95°	1-1/2"	3"	4-1/2"	6"	7-1/2"	9"	10-1/4"	11-3/4"
100°	1-1/2"	3"	4-3/4"	6-1/4"	7-3/4"	9-1/4"	11"	12-1/2"

Note: The above amounts do not allow for rail added during thermite welding nor rail removed in upset during flash-butt welding.

Use Table 6-3 to determine how much to shorten or lengthen a known rail length to adjust it from its current neutral temperature to the TNT.

- Infrared thermometers are used to measure the rail's current neutral temperature to be used with Table 6-3. (See section 6.2.4B.)
- The left column (Temperature Differential in Degrees F) is the difference between the current rail temperature and the TNT in degrees Fahrenheit. (See Figure 6-1 to obtain the TNT.)
- Values in the remaining columns are the rail length adjustment (in inches) required for the length of unrestrained rail (in feet) indicated at the top of each column.
- The rail length adjustment required to achieve Target Neutral Temperature is the intersection of the row containing the appropriate temperature differential and column containing the appropriate unrestrained rail length.

Adjust the known rail length by the number of inches determined above using a rail heater or a rail expander (see section 6.2.4C).

6.2.4 Laying CWR

When laying welded rail, ensure that the neutral temperature of the rail at the time it is anchored in the track is at or above the TNT. Lay a CWR string as follows:

A. Preparing Rail

Thread the string into the plates and position it so that the beginning end is butted against the last-laid string or parent rail.

When the actual rail temperature is below the TNT, rail adjustment may be necessary in the "pullback area" of the parent rail that the CWR is tying into. Prior to cutting rail or dismantling the rail joint in preparation for laying the first and last strings of welded rail, make match marks 20 feet and 200 feet back on both ends of the existing parent rail. If the parent rail at the project start location pulls back after cutting or dismantling the rail joint, it will be necessary to return the parent rail to its original position using the rail heater. Make sure the rail anchors on the parent rail are adjusted as needed to hold the rail growth.

B. Making Accurate Rail Temperature Measurements

Determine the current neutral temperature of the rail by accurately measuring the rail temperature soon after the rail is threaded into the plates. The temperature of the rail when the rail string is threaded into the plates is its current neutral temperature. Measure the rail temperature as follows:

1. Obtain two approved infrared thermometers from the Foreman in charge of rail laying.

2. Check the accuracy of the thermometer at least once per day by reading both thermometers at the same location on the rail. If the readings vary by more than 2° F, compare a third infrared thermometer to the first two.
3. When using an infrared thermometer, follow the manufacturer's recommendations.
4. Determine the best location along the side of the rail string to measure the rail temperature. The temperature may not be constant throughout the length of the rail. If necessary, take measurements at more than one location along the string to determine the most representative rail temperature.

   For example, if a portion of the rail string was buried in shoulder ballast before being threaded into the track, the temperature of that portion might be different from the exposed rail.

C. Adjusting Rail Length

Determine whether to adjust the rail length from the current neutral temperature.

- If the current neutral temperature of the rail is greater than the TNT, anchor the rail without adjusting its length.

  or

- If the current neutral temperature of the rail is less than the TNT, adjust the length of the rail so that the neutral temperature when the rail is anchored is at least equal to the TNT.

To adjust the rail length:

1. Rail Length Adjustment Marks

If the rail temperature is below the TNT, the rail temperature will have to be adjusted during the rail laying process.

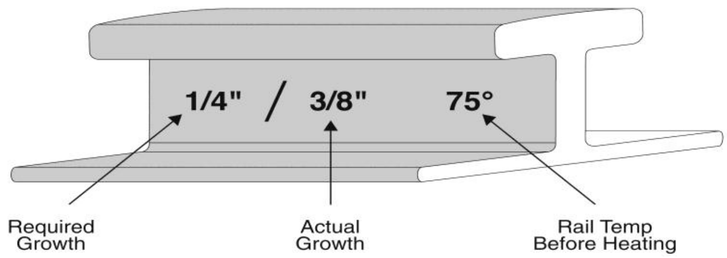
a. Before heating the rail at the beginning of the day, make a match mark 200 feet from the cut in by drawing a line across the base of the rail and tie plate on the field side of the rail. This will allow the Asst. Foreman or Rail Heater Operator to measure movement of the rail relative to the tie plate.

b. Before the rail heater passes the cut in, or a previous match mark, measure the rail temperature at the new match mark. Write the temperature on the web of rail.

c. Use Table 6-3 to figure the amount of rail movement required at the new match mark, then:

   1) Write the amount of rail movement required on the web of rail at the 200-foot mark.

2) If the tie plate with the match mark is not spiked to the tie, it could slide on the tie. If the tie plate slides, the match mark across the base of the rail and tie plate will not indicate the actual movement of the rail. Therefore, if the tie plate is not spiked, place an additional mark across the tie plate and tie to measure movement of the tie plate relative to the tie. Write the actual amount of rail movement as the rail heater progresses next to the required amount of rail movement on the web of rail at each 200-foot mark.



3) After the rail is properly heated, spiked, and anchored, each match-mark location should look like the example in the graphic above.

Repeat steps a, b, and c every 200 feet of the rail string being installed until you reach the end of the string, or until the rail reaches the Target Neutral Temperature. If the rail temperature meets or exceeds the TNT, the only marks at the 200-foot locations should be the rail temperature marked on the web of rail.

2. Rail Length Adjustment Amount

To find the rail movement measurement required to be marked at each 200-foot interval of rail:

a. Subtract the measured rail temperature from the TNT on Figure 6-1.
b. Find that temperature differential in the left column of Table 6-3.
c. In the row opposite that temperature differential, find the match-mark offset for each 200 feet.

Note: For example, assume that you are laying a CWR string in Montana that is 1,440 feet long and the rail temperature as measured with an infrared thermometer is 55° F. Since the neutral temperature when the match marks were made was 55° F and the TNT is 95° F (see Figure 6-1), the temperature differential is:

95 - 55 = 40 degrees

- At 200 feet from the beginning of the string, the match mark must move 5/8 inch.
- At 400 feet, it must move 1-1/4 inches.
- At 1,200 feet, it must move 3-3/4 inches.
- At 1,440 feet, from the interpolation between 1,400 feet and 1,600 feet, movement at the end of the string must be about 4-1/2 inches.

- When tying the end of the CWR string back in to the parent rail and the actual temperature of the rail is below the TNT, check the amount of movement that occurred at the pullback match marks. If an adjustment is required, stop the rail heater at the last match mark. When utilizing an in-track welder to make the closure weld, the amount of rail that it consumes will factor in to the final rail adjustment.

3. Rail Heating

Progressively heat the rail while monitoring the expansion at the match mark and anchor the rail.

a. Provide the rail with one free end that is neither attached to nor butting against another rail.

b. Start the rail heater at the beginning of the string, behind the gage spiker, and uniformly heat the rail while moving the heater toward the first match mark.

c. While heating the rail, vibrate the rail or tap the tie plates ahead of the rail heater to lessen the amount of friction between the rail and the plates. Lessening the friction ensures that the rail can expand without binding in the tie plates or spikes. Never strike the rail with a maul.

d. Heat the rail evenly and uniformly so that the rail expansion occurs evenly and uniformly throughout its length.

4. Rail Anchoring

Examine the first match mark to determine if the rail is being expanded by the right amount. If it is, begin anchoring behind the rail heater. If anchoring does not keep up with the rail heater, wait until after the rail heater passes the first match mark and anchor several ties beyond the match mark to preserve the expansion that has been achieved.

Note: When this procedure is performed properly, the rail will be anchored at its Target Neutral Temperature, and it will not have thermal compressive forces until its temperature reaches the TNT.

D. Installing Transition Rails

When installing 136/115 transition rail:

1. Place the transition 136/115 rails directly opposite from one another.
2. When placing field welds for transition rails, ensure that they fall into the same tie crib to ensure proper support for the transition rail in critical areas.

Note: This procedure does not apply to 136/132 transition rails.

E. Recording Rail Laying Temperatures

When laying CWR, record rail laying temperatures as follows:

1. Use a paint stick to write "laid," followed by the date and rail laid temperature, on both sides of the web of the rail near both ends of the string.
2. Complete the following form in Figure 6-2.
3. Division Engineers will retain completed forms for at least one year.

Record of Neutral Temperature of Welded Rail as Laid

Division ______________ Subdivn ______________ Line Segment ____________

Relay Between __________ and _________________ Recorded by ______________

Target Neutral Temperature = ____°F (see figure 6-1.)

Date Rail Laid	Curve No and/or MP Loca	Position		Trk No	Actual Rail Temp.	Temp Diff	Distance to Match mark	Expansion at Matchmark		Length of String	Remarks
		N/W Rail	S/E Rail					Required	Actual		

3-part form to be distributed as follows: White - Division Engineer, Canary - Roadmaster, and Pink - Foreman.

Figure 6-2. Record of Neutral Temperature of Welded Rail as Laid

Note: Be familiar with the following definitions when recording the temperature reading:

Term	Definition
Rail Temp	Rail temperature in degrees Fahrenheit taken when the rail is anchored
Time	When rail temperatures are taken
Date	Date rail is laid
Location/Description	Notes about special items (such as weather, curve number, high or low rail, north or south rail, near turnout, road crossing, etc.)

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 6-3).

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.

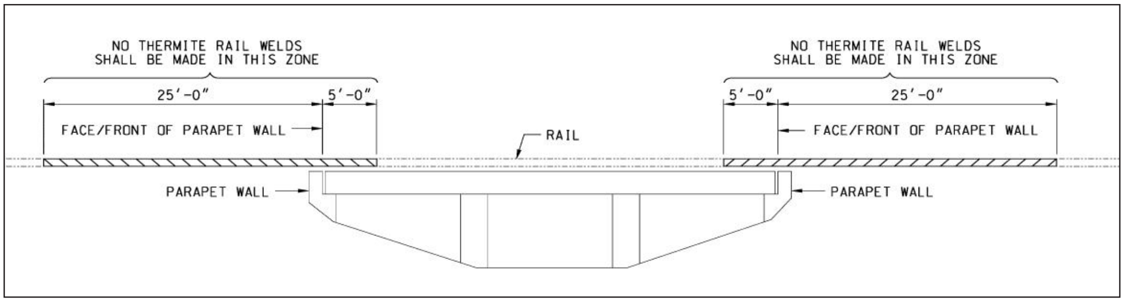


Figure 6-3. CWR Rail Welding Near Bridge Ends

6.2.5 In-Track Welding

When cropping and continuously welding conventional bolted rail by an in-track welding process, anchor the rail at a neutral temperature greater than or equal to the TNT. Follow this procedure:

1. Using an accurate infrared thermometer, measure the rail temperature six rail lengths behind the welder.
2. If the rail temperature is greater than the TNT, anchor the rail immediately per BNSF standards for continuous welded rail.
3. If the rail temperature is less than the TNT:
   a. Allow the welder to progress until there is approximately 500 feet of unanchored rail between the last anchored rail and the welder.
   b. Measure the rail temperature at the beginning of the unanchored length of rail and simultaneously make a match mark across the rail base and a tie plate 400 feet from the beginning of the unanchored rail.
   c. Subtract the measured rail temperature from the TNT; refer to Table 6-3.
   d. Determine the required match mark offset by finding the value directly opposite the temperature differential in the column headed "400 Feet."
   e. Move the rail heater ahead so that the proper expansion occurs at the match mark. Anchor the rail.
   f. Continue to monitor the rail temperature behind the welder and repeat the above process whenever the rail temperature is less than the TNT.
4. Complete the form "Record of Neutral Temperature of Welded Rail as Laid" (see Figure 6-2).

6.2.6 Destressing CWR

Destressing means adjusting the neutral temperature of rail in track by cutting the rail to adjust the amount of rail in a given length of track. Destressing is removing anchors or clips and adjusting the rail to the TNT. Replace or reset anchors after destressing.

A. Conditions That Require Destressing CWR

Conditions that cause incorrect neutral temperature in the rail are as follows.

1. **Rail Laid Cold**

   a. If very cold rail is laid or an operable rail heater is not available, the rail may have to be laid and anchored at a low neutral temperature. This often occurs with concrete tie renewal and new track construction. When laying rail at a rail temperature below the TNT and not properly adjusting the length, protect the track with an appropriate slow order (when conditions warrant) until the rail can be destressed.

   b. Rail laid below the TNT will have anchors applied to the field side of the string for 30 feet on each end. When the form "Record of Neutral Temperature of Welded Rail as Laid" (see Figure 6-2) is completed, the word "cold" must be entered in the "Remarks" column.

2. **Rail Laid Hot**

   Rail laid while hot will have a high neutral temperature. At certain locations, the rail can develop tensile forces that, in cold weather, can shear bolts in joints and turnout components and can cause curves to realign inward.

   These excessive tensile stresses may have to be destressed later when the rail temperature is lower than when it was laid.

3. **Longitudinal Rail Movement Due to Traffic**

   The neutral temperature of the rail changes only if the rail moves in response to thermal and mechanical forces acting on it. The rolling friction between the rail and the wheels of a moving train tend to move the rail in the direction of the movement of the train where heavy braking is required, and opposite the direction of movement where heavy tractive effort is required. This creeping movement of the track is permitted by the rail moving through the anchors (or clips), the anchors wearing on and imbedding into the ties, and/or the ties creeping in the ballast.

Rail creepage has the following characteristics:

- On tracks where gross tonnage is not directionally balanced, expect the rail to move in the direction of the heaviest tonnage, except when the heaviest tonnage ascends long grades.
- Expect the rail to move where trains are required to apply brakes, such as on grades and in approach to permanent speed restrictions (such as siding switches, yard limits, railroad crossings, restricted curves or bridges, and other locations where trains routinely decelerate).
- At certain track fixtures, such as road crossings, open-deck bridges, turnouts, etc., expect the rail to be more resistant to gradual longitudinal creeping than rail in open track. Rail with excessive longitudinal forces is often found adjacent to these fixtures.

4. Lateral Rail Movement on Curves

Curved track tends to move laterally in response to temperature changes. Since rail on a curve may line in (shorten) during cold weather, expect that curved rail may have a low neutral temperature and therefore develop high compressive forces as the rail temperature increases. Set offset stakes around curves per EI 8.6.3 and use the offset measurements and BNSF Form No. ENG00018 to monitor any lateral movement of the track that might change the neutral temperature. Out of face work activities involving tie renewal, undercutting, or surfacing track through curves will always adjust the neutral temperature of the rail in the curve toward the existing rail temperature at the time the track is disturbed.

5. Longitudinal Stresses Caused by Other Maintenance Activities

Many maintenance activities can alter the neutral temperature of the rail.

- Significantly disturbing the ballast section (undercutting, surfacing, performing heavy tie renewals, installing concrete ties, etc.) along a segment of track can make the rail shift in response to imposed thermal and mechanical forces.
- Straightening out alignment swings and surfacing over crests and through sags can change the amount of rail present in a given length of track and therefore change the neutral temperature of the rail.
- Breaking the continuity of rail (while installing repair plugs, insulated joints, track panels, turnouts, etc.) will allow rail to move longitudinally.

6. Maintenance Performed Near Fixed Objects

Any maintenance work performed within 400 feet of a fixed object such as an open-deck bridge, turnout, railroad crossing, road crossing, or bottom of a grade that has significantly altered the neutral temperature of the rail may require destressing. Excessive longitudinal forces often exist near these areas.

a. When performing such work, consider destressing rail for a distance of 400 feet away from a fixed object when:
   - Track is on or near the bottom of a grade of 2 percent or greater and traffic exceeds 10 MGT per year.
   - A curve is lined in within 400 feet of a fixed object.
   - Chronic subgrade problem areas exist.

b. When destressing rail near fixed objects, de-stress each rail to a temperature that is 10 degrees higher than the TNT.

c. Pay particular attention to fixed objects near locations that are routinely subjected to changes in train handling. Longitudinal rail stresses can concentrate in these areas. Examples are turnouts with a diverging route speed that is lower than the normal route speed, and locations with permanently posted speed restrictions.

d. If there is reason to believe, through observations or otherwise, that the current neutral temperature has been significantly lowered, then destress the rail after completing the surface correction and before removing the temporary speed restriction.

e. If the location has been destressed within the last year, or work has been performed within the last year such as a rail relay, you may not need to destress the rail.

f. Refer to existing policies and procedures contained in the Engineering Instructions for specific information on managing rail stress and temporary speed restrictions in conjunction with disturbed track.

7. Turnouts and Track Panels Installed

Certain minimum requirements must be met when placing track and turnout panels in conjunction with new construction projects, maintenance projects (i.e., road crossing renewal, subgrade and fouled ballast work, and bridge ballast deck renewal), and emergencies such as derailments.

a. When placing track and turnout panels, make a match mark 200 feet back on the existing undisturbed rail that track or turnout panels are connected to and monitor rail movement.

b. Following placement of the track or turnout panels, the employee in charge must document on the rail the date, the number of panels installed, and rail temperature at the tie-in joints. Report the same information in PARS. A PARS work order for destressing the track panels will be auto-generated. The destress work should be performed as soon as practicable. Turnouts installed will require destress zones ahead of and behind the turnout, both straight track and diverging route if both are CWR.

The 6.7.5E Adjusting 85 Feet or Less of CWR procedure may be utilized if 85 feet or less of rail or track panels are installed.

c. Where rail relay is not going to be performed, stagger (minimum 10 feet) or weld rail joints on track panels as soon as possible. Refer to EI Table 4-1 and Table 4-2 for appropriate panel track speed restrictions.

8. Concrete Tie Installation

Destress rail in conjunction with concrete tie installation as follows:

a. Determine whether to destress the rail.

1) If the rail temperature is at least 10° F above the TNT during the operation of the P-8-11, the undercutter, and the surfacing, do not destress the rail.
or
2) If the rail temperature is less than 10° F above the TNT for any one of the three activities (P-8-11, undercutting, and surfacing), destress the rail behind the final surfacing and ballast stabilization.

b. Immediately following the final pass of the surfacing gang, record the rail temperature at the end of every continuous welded rail string or approximately every 1,400 feet.

B. Estimating Limits of Destressing

Estimate the amount of rail to destress by considering what initially created the tight rail condition as follows:

1. Inspect the track for evidence of rail movement. Consider grades, curvature, track fixtures, and traffic conditions to estimate the limits of rail with low neutral temperature.

Note: For instance, if the rail is tight because of a cold weather emergency rail repair several weeks ago, probably not as much rail will need to be destressed than if the rail was tight because of track creepage under traffic over a period of months or years.

2. If destressing behind a steel gang or a concrete tie gang, obtain the records of those operations to determine the limits of destressing.

3. To determine how many track feet of rail to destress at a time, consider size of work force, available track time, rail temperature, and track conditions.
    a. Do not cut rail more often than necessary. However, avoid destressing long distances per cut, which reduces the chances of achieving a uniform neutral temperature.
    b. Recognize that it is more difficult to adjust rail on track filled with ballast, track with rough surface or alignment, curved track, concrete tie track, and so forth.

When evidence of compressive stress in the rail indicates that the track may buckle ("snaky rail"), an emergency exists. Immediately cut the rail to relieve the stress. Do not consider whether the rail can be destressed properly according to these instructions.

C. Eliminating Longitudinal Stress in Rail

To neutralize the thermal forces in the rail, each rail will need to be destressed.

1. Cut the rail in the middle of the destress zone, where practical.
    a. If the rail is in tension when cut, the rail ends will gap wider as the anchors are removed.

        or

    b. If the rail is in compression when cut, the rail ends will run toward each other and must be offset or the gap cut wider so the rail can expand freely. Remove the anchors from the rail over the entire length being destressed.

    Note: If the rail is restrained by elastic fasteners, the term "anchors," as used here, means the same thing as "clips."
2. Minimize the frictional resistance on the base of the rail by vibrating the rail or tapping the tie plates.

WARNING: Never strike the rail with a maul.

3. After the rail has moved as much as it will move, determine the rail temperature. This is the rail's new current neutral temperature.

D. Measuring Rail Temperature To Properly Adjust Length

After eliminating the stress in the rail, accurately measure the rail temperature according to section 6.2.4B.

Refer to Table 6-3 to determine the length adjustment required.

Note: For example, if the rail temperature in Texas is 65° F, the temperature differential is 35° F (100° F - 65° F). With a temperature differential of 35° F for an unrestrained rail length of 800 feet, the adjustment amount is the value under the column heading 800 feet and across from 35° F in the temperature differential column, or 2-1/4 inches.

To shorten the rail 2-1/4 inches, as indicated in the above example:

1. Make match marks after the unrestrained rail is relaxed:

   a. If the rail was saw cut initially, cut it again so that the overall difference in the match mark distances or gap is 2-1/4 inches.
      or
   b. If the rail was torch cut initially, crop the torch-cut rail ends and, if necessary, install a rail plug that meets the minimum length requirements for repair rail. Saw cut the rail-end gap 2-1/4 inches wider than the length of the plug. To add or subtract metal by field welding (which is not indicated in the above example):

2. To add or subtract metal by field welding (which is not indicated in the above example):

   a. If using a 1-inch gap thermite weld to rejoin the rail ends, cut the rail end gap 1 inch wider (per weld) than shown on Table 6-3.
      or
   b. If using an electric flash-butt welder to rejoin the rail ends, you must know the amount of rail that will be consumed by the welder. You will need to cut the rail-end gap shorter (per weld) than shown on Table 6-3 by the amount of rail consumption of that particular welder.

3. Refer to the graphic below, which shows rail markings when destressing rail, including the distance that rail anchors or clips were removed to relax the rail, the rail temperature after it has relaxed, and the amount of rail removed (PULL) per Table 6-3. Change in Length of Welded Rail to Change Neutral Temperature.

E. Using Hydraulic Rail Expander

Close the rail-end gap as follows so that a bolted joint or field weld can be installed:

1. Apply a rail expander to the rail ends.
2. Vibrate the rail or tap on the tie plates while stretching the rail to permit the longitudinal force in the rail to equalize over the unanchored length.

3. On long pulls, make match marks across the rail base and tie plates to monitor the rail movement to verify uniform expansion.
4. If possible, do not destress rail with the expander adjacent to a turnout, railroad crossing, or other special track work, which can be adversely affected by the high tensile stresses.
5. After destressing a continuous welded rail in track, do not assume that the opposite rail will require the same amount of adjustment at the same location.
6. Reapply rail anchors according to BNSF standards. Properly record the total amount of length adjustment in PARS, using the "Rail Adjustment Record" (Form 16430 N; see Figure 6-4) as an aid for recording the information until it can be entered in PARS:
    a. Determine the total amount of rail removed from (or added to) the track, not the rail-end gap determined from Table 6-3. The amount is the difference in the distance between the two paint marks made on the ball of the rail at the beginning and the end of destressing before rail was cut.
    b. On the web of the rail, near where the rail expander was applied, write "Adjusted" followed by the date.

RAIL ADJUSTMENT RECORD

BNSF RAILWAY

Division	Line Segment	Date:
Adjusted by (Signature)		

A. Reason for adjustment: ______
   1) Service failure, broken rail ______
   2) Detector Car defect ______
   3) Open joint ______
   4) Adjustment due to heat ______
   5) Other (explain) ______
   ____

B. Mile Post where adjustment occurred ______
C. Curve ot tangent ______
D. Weight of rail ______
E. Adjustment made to which rail ______
F. Rail temperature at time of adjustment ______
G. GAP (inches) ______
H. PULL (inches) ______
I. Rail was cut in, out, or welded ______
J. Show specific data recorded on rail ______
   ____

   If rail was added, indicate date
   follow up rail adjustment is made ______

FORM 16430-N 4-89 Original-Roadmaster Copy-Retain Printed in U.S.A.

Figure 6-4. Rail Adjustment Record

Track Buckle Summary Report

1. Date:
2. Time reported:
3. Track Buckle reported by:
4. Dispatcher:
5. Division:
6. Subdivision:
7. Milepost:
8. Location: (nearest station):
9. If train involved, speed and direction of train:
10. Last known train over area:
11. Have arrangements been made to secure pulse tapes from this train?
12. Degree and type of braking exercised prior to or at the point of the buckle:
13. If derailment occurred, position of first derailed car in train:
14. Train crew interview information:
15. Ambient temperature:
16. Rail temperature:
17. Total track misalignment (inches):
18. Over what distance (feet):
19. Tangent or curve (list degree and superelevation if curve):
20. Grade (percent descending eastbound or westbound):
21. Most recent track work performed in affected area:
22. Anchor condition including pattern and type:
23. Tie condition:
24. Ballast condition:
25. Ballast shoulder width:
26. Cribs full: Yes___ No___
27. Bolted rail or CWR (also indicate weight):
28. Rail laying date and relay temperature:
29. Distance to nearest fixed objects (bridges, crossings, etc.):
30. Location of any slow orders in vicinity:
31. When track was last inspected and by whom:
32. Root cause:
33. How was the track buckle corrected?
34. Amount of rail removed:
35. Length of track destressed:
36. When were repairs completed?
37. Trains delayed:

Submit via E-mail page to AVP Chief Engineer, Division General Manager, Division Engineer, District Roadmaster, and General Director Maintenance.

Figure 6-5. Track Buckle Summary Report

6.2.7 Laying Bolted Rail

Controlling longitudinal forces in bolted rail is not as critical as controlling them in continuous welded rail. Still, follow the proper procedure for laying and maintaining bolted rail.

Lay bolted rail of a 39-foot length so that expansion gaps exist between the ends of adjacent rails according to Table 6-4 below.

Use standard expansion shims on bolted rail and leave them in place until the bolts are tightened. Measure the rail temperature at least once per hour or more often if weather dictates.

Table 6-4. Expansion Gaps for Bolted Rail.

Rail Temp. °F	Rail-End Gap
-20 to 0°	3/8"
0 to 25°	1/4"
25 to 50°	3/16"
50 to 75°	1/8"
75 to 100°	1/16"
Over 100°	Laid tight

6.2.8 Observing Longitudinal Stress in Bolted Rail

If rail is laid with the proper rail-end gaps (computed from the coefficient of expansion of steel), no significant compressive forces will develop in the rail at rail temperatures of 100° F and less. The rail can expand and contract with changes in rail temperature and the neutral temperature will change accordingly.

When the rail-end gaps completely close above 100° F, the rail will experience compression similar to continuous welded rail with increasing rail temperatures, but well-maintained track can restrain this compression.

A. Expansion Gap Adjustment

With expansion gaps at the rail ends, bolted rail is probably more susceptible than continuous welded rail to longitudinal movement from traffic, particularly if anchor, tie, or ballast conditions are less than standard.

- If no expansion gaps exist between the rail ends at a given location when the rail temperature is less than 100° F, the rail has moved toward that location and should experience higher than normal compressive forces in hot weather. If necessary, re-establish the proper rail-end expansion gaps through the affected area and replace the rail with a shorter rail.

- If larger than prescribed expansion gaps exist between rail ends, the rail has moved away from the location and higher than normal tensile forces may exist in the rail at low temperatures. If needed, re-establish the proper rail-end expansion gaps through affected area and replace rail with longer rail.
- When the size of rail-end expansion gaps does not change over a range of rail temperatures, the joint bars and rail ends have rusted together, which prevents the rail ends from moving. To correct this condition, loosen the joint bars and apply a lubricant on the contact surfaces of the rail and bars.

6.2.9 Track and Turnout Panel Management

Certain minimum requirements must be met when placing track and turnout panels in conjunction with new construction projects, maintenance projects (i.e. road crossing renewal, subgrade and fouled ballast work, and bridge ballast deck renewal), and emergencies such as derailments.

1. When placing track and turnout panels, make a match mark 200 feet back on the existing undisturbed rail that track or turnout panels are connected to and monitor rail movement.
2. Following placement of the track panels, the employee in charge must report in PARS the rail temperature and number of panels installed. A work request for destressing the track panels will be auto-generated.
3. Stagger rail joints on track panels as soon as possible, but no later than one month after installation, unless it has been determined that the resulting track panel speed restriction (currently 60 MPH for passenger trains and 40 MPH for freight trains) is acceptable.

6.3 Rail Fasteners and Spiking

6.3.1 Spiking

When spiking, drive two rail-holding (line) spikes in each tie plate as follows:

1. During initial construction, stagger the spikes so that the inside line spikes are toward Timetable East and the field side line spikes are toward Timetable West. When a curve or OOF relay indicates complete re-spiking, plug the old holes and reverse the spiking order.
2. In other rail replacements such as detector car rail and tie renewals, plug the spike holes, use new gage spikes, and re-use anchor spikes. Drive spikes in the same holes to preserve the pattern.
3. When performing spot maintenance work that involves completely pulling a gage-holding track spike, replace the pulled spike with a new track spike. When spot gaging in a curve, place two new gage-holding track spikes in each tie on both sides of high rail opposite low rail segment being gaged.

4. At insulated joint locations, turn spikes so spike heads face away from rail.
5. Start and drive spikes vertically, square and snug against the rail.
6. Comply with the following restrictions:
    a. Do not drive spikes in the holes of slotted joints.
    b. Do not drive line spikes against the rail within 3 inches of any joint.
    c. Do not strike the rail directly with the spike maul during spiking.
7. Anchor spike according to Table 6-5.
8. When performing out-of-face gaging of a curve:
    a. When gaging the low rail of a curve, pull spikes, plug holes, and drive new spikes to match the existing pattern.
    b. When the Manager Roadway Planning determines the high side rail will receive additional spikes, drive two additional spikes—one on the field and one on the gage side next to the rail base. These are in addition to existing spikes.

Table 6-5. Anchor Spike Requirements.

Tie Plate Configuration	Tangent and Curves 1 Degree or Less	Curves Greater Than 1 Degree
4 Hole	None	1 additional line spike per plate on gage side
6 Hole	1 additional line spike per plate on gage side	2 additional line spikes per plate. 1 on gage *and* 1 on field side
6 Hole (13" or greater)	2 anchor spikes per plate. 1 on gage *and* 1 on field side	2 anchor spikes per plate. 1 on gage *and* 1 on field side
8 Hole	2 anchor spikes per plate. 1 on gage and 1 on field side using hole farthest from line spike	2 anchor spikes per plate. 1 on gage and 1 on field side using hole farthest from line spike

6.3.2 Curve Blocks

Install curve blocks in conjunction with rail relay or out-of-face gaging projects on all main line curves, including curved closure and reverse curves behind main line turnouts. This does not apply to curves that already have curve blocks or elastic fasteners. For all other applications, the Division Engineer determines curve block requirements. See BNSF Drawing 2602.01 for details.

Replace every third standard tie plate with a curve block plate so the curve block is situated on the gage side of the rail being relaid or gaged.

Curve blocks are available for both 115# and 136# rail sections. Curve blocks are the preferred fastener on new installations to prevent rail rollover.

Curve Block Spike Patterns. Inside east and field side east may not always be possible. Consider the following: As you face the rail, every curve block is placed on the gage side, right-hand spike hole, which requires the following:

On the tie plates with curve blocks, spike the left-hand rail spike holes (anchor spikes go in the opposite hole or right-hand position). The curve block spike pattern applies to all plates on the curve, even though not all plates are curve block plates.

6.3.3 Spiking Pattern

Different elastic fasteners (including Pandrol e-clips and Safelok) and curve blocks are installed to prevent rail roll over. Any one of these rail restraints may be installed with another type of rollover restraint on the opposite rail, or the opposite rail may have standard tie plates (i.e. one rail may have any restraint system and the opposite rail is not required to have the same or another rail rollover restraint).

Install track spikes on flexible fastener tie plates (Pandrol) for Class 3 track and greater (see table below).

Note: Hair pins are no longer installed on BNSF.

Spiking Pattern—Screw Spikes and Track Spikes (effective 11-1-99)		
Curved track with elastic fastener tie plates	**Lag screws per plate. For use on tie plates with round holes. Use 15/16" approved lag screws.**	**Track spikes per plate. For use on tie plates with square holes.**
Tangent to curves < 2 degrees	1 lag in each corner. 4 total lags.	1 cut spike in each outside square hole. 4 total cut spikes.
>= 2 degrees but < 4 degrees	1 lag in each corner plus 1 cut spike in the center outside square hole. 4 lags and 1 cut spike.	1 cut spike in each outside square hole plus 1 spike in the center outside square hole. 5 total cut spikes.
>= 4 degrees	1 lag in each corner plus 1 cut spike in the center outside and 1 spike in the center inside square hole. 4 lags and 2 cut spikes.	1 cut spike in each outside square hole plus 1 spike in the center outside and 1 spike in the center inside square hole. 6 total cut spikes.

6.4 Anchoring Rail

Rail anchors prevent rail from moving longitudinally relative to the ties. Be careful to ensure that the anchor is fully driven but not overdriven. Apply the following anchor policy to all new and second-hand (SH) rail relays. You are not required to apply additional anchors to rail currently in track to comply with this standard unless conditions warrant.

6.4.1 Anchoring CWR

Anchor continuous welded rail as follows:

1. Box anchor the rail anchors for 195 feet on each side of permanent bolted joints, railroad crossings, and open-deck bridges. Do not apply anchors opposite of joint bars.
2. Box anchor the rail anchors for 195 feet ahead of a switch point and behind the heel of a frog on both the main track and the turnout side.
3. Elsewhere, box anchor every second tie.
4. Maintain anchors so they bear against the edge of either the tie or tie plate.

6.4.2 Anchoring Bolted Rail

Anchor conventional bolted rail as follows:

1. On all bolted rail track:
   a. Box anchor every second tie for eight rail lengths on each side of railroad crossings and open-deck bridges.
   b. Box anchor every second tie for eight rail lengths ahead of a switch point and behind the heel of a frog on both the main track and the turnout side.
2. On bolted rail track carrying 10 MGT or more annually, box anchor every third tie except at those locations specified above.
3. On bolted rail track carrying less than 10 MGT annually, box anchor every fourth tie except at those locations specified above.
4. When anchoring rail as specified above and the anchors would fall at a rail joint, do not box anchor that tie. Box anchor the tie next to the joint.

6.4.3 Transition Anchoring

Where conventional bolted rail joins continuous welded rail, box anchor every tie for 195 feet in both directions.

6.4.4 Anchoring Turnouts

Where possible, anchor a turnout with eight anchors on each switch tie. Apply this pattern to both welded and bolted turnouts, except where elastic fasteners are used.

6.4.5 Anchoring Bridges

Anchor rail on bridges as follows:

1. Anchor rail on ballast deck bridges with the same pattern as the rail adjacent to the bridge.
2. On open-deck timber bridges, apply anchors to all ties fastened to stringers.
3. On open-deck steel spans 150 feet long or less, apply anchors to all ties fastened to the steel structure.
4. On other structures, apply anchors as Director Bridge Engineering directs.

6.4.6 Maintaining Anchors

Maintain anchors as follows:

1. When applying anchors in prescribed pattern and rail movement is evident:
   a. Inspect the anchors to ensure that they have full bearing against the side of the ties, they are the proper size and dimension for the rail section, and they are not defective or weakened by overdriving.
   b. If any of the above conditions exist, reset the anchors, replace the anchors, or apply additional anchors as needed.
   c. If investigation reveals a poor tie condition, insufficient ballast, corroded rail base, or excessive longitudinal rail stress, correct these track conditions before deciding to add additional anchors.
2. When removing anchors from the track for spot maintenance or repair, immediately reapply the anchors to conform to the prevailing anchor pattern for the track being repaired.
   a. Be careful when applying anchors (either by machine or by hand). Ensure that the anchors have full bearing against the tie. Do not overdrive or overapply the anchors.
   b. Adjust anchors by using anchor machines or hand tools, but do not drive anchors along the base of the rail with a hammer. To adjust anchors using hand tools, remove the anchor and reapply it against the tie.
3. Periodically inspect existing anchors.
   a. Reset anchors that do not have full bearing against a tie.
   b. Replace faulty or missing anchors to establish proper anchor pattern.

4. After applying an anchor to the rail, apply an anchor to the opposite rail with bearing on the same side of the same tie. Anchor the rail adjacent to the insulated joint plugs welded into the track as though no joint exists.

5. Fully box anchor each tie that is adjacent to a field weld.

6.5 Rail Joints

6.5.1 Handling Torch-Cut Rail Ends

Leave a torch-cut rail end in the track only in an emergency and only with the Roadmaster's authorization. Apply a 10 MPH temporary speed restriction to trains operating over torch-cut rail ends.

6.5.2 Drilling Rail

When drilling rail:

1. Do not torch cut bolt holes.
2. Drill bolt holes to the diameter and spacing shown on BNSF Standard Plans.
   a. Ensure that field-drilled bolt holes are chamfered or peened so that no sharp edges remain on either side of the rail.
   b. Do not drill bolt holes through holes in the joint bars.
3. In jointed rail territory, fully drill rail as follows:
   a. When using 4-hole angle bars, drill 2 holes per rail end.
   b. When using 6-hole angle bars, drill 3 holes per rail end.
4. In CWR territory when inserting a replacement rail to be welded, do not drill the 2 holes closest to the rail ends, unless using 4-hole joint bars.

6.5.3 Using Joint Bars

Use standard and compromise joints when connecting rail as follows:

1. Ensure that standard and compromise rail joints:
   a. Consist of correctly dimensioned joint bars.
   b. Have the full number of bolts, nuts, and nut locks according to the BNSF Standard Plans.
   c. Have not been cracked, broken, or altered by welding, cutting, or grinding. Replace damaged bars immediately.
2. Use compromise joints to connect rail as follows:
   a. Use only compromise joints (step joints) of an approved design and fit to connect rail sections. A set of compromise joints has four bars and two joints.

Four Bars. Identify bars as right gage, right out, left gage, and left out (except for newer-design 6-inch rail base compromise joint bars which have no right or left designation; identify them instead by the head wear difference of the two 6-inch rail base sections).

Two Joints. Identify the right-hand or left-hand joint by standing between the rails in the track while facing the rails to be jointed. If the heavier rail is on the right side, it is a right-hand joint. If the heavier rail is on the left side, it is a left-hand joint. Current newer-design 6-inch rail base compromise joint bars are not handed or marked gage and out. These bars are now identified as the measurement of the head wear difference between the two rails the bars will join. Refer to BNSF Standard Drawing No. 14050200 for the newer-design 6-inch rail base compromise joints.

b. Suspend the rail ends of a compromise joint in the middle of the crib between two properly tamped cross ties in good condition to support the joint for both sections of rail. This will help minimize shear stresses that wheel loads transfer through the compromise joint bars.

c. Pay particular attention to recently surfaced compromise joints. Stress reversals in the bars may contribute to failure.

d. Do not use compromise joints in turnouts or on open-deck bridges, switch ties, or curves. Instead, extend the rail section beyond these areas.

e. You may use the newer-design 6-inch rail base compromise joint bars (BNSF Standard Drawing No. 14050200) in turnouts or curves only if the head wear difference between the two rails the bars will join is 1/4 inch or less.

f. Do not reuse mates of failed or broken compromise bars.

It is particularly important that compromise joints are properly anchored, bolted, and maintained. These joints take a tremendous beating, especially during the winter months. Temperature swings put more stress on joint bars, bolts, and anchors. Closely inspect compromise and standard joint locations for potential problems. Where possible, use transition rails (see section 6.2.4D) or approved compromise thermite welds instead of compromise joint bars.

3. Remove joint bars as follows:
    a. Visually inspect the rail in the joint area for bolt hole cracks or head-and-web separation.
    b. Replace rails that have extremely battered rail ends.

6.5.4 Bolting Rail

When bolting rail:

1. Fully bolt joints. Use bolts and angle bars of the proper size and design for the rail section being jointed.
2. Tighten bolts in joint bars in sequence as follows:
    a. Start by tightening the two bolts nearest the rail end and work toward the two bolts farthest from the rail end.
    b. As you tighten each bolt, properly seat the fishing surfaces of bars to rail by tapping inward on the bottom flange of the joint bars with a sledge.
    c. Retighten bolts as needed but at least within 2 weeks of installing joint.
    d. Keep the bolted joints tight. Immediately replace broken or missing bolts or lock nuts.
3. To prevent chipped rail ends caused by metal overflow, use a 1/8-inch grinding stone to cross-slot the rail-end surfaces at joints to a depth of at least 3/16 inch below the running surface of the rail.

6.5.5 Establishing and Maintaining Rail Joints

Establish and maintain rail joints as follows:

1. Drill bolt holes to the diameter and spacing shown on BNSF Standard Plans.
    a. Ensure that field-drilled bolt holes are chamfered (beveled).
    b. Do not drill bolt holes through holes in the joint bars.
2. Ensure that bolted rail joints (standard and compromise) consist of correctly dimensioned joint bars and the full number of bolts, nuts, and nut locks according to BNSF Standard Plans. Do not use in track a joint bar (straight or compromise) that has been altered by welding, cutting, or grinding.
3. Tighten bolts in joint bars in sequence:
    a. First, tighten the two bolts nearest the rail end.
    b. Then, tighten the two bolts farthest from the rail end.
    c. As the bolts are being tightened, properly seat the fishing surfaces of the bars to the rail by tapping inward on the bottom flange of the joint bars with a sledge.

d. Retighten the bolts within 2 weeks after the joint is installed.

e. Keep the bolts in bolted joints tight. Immediately replace broken or missing bolts or lock nuts.

4. Do not install compromise joints on switch ties, curves, or bridges.

5. When removing joint bars, visually inspect the rail in the joint area for bolt hole cracks or head-and-web separation.

   a. If cracks are visible in the rail end or if the bolt holes are extremely deformed or elongated, replace the rail.

   b. Replace rails that have extremely battered rail ends.

6. To prevent chipped rail ends caused by metal overflow, use a 1/8-inch grinding stone to cross-slot the rail-end faces at joints to a depth of at least 3/16 inch below the running surface of the rail.

6.6 Rail Identification

6.6.1 Brand Side

The brand side of the rail, with raised characters, identifies the rail weight, section, sometimes type (but the type is usually on the stamp side, not the brand side), method of hydrogen elimination, manufacturer, and the year and month rolled.

The following shows the typical arrangement of the brand:

136 (weight)	RE (section)	HH (type)	VT (Hydrogen elimination)	Manufacturer 2001 IIIIII (year and month rolled)

A. Type of Rail

Rail type (standard or premium) may be designated on the brand side, but usually it is on the stamp side (see section 6.6.2A).

B. Hydrogen Elimination Method

Most rail manufactured before 1938 did not have hydrogen eliminated by control cooling or other means. Non-control-cooled rail is more likely to develop transverse fissures. Most rail manufactured in 1938 and later had hydrogen eliminated by control cooling (CC or CH), vacuum treating (VT), bloom cooling (BC), or other processes. From 1938 to 1947, control-cooled rail was identified with "CC" or "CH" on the stamp side. Beginning in 1947, the method of hydrogen elimination was indicated on the brand side. Later, starting in 2010, due to vacuum degassing being a universal practice, noting the method of hydrogen elimination in the brand began to be phased out.

See sections 6.7.5A(5), 6.7.5B(2), and 6.7.5D(1) to handle non-control-cooled rail.

C. Manufacturer

See 6.7.5A(6) and 6.7.5D(5) for restrictions on rail produced by the manufacturers.

6.6.2 Stamp Side

The stamp side of the rail, with indented characters, has information unique to each rail. The following shows typical arrangements of stamp marks.

Rail from cast ingots:

MH	297165	B	12
(type)	(heat number)	(rail letter)	(ingot number)

Rail from continuous cast blooms:

THC	9713	P	204
(type)	(heat number)	(rail letter)	(strand and bloom number)

Information may be ordered differently, depending on the manufacturer.

A. Type of Rail

Rail type (standard or premium) may be designated on the brand side, but usually it is on the stamp side (see section 6.6.2). Do not use standard rail to remove defects, repair service failures, or eliminate joints in premium rail (see section 6.7.5D[8]).

1. Acceptable premium rail:
   DH (deep head hardened)
   DHH (deep head hardened)
   DR (damage resistant)
   HC (high carbon)
   HCP (high carbon pearlite)
   HE (hypereutectoid)
   HH (head hardened)
   NB (NKK bainite)
   OCP (one percent carbon)
   SP (super pearlite)
   TH (thick head hardened)
   THC (thick head hardened)
   THH (thick head hardened)
2. Unacceptable premium rail:
   FT (fully heat-treated)
   Some rail produced by Bethlehem Steel before 1998 was fully heat-treated. Bethlehem fully heat-treated rail is identified by rail type "FT" in the stamp-side markings. This fully heat-treated rail may have high residual stresses that can produce a rapid web crack at bolt holes. See sections 6.7.5A(7) and 6.7.5D(6) for handling of Bethlehem fully heat-treated rail. Bethlehem standard rail and Bethlehem head-hardened rail, which are not stamped "FT", are not restricted, except for rail produced in 1986, 1987, and 1988 (see sections 6.7.5A(6) and 6.7.5D(4).

   Chrome Vanadium alloy rail
   Alloy rail produced by Thyssen and Krupp can have externally introduced stress factors that increase the likelihood of rail failure. Chrome Vanadium alloy rail is identified by "THYSSEN-AL" or "KRUPP-AL" on the brand-side markings. See section **Defects That Condemn Entire Rail** to handle Thyssen and Krupp Chrome Vanadium alloy rail. Standard rail and head-hardened rail from these manufacturers, not branded 'AL', are not restricted.

3. Consider rail without type designation on either the brand side or stamp side as standard rail. Also, classify rail with the following marks as standard:

CROMO (chrome molybdenum)	MH (medium hardness)
HiSi (high silicon)	SC (standard carbon)
IS (intermediate strength)	SS (standard strength)
IHHS (intermediate hardness)	

4. Second-hand premium rail shipped from rail complexes will be marked with orange paint on the base of the rail 3 feet from the end of the rail.

B. "A" Rails

Until 1986, rail produced from the top of cast ingots was designated with an "A" on the stamp side of the rail. Because shrinkage cracks could develop in the top of the ingot as it cooled, and impurities are lighter than steel and tended to rise to the top of the ingot, "A" rails can be more prone to defects than "B" and lower rails. Rail letter "A" in the stamp-side marking designates it as the top rail from a cast ingot.

See sections 6.7.5A(4), 6.7.5B(2), and 6.7.5D(1) for handling of "A" rails.

6.7 Defective Rail

6.7.1 Service Failures

A. Reporting

Immediately report all rail service failures on main track, sidings (as identified by the Timetable), and main track crossovers using the PARS system (Figure 6-6).

When a service failure occurs, record the GPS coordinates and distance measurement from the defect location to the closest fixed point, such as to a field weld with drillings, switch, frog, or rail joint. This allows the failure to be precisely matched to a specific point on the detector car test record. This information must be available from the District Roadmaster upon request.

Previously detected rail defects that fail prior to removal from the track should not be reported as service failures. Report repairs to these failures as a repair to the detected defect (see section 6.7.4A).

B. Saving Rail for Service Failure Investigation

When a request is made to save a rail defect specimen for investigation, adhere to the following procedures:

1. Cut the rail 18 inches away from the break in both directions.
2. Make sure the specimen pieces are marked with the following:
   - Subdivision (line segment number)
   - Milepost + tenths
   - Track
   - Which rail: L/R
   - Date of failure
3. Store rail in area designated for rail specimens. The area must be dry (out of the weather). Hold specimen for at least 30 days unless otherwise notified.
4. When the District Roadmaster is contacted by a service failure investigator, the Roadmaster must respond to the investigator in a timely manner, and:
   - Provide the location of the service failure specimen.
   - When requested by the investigator, arrange for a qualified escort to meet with the investigator and accompany the investigator for a failure site examination, providing proper protection.

C. Weld Service Failures

1. Advise the Welding Supervisor of any weld that fails within 12 months of being made.
2. If the failure is a defective field weld, describe the defect as well as possible. (The description will determine the next step.)

D. Rail Shipped to Physical Test Lab

1. When required to ship the rail to the physical test lab in Topeka, Kansas, be careful to weatherproof the rail.
2. When the rail is shipped, advise the Engineer Rail Integrity of:
   - Shipper
   - Date shipped
   - Waybill
3. When shipping rail, ship it to:

   BNSF Railway Co.
   Physical Test Lab
   100 NE Jefferson Trafficway, Spot 24
   Topeka, KS 66616

PARS Rail Maintenance Reporting		
To report service failures including broken rail, maintenance rail replacement, defective welds, component replacement, pull aparts, track buckles, and broken bars, use the proper PARS work order **task and click the "Report Service Failures" button to enter the required information**.		
Rail Service Failure Details	**Enter**	**Example**
Service Failure Date	Eight digits MM/DD/YYYY	11/13/2002
Time Notified	Four digits HHMM	2132
Date Defect Corrected	Auto filled from the date time is being entered	
Time Defect Corrected	Four digits HHMM	2246
MP Location	Four to seven digits - Must be within actual BMP and EMP of the work order	1047.123
Rail Position	Select from drop-down menu	Left High Rail
		Left Low Rail
		Left Tangent Rail
		Right High Rail
		Right Low Rail
		Right Tangent Rail
Defect Type	Refer to Defect Descriptions 6.7.3 from the Engineering Instructions	
Defect Zone	Select from drop-down menu -If required	Head - Gage Side, Head - Field Side, Web, Base
Defect Location	Select from drop-down menu - If required	Bolted, Plug, Welded
Weld Month & Year	Six digits MMYYYY or check the box "Weld Date Not Known"	081999
Track Buckle Length	Whole increments in track feet	205
Track Buckle Lateral	Whole increments in lateral inches	37
Did you add or remove rail?	Yes/No or Neither	
Amount in Inches	Enter in .25 inch increments (not to exceed 12 inches)	.75
Was a certified replacement rail or a "Shave & Shoot" weld installed?	Yes or No	
Rail Manufacturer	Select from drop-down menu	Algoma
		All Other
		Bethlehem/Steelton
		CF&I
		CORUS HY (Hayange)
		DO (Voest-Alpine)
		ERMS
		Evraz
		Illinois
		JFE
		Mittal
		NKK
		Nippon
		PST (Penn. Steel Technologies)
		Rocky Mountain Steel
		Tennessee
Rail Year Rolled	Select from drop-down menu	1900 through Current Year
Rail Weight	Select from drop-down menu	Less than 90# through 141#
Click the "Add Failure" Button		
After clicking the "Report Failure" button, your service failure should appear at the top of the screen showing the status as "Closed".		
To report two or more failures, click on the "Clear All Fields" button and enter in the additional information.		
When done reporting failures, **click the "Return to Work Reporting" button.**		

Figure 6-6. PARS Rail Maintenance Reporting

6.7.2 Rail Detector Car Operation

A. Frequency and Scheduling

Managers Rail Detection contract for and schedule rail detector cars. How often a main track is tested depends on many variables, including annual passing tonnage, type of traffic, age of rail, and defect history. Table 6-6 shows siding and crossover test frequency. Frequencies are target intervals between tests. Tighter target test frequencies can be established when conditions warrant.

Only the Manager Rail Detection or General Director Maintenance can modify or change a detector car schedule, including skipping sidings or yard tracks in the test plan or segments of main track.

Table 6-6. Test Frequency for Sidings and Crossovers.

Main Track Rail Test Frequency	Track	Minimum Test Frequency
More than 180 days	Sidings and crossovers	365 days
180 days or less	Sidings off single MT	Every other adjacent main line test
180 days or less	Sidings off multiple MT	365 days
180 days or less	Crossovers	Double MT frequency

Tracks other than main tracks and sidings—with track speed of 20 MPH or higher—will be tested on a 365-day frequency, or more frequently if the Division Engineer requests.

Critical tracks (see section 25.4) will be tested on a minimum 365-day frequency. Divisions can request through their Manager Rail Detection to set a particular yard test frequency to something less than 365 days, if deemed necessary.

Main tracks on "Key Routes" (see section 2.4.1A) will be tested at least two times each year. Sidings on "Key Routes" will be tested at least one time each year.

B. Division Responsibility

Division personnel should be familiar with the detector car test plan and support detector cars to ensure that they work safely and efficiently.

1. Turn rail lubrication systems down or off before test to make sure rail head surface is clean, but not early enough to cause severe dry rail conditions.
2. Establish with the Maintenance Planning Team the weekly test plan with work locations and expected testing times.
3. Provide maintenance support to repair defects anticipated in test plan limits.

4. Provide a qualified escort to obtain track authority for the detector car and to supervise its movement on the railroad. The escort must ride in the test vehicle while it is on the track. If two test vehicles are being used, for example a lead car and a chase car, an escort must ride in each car.

   EXCEPTION: The escort for the chase car can ride in a separate hy-rail vehicle behind the chase car, if subject to both of the following:

   a. The lead car and the chase car operate under the same track authority, and the lead car does not clear the track until the chase car arrives at the point where both cars will clear.

   b. Whenever the Chase Car Operator stops to hand test rail or perform other work, the Operator will stop the chase car and exit the vehicle, but will not foul the track until the escort has stopped hy-rail behind the chase car and exited hy-rail to accompany the Operator.

5. When using chase car to hand test indications of potential defects identified by a lead car, the escort for the chase car should stay informed of number of indications the chase car has to hand test. If chase car is not allowed to complete hand testing before train operations resume, any indications of potential defects identified by the lead car but not hand tested must be protected with a 10 MPH temporary speed restriction until hand tested.

6. Immediately protect rail defects with the appropriate speed restriction as the detector car locates rail defects. See section 6.7.4 (Remedial Action).

7. Remove rail defects and select and install replacement rail to comply fully with section 6.7.5.

8. Properly report all defects in the PARS system as defined in section 6.7.4A.

9. The division escort working with the rail detector during yard tests must be familiar with the current critical track map (see section 25.5) and work jointly with Detector Car Operators to ensure proper reporting of click numbers for the yard test. The escort must also ensure that all tracks are tested per the map, and a list provided with each yard map is printed and used during the course of the test to ensure that each track is tested. Report all tracks and crossovers skipped to the Division Engineer, General Director Maintenance, and Manager Rail Detection with explanation.

C. Ultrasonic Hand Testing

On turnouts within the limits of the scheduled test, a hand test will be performed in addition to a regular test. Whenever possible, hand test during periods of train delay, when track authority is not available to test with the rail detector car. When hand testing without track authority, the Hand Test Operator must be accompanied by a qualified BNSF employee to act exclusively as a lookout for train movements. The hand test will include the following:

Frogs. Hand test bolt holes in heel rails (long/short-point rails on ATSF-design frogs) and bolt holes in wheel-contact area of wing rails not tested by test vehicle. On ATSF-design frogs, test bolt holes in wing rails not tested by test vehicle.

Crossing Frogs. In all railroad crossing diamonds where BNSF has maintenance responsibility, perform a normal test through the crossing and an additional hand test of the bolt holes on the foreign line side.

Switch Point Heel Area. Hand test bolt holes not tested by the test vehicle.

Stock Rails. Hand test bolt holes not tested by the test vehicle. Hand test the transition area of the stock rail not tested by the test vehicle.

Moveable Bridge Joints. Hand test wheel contact areas of joint components not tested by the test vehicle at ends of moveable bridges (see EI 2 Track Inspection, specifically section 2.5.4, for information on inspecting moveable bridge joints).

D. Crossover Testing With Portable Test Unit

When a portable test unit is used to test crossovers, the test will include all rails on turnout ties, both on the main track and crossover.

E. Marking Rail Defects

The Detector Car Operator will clearly mark rail and weld defects as follows:

- Crow's foot at the location of the defect
- Type of defect, defect size, and date detected
- Detector car number and defect number

In addition, if the defect condemns the entire rail (see 6.7.5A), the Detector Car Operator will paint a red stripe on the base of the rail along the entire length of rail.

F. Yard Testing

Division personnel will identify critical tracks per section 25.5. The Managers Rail Detection will schedule the rail detector cars based on the division plan. Critical tracks will be tested on a minimum 365-day frequency. Divisions can request through their respective Manager Rail Detection to set a particular yard test frequency to something less than 365 days if deemed necessary.

1. If an entire yard plan is added that was not previously identified, the division must notify the Manager Rail Detection to ensure that the yard is scheduled accordingly.

2. Maps illustrating the critical tracks can be found on the following BNSF Intranet Website:

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

3. Once a yard test is started, division personnel must work with the Operations Department to ensure that tracks are cleared and available to facilitate testing.

   a. All identified tracks, including crossovers, must be tested according to the map and corresponding click numbers.

   b. A list is provided with each yard map that must be printed and used during the course of the test to ensure that each track is tested.

   c. If tracks are blocked, out of service, or partially tested, that information must be documented on the space provided on the list.

   d. Notify the Division Engineer of tracks skipped or partially tested. The Division Engineer must notify the General Director Maintenance, and they must agree upon remedial action in lieu of the skipped test.

   e. The division will report to the Manager Rail Detection the tracks and crossovers that are skipped before the conclusion of the test.

G. Requirements When Target Test Frequency Is Exceeded

Primary Corridor subdivisions consist of those subdivisions on corridors measured for slow order performance. Primary Corridor subdivisions may be viewed on the BNSF Intranet Website:
http://wfprd.bnsf.com/ibi_apps/WFServlet?IBIAPP_app=en_mtex&IBIF_ex=0453-CORRIDORS

Managers Rail Detection will notify division personnel when subdivisions are forecast to exceed target test frequencies.

When the actual test interval on a main track segment exceeds the target test frequency by more than 30 percent, comply with these requirements:

1. **Required Weekend Testing With Rail Detector Cars**

   Weekend testing with rail detector cars is required when any portion of a subdivision is greater than 30 percent behind target test frequency. The division must provide a minimum of two days notice to the Manager Rail Detection to arrange equipment availability.

   The line Chief Engineer may waive the weekend testing requirement based on application of alternative remedial steps.

2. **Temporary Speed Restriction Requirement for the 20 Percent Highest Defects/Mile Primary Subdivisions**

   On the worst performing 20 percent of Primary Corridor subdivisions for internal rail defects/mile, place a temporary speed restriction on each main track segment greater than 30 percent behind target test frequency.

   The subdivisions meeting the defect/mile criteria may be viewed on the BNSF Intranet Website:
   http://wfprd/ibi_apps/WFServlet?IBIAPP_app=en_scr&IBIF_ex=0494-WORST

   The qualifying subdivisions are updated the first day of each month based on the previous 12 months of defect performance.

   a. An auto-generated E-mail issues 14-day advance notice to Division Transportation and Engineering Managers identifying required temporary speed restriction dates for candidate segments if not tested.

   b. A temporary speed restriction reducing speed by one FRA track class below the maximum authorized Timetable speed on the subdivision is placed on each identified main track segment greater than 30 percent behind target test frequency.

   c. The Maintenance Desk will notify field personnel of the need to issue Form A based on the required segments identified on the auto-generated E-mail. The temporary speed restriction will be issued to become effective 12 hours after the Form A is released.

   d. The Roadmaster and Manager Rail Detection are required to verify based on their knowledge of completed detector car tests.

   e. The Roadmaster is required to ensure that track flags are placed as appropriate prior to the temporary speed restriction being in effect (12 hours after Form A issuance).

3. **Compliance Requirements for Sidings**

   Take out of service multiple track sidings exceeding 365 days.

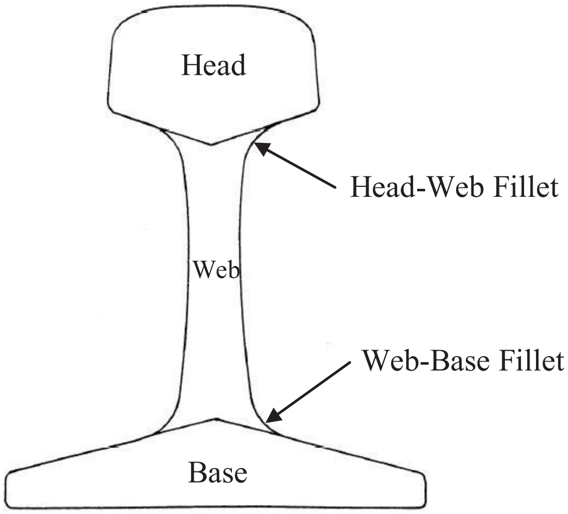
   For single track sidings exceeding twice the detector car interval:

   a. If a siding is not tested during the second main track test, notification will be issued for a 10 MPH slow order effective 4 days from the main track test.

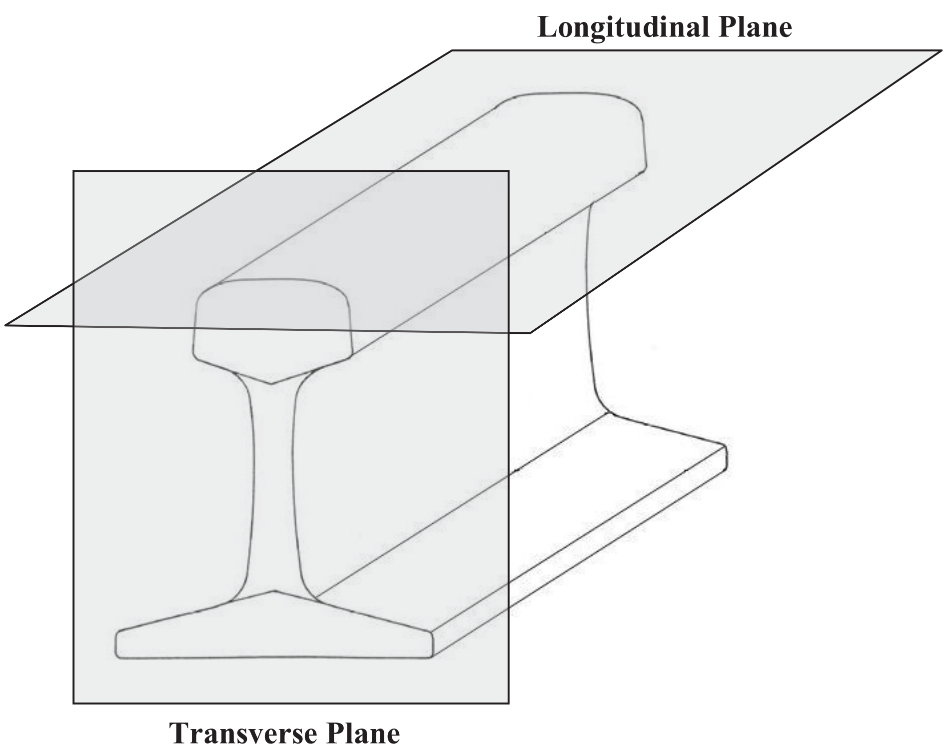
   b. If a siding is not tested during the third main track test, notification will be issued to remove the track from service effective 4 days from the main track test.

6.7.3 Defect Descriptions

Rail Zones



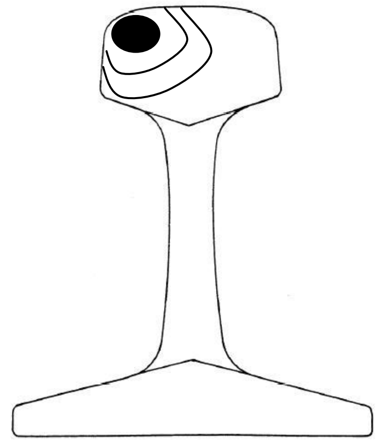
Defect Planes



Be familiar with the following defect descriptions:

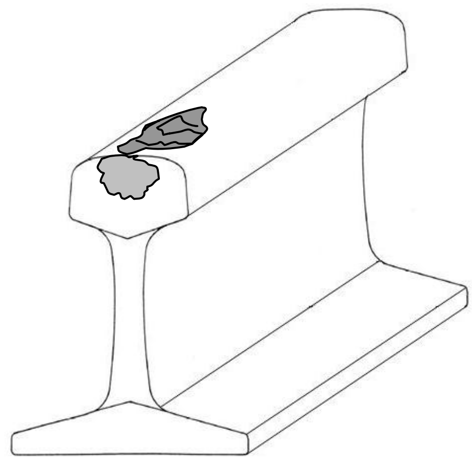
Detail Fracture (Type 13)

A progressive fracture originating from shelling or head checking that turns downward to form a transverse separation. These fractures should not be confused with compound fissures, which have a horizontal component. This type of defect can only occur in the rail head. Rail zone should be specified as either 1 – Head Gage Side or 2 – Head Field Side.



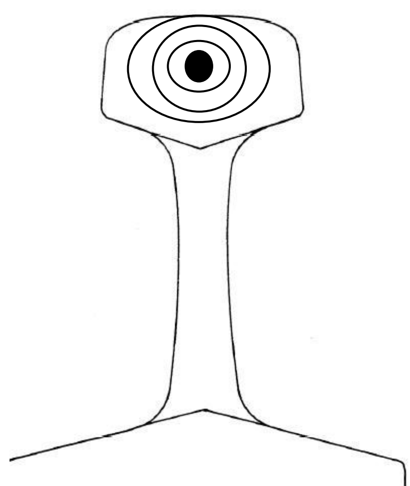
Engine Burn Fracture (Type 14)

A progressive fracture originating in spots where driving wheels have slipped on the top of the rail head. In developing downward, they frequently resemble detail fractures, compound fissures, or even transverse fissures with which they should not be confused or classified. Engine Burns without an underlying transverse defect should be classified as Type 52. No rail zone is required.



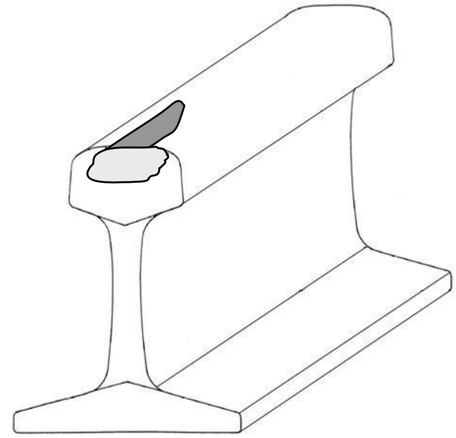
Transverse Fissure (Type 15)

A progressive fracture originating from a center or nucleus in the rail head that propagates in the transverse plane as a smooth, bright or dark, and round or oval surface, substantially at a right angle to the length of the rail. Features that distinguish a transverse fissure from other types of fractures or defects are the center or nucleus and a nearly smooth surface of development that surrounds it. This type of defect can only occur in the rail head. Rail zone should be specified as either 1 – Head Gage Side or 2 – Head Field Side.



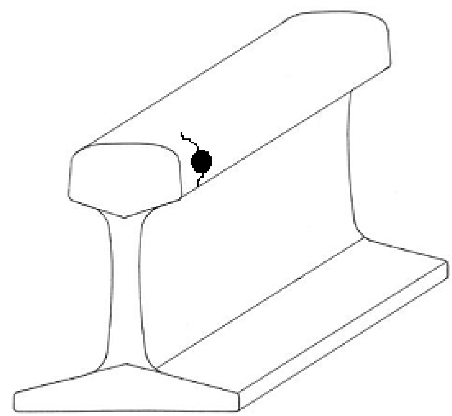
Compound Fissure (Type 16)

A progressive fracture originating from a horizontal split head which turns up or down or in both directions, forming a transverse separation. Compound fissures require examination of both fracture faces to locate the horizontal split head from which they originate. This type of defect can only occur in the rail head. Rail zone should be specified as either 1 – Head Gage Side or 2 – Head Field Side.



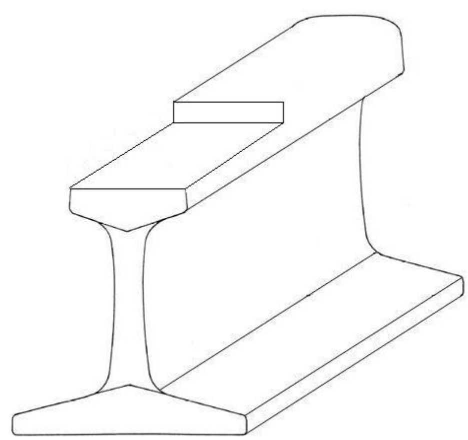
Bond Pin Rail Head Fracture (Type 17)
Bond Wire Exothermic Welded Rail Head Fracture (Type 18)
Bond Wire Pin-Brazed Rail Head Fracture (Type 19)

A progressive transverse fracture in the rail head originating at or near a signal bond wire connection. Rail zone should be specified as either 1 – Head Gage Side, 2 – Head Field Side, or 5 – No Visible Defect.



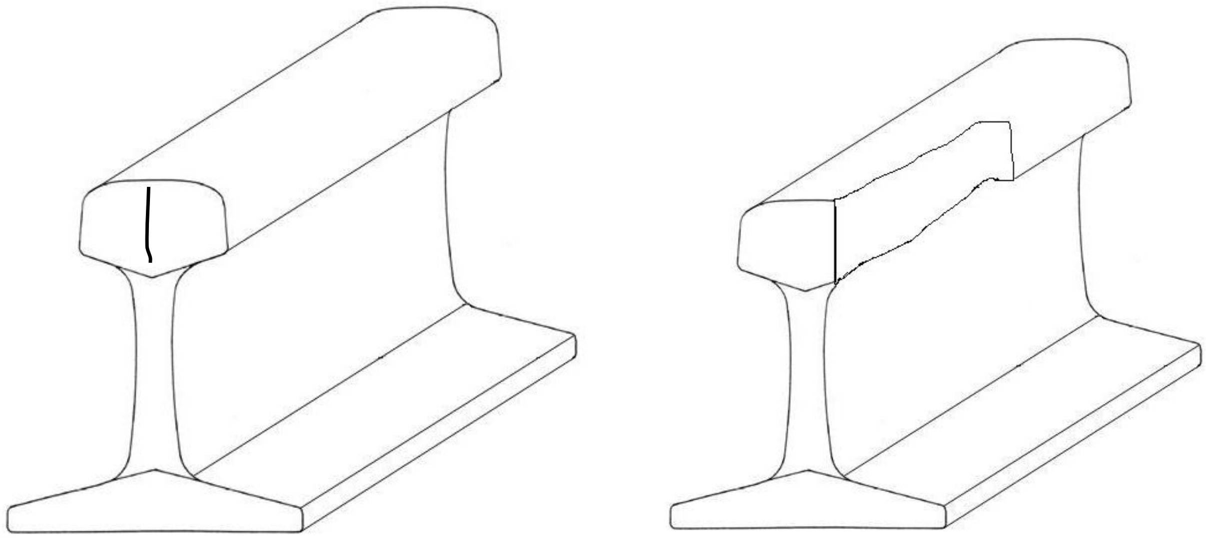
Horizontal Split Head (Type 21)

A progressive longitudinal fracture occuring in the rail head, usually 1/4 inch or more below the running surface, and spreading horizontally in all directions. It is generally accompanied by a flat spot on the running surface. The defect appears as a lengthwise crack when it reaches the side of the rail head. No rail zone is required.



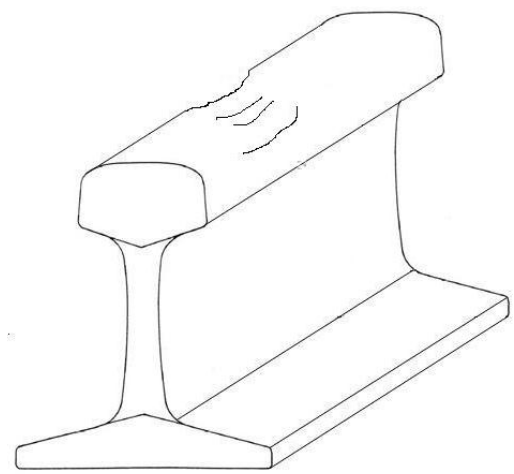
Vertical Split Head (Type 22)

A progressive longitudinal fracture occurring in the rail head, where separation occurs at a seam spreading vertically at or near the middle of the head. A crack or rust streak may be visible at the head-web fillet, or pieces may split off the side of the rail head. No rail zone is required.



Crushed Head (Type 23)

A short length of rail, not at a joint, that has flattened out across the width of the rail head to a depth below the rest of the rail. Crushed heads have no repetitive regularity and thus do not include corrugations. Also, they have no apparent localized cause such as an engine burn. Their individual length is relatively short, as compared to a condition such as head flow on the low rail of curves. No rail zone is required.



Shelled, Spalled, Corrugated (Type 24)

Imperfections or deformations at or near the rail surface that may interfere with a valid search for internal defects. No rail zone is required.

Damaged Rail (Type 25)

Any rail broken or injured by derailments; track equipment; broken, flat, slipping, or unbalanced wheels; or any similar causes. Rail zone should be specified.

Worn Rail (Type 26)

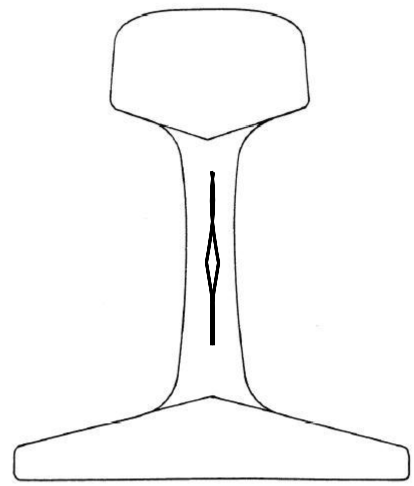
Extreme metal loss on the gage face and/or top of rail. No rail zone is required.

Rail Exception (Type 27)

Conditions such as head checks, slivers, and grease that may interfere with a valid search for internal defects. Rail exception is a defect code to be used by the detector cars only.

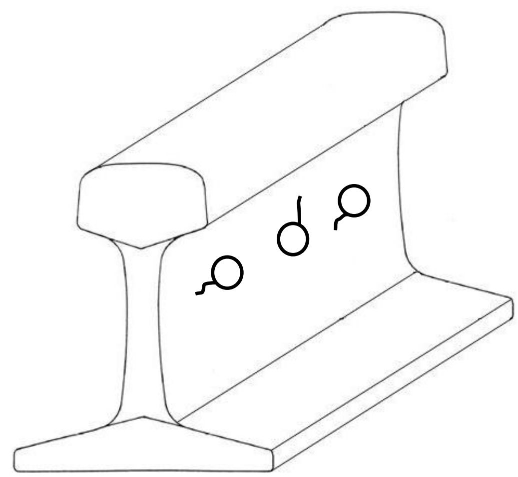
Piped Rail (Type 31)

A vertical split in the web of the rail caused by a vertical separation or seam in the rail. No rail zone is required since this can only occur in the web.



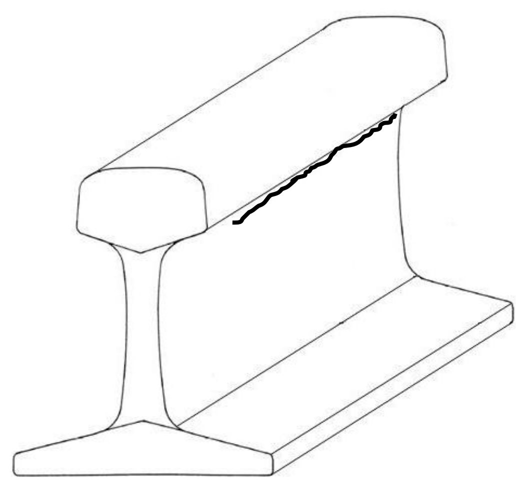
Bolt Hole Break (Type 32)

A progressive crack that originates at a bolt hole. No rail zone is required since this can only occur in the web.



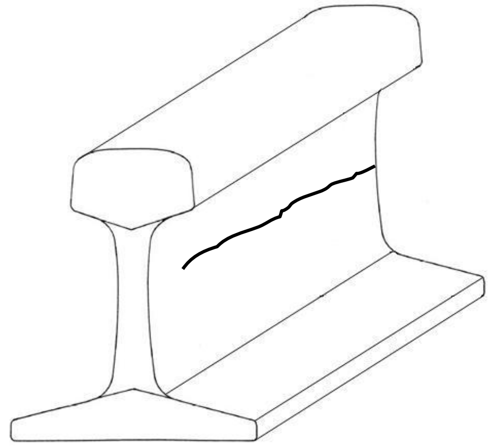
Head and Web Separation (Type 33)

A progressive, longitudinal fracture that separates the head and web of the rail at the fillet. No rail zone is required since this can only occur in the head-web fillet.



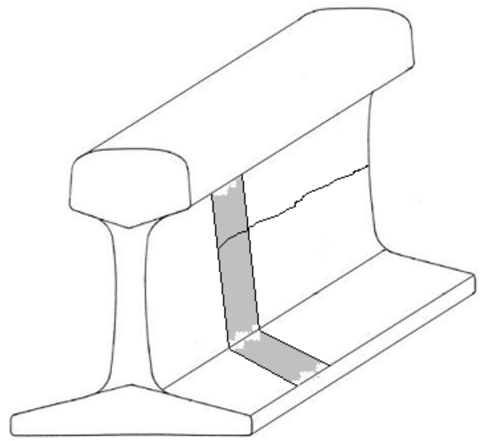
Split Web (Type 34)

A progressive, lengthwise crack through the rail web. No rail zone is required since this can only occur in the rail web.



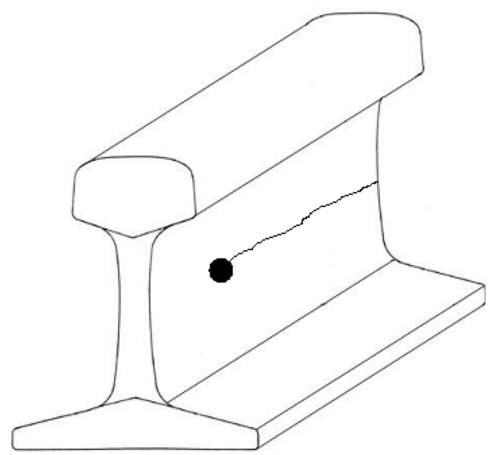
Thermite Weld Web Split (Type 35)
Pressure Electric Weld Web Split (Type 36)

A weld with a crack originating from it running lengthwise along the side of the web and extending into and through it. No rail zone is required since this can only occur in the web.



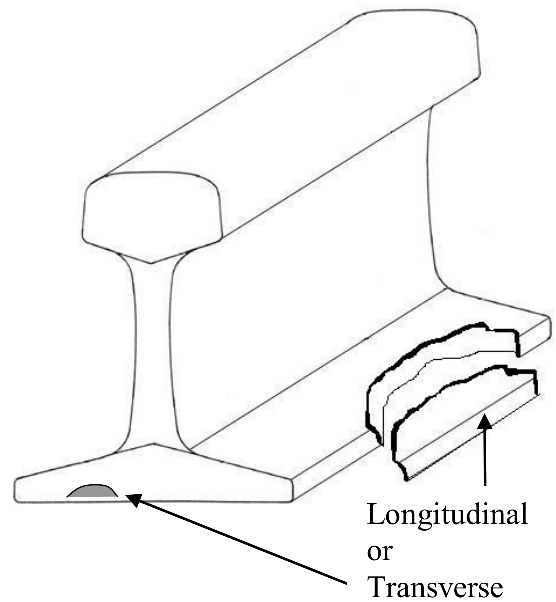
Bond Pin Split Web (Type 37)
Bond Wire Exothermic Welded Split Web (Type 38)
Bond Wire Pin-Brazed Split Web (Type 39)

A signal bond wire connection in the rail web with a crack originating from it running lengthwise alongside of the web and extending into and through it.



Broken Base (Type 41)

Any break in the base of the rail, or any fracture originating from a defect in the rail base. No rail zone is required since this can only occur in the base.

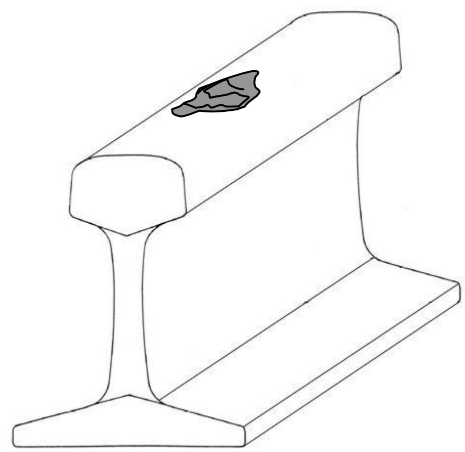


Rail End Weld Fracture (Type 51)

A fracture to the welded rail ends of a joint. No rail zone is required.

Engine Burn (Type 52)

Burned rail caused by friction of slipping locomotive wheels. No rail zone is required.



Boutet Weld (Type 57)
Orgotherm Weld (Type 58)
Boutet Wide Gap Weld (Type 59)
Orgotherm Wide Gap Weld (Type 60)

Thermite Weld (Type 61)
Pressure Gas Weld (Type 62)
Pressure Electric Weld (Type 63)

A fracture within a weld or its heat-affected zone (HAZ). The HAZ generally extends 1/2 inch beyond each side of the weld. Rail zone should be specified. If there is no visible defect in the weld, mark the rail zone as 5 – No Visible Defect.

Ordinary Break (Type 81)

A partial or complete break (not in a weld or the HAZ of the weld) in which there is no sign of a defect. Visually inspect the rail closely for a defect before classifying it as an ordinary break. No rail zone is required since there is no visible defect location.

Pull Apart (Type 82)

A separation of the rail ends at a joint due to bolt failure. Usually caused by high longitudinal tensile stress in the rail.

Broken Angle Bar (Type 84)

A fracture in the angle bar(s) at a joint. If both angle bars of a joint are fractured, only one service failure should be reported.

Frog/Wing Rail (Type 90)

Any fracture, including bolt hole breaks, in the wing rail or frog area that is in a non-contact wheel area. (Fracture in wheel contact area should be assigned applicable specific defect type.)

Insulated Joint Insulation Failure (Type 92)

A failure in the insulation or bars of an insulated joint.

6.7.4 Remedial Action

When a rail has any defect listed in the following table, until the defect is removed (BNSF Remedial Action Code "R") or condition corrected and valid search[^] for defects conducted (Code "T"), take the remedial action specified in the table.

Table 6-7. BNSF Remedial Actions.

Defect	Defect Size	BNSF Remedial Action
Compound Fissure	1–69%	• Limit operating speed over defective rail not to exceed 10 MPH. • After 30 days remove track from service until rail replaced. (Code "J")
	70–100%	• Qualified person visually supervises each operation over defective rail. (Code "A")
Transverse Fissure Detail Fracture, Engine Burn Fracture, Bond Wire Rail Head Fracture, or Defective Weld	1–59%	• Within 7 days apply joint bars bolted through outermost holes[%] and • Limit operation over defective rail until removed as follows: ◦ Before joint bars are applied: • Limit operating speed not to exceed 10 MPH. • If joint bars are not applied within 7 days, remove track from service. ◦ After joint bars are applied*: • Limit operating speed not to exceed 50 MPH. (Code "C")
	60–100%	• Apply joint bars bolted according to 213.121 D and E and • Limit operation over defective rail until removed as follows: ◦ Before joint bars are applied: • Qualified person visually supervises each operation over defective rail. ◦ After joint bars are applied*: • Limit operating speed not to exceed 50 MPH. (Code "E")
Ordinary Break	n/a	• Apply joint bars bolted according to 213.121 D and E and • Limit operation over defective rail until removed as follows: ◦ Before joint bars are applied: • Qualified person visually supervises each operation over defective rail. ◦ After joint bars are applied: • No restriction required. (Code "L")

Horizontal Split Head, Vertical Split Head, Split Web, Bond Wire Split Web, Piped Rail, or Head Web Separation	0" to 2"	• Limit operation over defective rail until removed as follows: ◦ Limit operating speed not to exceed 50 MPH. ◦ After 30 days limit operating speed not to exceed 10 MPH. (Code "F")
	Greater than 2" to 4"	• Limit operation over defective rail until removed as follows: ◦ Limit operating speed not to exceed 30 MPH. ◦ After 30 days limit operating speed not to exceed 10 MPH. (Code "G")
	Greater than 4"	• Limit operation over defective rail until removed as follows: ◦ Limit operating speed not to exceed 10 MPH. ◦ After 30 days remove track from service. (Code "J")
	Breakout in rail head	Qualified person visually supervises each operation over defective rail. (Code "A")
Bolt Hole Crack, within joint bars or Weld Web Split, within joint bars	0"–1 1/2"	• Limit operation over defective rail until removed as follows: ◦ Limit operating speed not to exceed 50 MPH. ◦ After 30 days limit operating speed not to exceed 10 MPH. (Code "K")
	Greater than 1 1/2"	• Limit operation over defective rail until removed as follows: ◦ Limit operating speed not to exceed 10 MPH. (Code "B")
Bolt Hole Crack, without joint bars or Weld Web Split, without joint bars	0"–1 1/2"	• Limit operation over defective rail until removed as follows: ◦ Before joint bars are applied bolted according to 213.121 D and E: • Limit operating speed not to exceed 10 MPH. • After 30 days remove track from service. (Code "J") ◦ After joint bars are applied bolted according to 213.121 D and E: • Limit operating speed not to exceed 50 MPH. • After 30 days limit operating speed not to exceed 10 MPH. (Code "K")
	Greater than 1 1/2"	• Limit operation over defective rail until removed as follows: ◦ Before joint bars are applied bolted according to 213.121 D and E: • Limit operating speed not to exceed 10 MPH. • After 30 days remove track from service. (Code "J") ◦ After joint bars are applied bolted according to 213.121 D and E: • Limit operating speed not to exceed 10 MPH. (Code "B")
Bolt Hole Crack or Weld Web Split	Breakout in rail head	Qualified person visually supervises each operation over defective rail. (Code "A")

Broken Base	0"–6"	• Within 7 days apply joint bars bolted through outermost holes[%] and • Limit operation over defective rail until removed as follows: ◦ Before joint bars are applied: • Limit operating speed not to exceed 30 MPH. • If joint bars are not applied within 7 days, limit operating speed not to exceed 10 MPH. ◦ After joint bars are applied: • Limit operating speed not to exceed 50 MPH. • After 50 MGT[#] (but not less than 180 days) limit operating speed not to exceed 40 MPH. (Code "D")
	More than 6"	• Apply joint bars bolted according to 213.121 D and E and • Limit operation over defective rail until removed as follows: ◦ Before joint bars are applied: • Qualified person visually supervises each operation over defective rail. ◦ After joint bars are applied: • Limit operating speed not to exceed 30 MPH. (Code "H") • Where base break is moon-shaped breakout, resulting from a derailment, with length greater than 6" but not exceeding 12" and width not exceeding 1/3 of the rail base width: • Within 7 days apply joint bars bolted through outermost holes[%] and • Limit operation over defective rail until removed as follows: ◦ Before joint bars are applied: • Limit operating speed not to exceed 30 MPH. • If joint bars are not applied within 7 days, remove track from service. ◦ After joint bars are applied: • Limit operating speed not to exceed 50 MPH. • After 50 MGT[#] (but not less than 180 days) limit operating speed not to exceed 40 MPH. (Code "D")
Damaged Rail	n/a	• Within 7 days apply joint bars bolted through outermost holes[%] and • Limit operation over defective rail until removed as follows: ◦ Before joint bars are applied: • Limit operating speed not to exceed 30 MPH. • If joint bars are not applied within 7 days, limit operating speed not to exceed 10 MPH. ◦ After joint bars are applied: • Limit operating speed not to exceed 50 MPH. • After 50 MGT[#] (but not less than 180 days) limit operating speed not to exceed 40 MPH. (Code "D")

Flattened Rail (Crushed Head)	Depth >3/8" and length >8", or deform-ation under rail head	• Replace rail (Code "R") or correct condition, conduct valid search[^] for internal defects, and Operator mark rail "VT". (Code "T") • Until rail replaced, or valid test conducted and rail marked "VT", limit operating speed as follows: ◦ Limit operating speed not to exceed 50 MPH. ◦ After 15 MGT[#] (but not less than 30 days) limit operating speed not to exceed 25 MPH. (Code "I") • Within "Dead Zones", turnouts, or crossovers: within 5 days FRA-qualified exempt maintenance officer must visually inspect rail and if judged necessary further limit operating speed. (Code "M")
Shelled/ Spalled/ Corrugated	n/a	• Replace rail (Code "R") or correct condition, conduct valid search[^] for internal defects, and Operator mark rail "VT". (Code "T") • Until rail replaced, or valid test conducted and rail marked "VT", limit operating speed as follows: ◦ Within "Dead Zones", turnouts, or crossovers: • After 30 days limit operating speed not to exceed 50 MPH. • After 15 MGT[#] (but not less than 30 days) limit operating speed not to exceed 25 MPH. ◦ All SSCs regardless of location, after 15 MGT[#] (but not less than 30 days) limit operating speed not to exceed 25 MPH. (Code "N") • Within "Dead Zones", turnouts, or crossovers: within 5 days FRA-qualified exempt maintenance officer must visually inspect rail and if judged necessary further limit operating speed. (Code "M")
Cracked or Broken Joint Bar	Center cracked (Fig. 6-7b) Both bars at joint quarter cracked	• Replace bar. (Code "R") • Until defective bar replaced limit operations as follows: ◦ Limit operating speed over defective bar to 10 MPH after FRA-qualified employee determines operations can safely continue for a period not exceeding 30 days. ◦ Report a 213.9(b) qualifying defect in TIMS. ◦ If bar not replaced within 30 days remove track from service. (Code "P")
	Single quarter cracked (Fig. 6-7b)	• Limit operating speed over defective bar to Class 2 (25 MPH freight, 30 MPH passenger). (Code "Q").
Rail Exception	n/a	• Within 14 days FRA-qualified exempt maintenance officer must visually inspect rail. (Code "X") ◦ If judged necessary, limit operating speed based on visual inspection. • Replace rail (Code "R") or Correct condition, conduct valid search[^] for internal defects, and Operator mark rail "VT". (Code "T")

Rail Exception (continued)	n/a	• If rail replacement or valid search for internal defects is not conducted before expiration of required period, limit operating speed as required by section 6.7.7C(3). (Code "Y") ◦ The period between valid tests may not exceed: ◦ For Class 4, 5, and Class 3 over which passenger trains operate or which is a key route, the lesser of: • 30 MGT accumulated traffic or • 1 year ◦ For Class 3 without passenger trains and not a key route, the greater of: • 30 MGT or • 1 year ◦ For Class 2 and Class 1: • No requirement Period is the time interval between the last valid test performed prior to rail exception reporting and the date of required track class reduction.

*** Note: If defect progresses to 100% after joint bars applied, replace rail.**

 # Note: (MGT) main track Million Gross Tons accumulated traffic from date of defect detection. Annual MGT rate to be determined from the 12 months main track traffic previous to the date of defect detection. Tracks other than main (sidings, crossovers, wyes, etc) shall use the main track annual MGT rate at that point. If preceding 12 months main track traffic is not available at that point, a rate of 50 MGT per year shall be used. Accumulated traffic for defects reported prior to 11/1/2013 will start accumulating effective 11/1/2013.

^ Note: For the search to be valid, the Detector Car Operator must be informed that he or she is testing a previously identified defect. If the search is valid, the Operator will mark the base of the rail as follows: VT (for valid test) – test date – car ID. Do not show the condition corrected and retested (Code "T") unless the Operator marks the rail.

% Note: When applying angle bars bolted through outermost holes—Codes "C" or "D"—do not drill the closest bolt holes next to the defect that is being remediated. Ensure that the defect is centered between the innermost holes of the bars. Do not drill next to the defect to prevent the propagation of the crack into the hole closest to the defect. Acceptable drilling arrangements are shown in Figure 6-7a. When applying angle bars bolted per 213.121 D and E—Code "E" or "H"—install at least two bolts on each side of the defect. Ensure that the defect is centered between the innermost holes of the bars.

Variances to Table 6-7 must have written authorization of Line Chief Engineer on an individual subdivision and defect type basis, and may not exceed requirements of CFR 213.113 and 213.237.

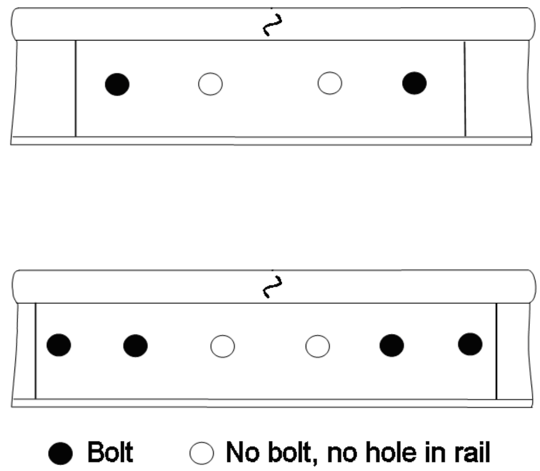
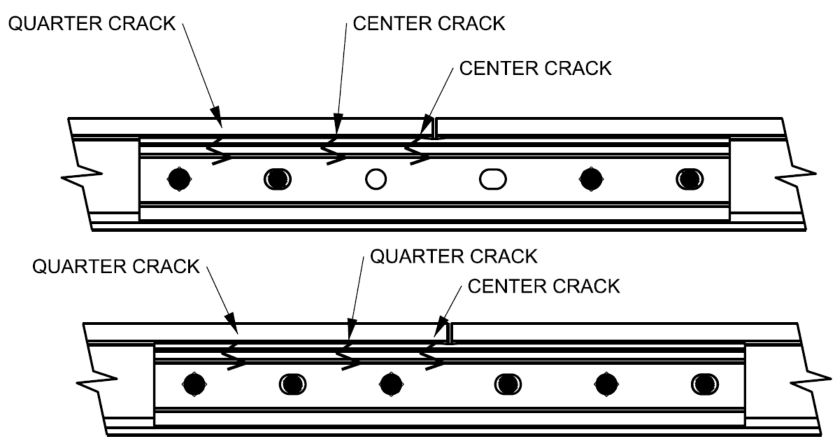


Figure 6-7a. Acceptable Drilling Arrangements of Bolt Holes



Center Cracked Bar – Crack between the innermost bolts of each rail end
Quarter Cracked Bar – Crack between the individual bolts of a single rail end

Figure 6-7b. Center Cracked and Quarter Cracked Joint Bars

For each defect listed on the rail inspection report from the detector car, mark on the list each defect with the correct BNSF remedial action code and the date the remedial action was taken. Codes are listed in Table 6-7; use Code "R" when removing the defect. Report all BNSF remedial action taken using PARS.

A. Reporting Repaired Rail Defects Identified by Rail Detector Vehicles

Use the PARS reporting system to report repairs to rail detector defects. To use the system, have the hard-copy report that the rail detector personnel provided. You will need the following information:

1. Defect Number
2. Test Date
3. Car Number

To report repairs to detector car defects, use the proper PARS work order task.

Note: Items designated in bold need to be identical to the defect information from the detector car.

Rail Detector Defect Reporting	Enter	Example
Defect Number	Enter Defect Number from Detector Car Printout	0001
Test Date	MM/DD/YYYY or select date from Calendar Icon	02/19/2003
Car Number	Select from drop-down menu	SRS827, HRZ026, DRS002
Search Defect	Click on the "Search Defect" button	

If the defect number is not found, the "Add Defect" box will appear asking the user if they want to add and repair this defect. Select Yes to continue and report repairs against the defect. If the defect number was found, verify that the defect number, test date, and car number are correct and proceed to repair information.

See Appendix A at the end of this instruction for BNSF PARS Remedial Action Descriptions.

6.7.5 Removing Rail Defects

A. Defects That Condemn Entire Rail

1. Scrap any rail (bolted or welded) manufactured prior to 1996 that contains any of these defects:

   - Transverse fissure
   - Vertical split head
   - Piped rail

   If a conventional bolted rail contains any defect listed above, do not crop or reuse that rail in any track.

   If rail in continuous welded territory manufactured prior to 1996 contains any of the defects listed above, cut the rail out of the track from weld to weld, including the welds. Identify and handle scrap rail according to section 6.7.5J.

   After cutting rail, the rail ends must be inspected closely for cracks to ensure that the defect has not progressed beyond the section being removed.

2. Rail With Previous Defect

   For rails manufactured before 1996, if a defect is found in a rail with a previously noted defect (excluding SSC, rail exceptions, or weld defects), the rail must be removed from track, joint-to-joint, or weld-to-weld.

   If a second transverse fissure, vertical split head, or piped rail defect develops in any rail manufactured after 1996, cut the rail out of the track from weld to weld, including the welds. Identify and handle scrap rail according to section 6.7.5J.

3. Previously Installed Replacement Rail

   Completely remove from track, joint-to-joint or weld-to-weld, any previously installed replacement rail with a detail fracture, transverse fissure, compound fissure, horizontal split head, vertical split head, piped rail, or service failure broken rail of any type. Do not apply joint bars to defects in replacement rail. Identify and handle scrap rail according to section 6.7.5J.

4. "A" Rails

   Until 1986 rail produced from the top of cast ingots was designated with an "A" on the stamp side of the rail. Because shrinkage cracks could develop in the top of the ingot as it cooled, and impurities are lighter than steel and tended to rise to the top of the ingot, "A" rails can be more prone to defects than "B" and lower rails. Typical stamp-side marking on rail from cast ingots is: CH 2 0816 A 12. "A" designates it as the top rail from the ingot.

In main tracks, sidings, and crossovers off main tracks, completely remove from track, joint-to-joint or weld-to-weld including welds, any "A" rail with a defect (excluding SSC, rail exceptions, or weld defects). Scrap the entire rail. Identify and handle scrap rail according to section 6.7.5J.

5. Non-Control-Cooled Rail Including Open Hearth (OH)

   Most rail manufactured before 1938 did not have hydrogen eliminated by control cooling or other means. Non-control-cooled rail is more likely to develop transverse fissures. Most rail manufactured in 1938 and later had hydrogen eliminated by control cooling (CC), vacuum treating (VT), bloom cooling (BC), or other processes. From 1938 to 1947, control-cooled rail was identified with "CC" or "CH" on the stamp side (with indented letters) of rail. Beginning in 1947, the method of hydrogen elimination was indicated on the brand side (with raised letters) of rail. In 2010, due to vacuum degassing being a universal practice, noting the method of hydrogen elimination in the brand started being phased out.

   In main tracks, sidings, and crossovers off main tracks, completely remove from track, joint-to-joint or weld-to-weld including welds, any 112# and heavier rail older than 2010 with a defect (excluding SSC, rail exceptions, or weld defects) that does not have "CC", "VT", or "BC" on the brand side of the rail, or "CC" or "CH" on the stamp side of the rail, and scrap entire rail. Identify and handle scrap rail according to section 6.7.5J.

6. Algoma, British, 1986 to 1988 Bethlehem Steelton, Vilru, and Workington Rails

   Completely remove from track, joint-to-joint or weld-to-weld including welds, any rail with a defect (excluding SSC, rail exceptions, or weld defects) in the following brands: Algoma, British, 1986 to 1988 Bethlehem Steelton, Vilru, or Workington. Identify and handle scrap rail according to section 6.7.5J.

7. Bethlehem Fully Heat-Treated (FT) Rail

   Some rail produced by Bethlehem before 1998 was fully heat-treated. Bethlehem fully heat-treated rail is identified by "FT" on the stamp side of the rail. Completely remove from track, joint-to-joint or weld-to-weld, any Bethlehem FT rail with a defect (excluding SSC, rail exceptions, or weld defects). Identify and handle scrap rail according to section 6.7.5J.

   Do not drill holes in any non-defective Bethlehem FT rail that stays in track. Bethlehem standard rail and Bethlehem head-hardened rail, which are not stamped "FT", are not restricted, except for 1986, 1987, and 1988 (see No. 6).

8. Thyssen and Krupp Chrome Vanadium Alloy (AL) Rail

   Chrome Vanadium alloy rail is identified by "THYSSEN-AL" or "KRUPP-AL" on the brand-side markings. Completely remove from track, joint-to-joint or weld-to-weld, any Thyssen-AL or Krupp-AL rail with a defect (excluding SSC, rail exceptions, or weld defects). Standard rail and head-hardened rail from these manufacturers, not branded 'AL', are not restricted.

B. Detail Fracture and Defective Weld Removal

The Detector Car Operator will mark the location of the defect. Do the following:

1. Remove a minimum of 1 inch of rail *each side* of the mark.
2. For detail fractures, if the rail is an "A" rail, has had a previous defect in it, is in a previously installed replacement rail, is non-control-cooled 112# rail or heavier, or is shelled or heavily head-checked, remove the entire rail. Identify and handle scrap rail according to section 6.7.5J.
3. After cutting rail, inspect both rail ends to ensure that no defects are present.
4. Ensure that all thermite welding after the defect is removed conforms to the requirements of Engineering Instruction 11 Welding and Grinding, specifically section 11.15, and the BNSF Thermite Welding Manual.
5. If installing a rail plug to remove a detail fracture, to the extent possible, center the plug on the location of the defect. Scrap all rail removed from track in the defect removal process. Identify and handle scrap rail according to section 6.7.5J.

C. Other Defects

Remove defects other than those discussed in sections 6.7.5A and 6.7.5B by installing a rail plug that is as long or longer than the minimum length required. To the extent possible, center the repair plugs on the location of the defect. Scrap all rail removed from track for detail fractures, transverse fissures, compound fissures, horizontal split heads, vertical split heads, and piped rail. Identify and handle scrap rail according to section 6.7.5J.

D. Selecting Replacement Rail

The minimum length of replacement rail that may be installed in continuous welded rail is as follows:

Temporarily bolted into welded rail	12 feet on tangents and curves
Thermite or flash-butt welded into welded rail	16 feet on tangents 18 feet on curves

The minimum length of replacement rail installed in bolted rail is 10 feet on tangents and curves, but make every effort to replace rail with rail of the same length to avoid adding joints. Stagger joints as close as possible to one-half rail length. Avoid placing joints within 6 feet from the ends of open-deck bridges.

The above minimum lengths of rail replacement are for:

- Main tracks
- Sidings
- Yard tracks
- Industry tracks

EXCEPTION: The minimum lengths described above are not required when inserting replacement rail during an emergency or in the following locations:

- **Railroad crossings (crossing frogs)**
- **Turnouts (as permitted in the BNSF Standard Plans)**
- **Bonded insulated joints**
- **Where special trackwork makes a full-length rail impossible to install**

Poor quality rail used for defect removal may itself become defective. One survey found that 17 percent of defects during the month measured were in rails installed to remove previous defects. To reduce the probability of replacement rail becoming defective, follow these requirements.

1. Do not use "A" rails or non-control-cooled rail 112# or heavier for replacement in main tracks, sidings, and crossovers off main tracks.
2. Select and install replacement rail that provides the best possible match on both the gage side and the running surface. The mismatch on the gage side and running surface may not be more than 1/8 inch.
   - When gage face offset between parent rail and temporary replacement rail exceeds 1/8 inch (.125), the temporary replacement rail's gage face must be tapered 6 inches for every 1/16 inch (.063) offset difference.
   - When a 36-inch straight edge is centered on the rail joint, the maximum distance between the rail gage face and any point on the straight edge shall not exceed 1/8 inch (.125).
   - The distance between the rail gage face and the straight edge shall not exceed 1/64 inch (0.015) at any point along the taper.
   - Permanent replacement rails for welding may not exceed 1/8 inch (.125) gage face difference.
3. Use replacement rail with good surface quality, with no corrugation, head checking, shelling, spalling, base knicks, corrosion, or gouges. Crop all thermite welds from replacement rail prior to installation.
4. Do not use rail branded "Algoma", "British", "1986, 1987, or 1988 Bethlehem Steelton", "Vilru", or "Workington".
5. Do not use Thyssen or Krupp Chrome Vanadium Alloy (AL) rail (see section 6.7.5A[8]).
6. Do not use Bethlehem fully heat-treated rail (see section 6.7.5A[7]).

7. Do not use rail recovered from the main body of curves relayed due to defects or rail surface condition.

8. Install rail of the same metallurgy. Do not install standard carbon rail in curves with premium rail.

9. On subdivisions with one or more of the following—passenger trains, AAR hazardous material key route, TIH/PIH evaluation route, maximum authorized speed greater than 25 MPH, or 20 MGT/year or more—secondhand rail installed in main tracks, sidings, and crossovers off main tracks must be certified that it has been ultrasonically tested for internal defects.

   On critical tracks, secondhand rail installed for defect removal, service failure repair, joint elimination, and derailment repair must be certified it has been ultrasonically tested for internal defects.

   Ultrasonically tested secondhand rail will be marked as follows on the base of the rail: UTT (for "ultrasonically tested")–Test Date–Test ID # (assigned by the Manager Rail Detection)–tester's initials. Rail acceptable for yard use only will be marked "YARD" adjacent to the UTT marking. If new rail or ultrasonically tested secondhand rail is not available and noncertified rail is used, it must be protected as follows with a temporary speed restriction until it is tested in track and marked UTT: If maximum authorized speed at location is greater than 25 MPH, place a 25 MPH temporary speed restriction.

E. Adjusting 85 Feet or Less of CWR

When CWR rail breaks (service failed rail) or is cut (saw or torch), the rail stress is relieved and the distance the rail moves while restrained by fasteners indicates the rail neutral temperature (RNT). Making match marks prior to cutting the rail allows you to determine the GAP distance, which is the change in the distance of the match marks after the rail is cut or its joint bars are removed.

1. Use the GAP distance and rail temperature to identify if the RNT was near the target neutral temperature (TNT) prior to the service failure or rail cut. Input the GAP distance and rail temperature into the Rail Adjustment Calculator found at http://udprd.bnsf.com/enme/mtex/Radj.html, to determine the PULL distance required to restore the RNT to near the area's TNT. This information forms the basis for the CWR Pull Chart and PARS Rail Removal work orders.

   Note: If there is a fixed object (switch, crossing diamond, road crossing, or open-deck bridge) within 400 feet of the rail adjustment, do not use this procedure.

2. The GAP distance can be:

   a. Zero (0) indicating that the rail was neither in tension of compression, so the RNT is the same as the current rail temperature.

b. Positive, indicating the rail was in tension, as the rail ends moved away from each other, so the RNT is greater than the current rail temperature.

c. Negative, indicating that the rail was in compression, as the rail ends ran together, so the RNT is less than the current rail temperature.

For example, if you are removing a rail defect and you have to torch cut the rail because the rail squeezed the saw blade, the GAP distance will be negative. As the current rail temperature is above the rail neutral temperature, the rail is in compression. The GAP distance equals the change in the distance between the match marks before and after the torch cut.

3. The PULL distance is the required change in the distance between the match marks to return the RNT close to the required TNT. For example, if you saw cut rail on wood tie track with a required TNT of 100° F when the rail temperature is 40° F and the GAP distance is 2.5 inches, the CWR Pull Chart indicates that a PULL distance of 3.25 inches is required to return the RNT close to a TNT of 100° F. The PULL distance is the required change in the distance between the match marks after the rail was cut and the final rail adjustment.

   The CWR Pull Chart is located on the CWR Rail Removal page under the Track Stability header located here: http://wfprd/approot/en_rail/en_cwr_rail_removal_work_orders.htm

4. If it is necessary to remove rail and it is not pulled enough or at all during the initial cut, PARS will generate a rail removal work order for the affected track location after all the rail temperature and GAP and PULL distances are entered into PARS.

   a. Rail removal work orders dictate how much rail is to be removed and are based upon the rail temperature and GAP distance reported in PARS at the time of the initial rail adjustment.

   b. Review auto-generated work orders on the CWR Rail Removal page under the Continuous Welded Rail Reports header located here: http://wfprd/approot/en_rail/en_cwr_rail_removal_work_orders.htm

   c. Using a yellow paint stick, write this information on the web of the rail, field side:

      - Welder's name
      - Year-to-date consecutive weld number
      - Weld date (month/day/year)
      - Rail temperature
      - GAP and PULL
      - Grinder's name

d. Refer to the below diagram for rail markings when adjusting no more than 85 feet of CWR.

5. Rail is considered adjusted to TNT, only if the CWR destress procedures under 6.2.3B are followed. If adjusting more than 85 feet of rail, follow the CWR destress procedures. The CWR destress procedures ensure that the rail is relaxed, while CWR rail adjustments allow the rail to be pulled through the anchors.

F. Using Match Marks

Use the following match mark procedures at any location where CWR rail is cut or repaired to remove a defect or to replace short sections of rail. If replacement rail is longer than 85 feet, use the Destressing Procedures in section 6.2.6, as appropriate.

1. Making Match Marks

a. Make match marks outside of the rail section to be repaired or removed. Match marks should be made:

- On the field side of the rail using a ball-point paint marker.
- At least 4 feet from any planned cuts or drilled holes in the rail.
- A whole number of feet apart.

b. If there is a gap due to broken rail or a pulled-apart joint, consider this gap when making the match marks. The match mark dimension is equal to the actual distance between the match marks minus the sum of the rail gaps between the match marks.

Note: For example, if the match mark dimension is to be 28 feet and the gap is 3 inches, then the actual distance between the marks is 28 feet 3 inches, and the match mark measurement is 28 feet.

c. Write the match mark measurement on the web of the rail next to both of the match marks. The markings should not be between the match marks.

2. Auditing Match Marks

Unless the rail has been destressed or re-laid, the distance between the match marks after final repair must be no greater than the match mark measurement.

G. Using GAP and PULL

1. Determining GAP

a. If there is no opening in the rail, make marks on the rail head outside of the location to be cut or unbolted. These marks should be a whole number of feet apart for ease of calculation. Make the cut or unbolt the joint and determine how much the rail ends moved. The amount of movement is the GAP. If the rail ends move apart, the GAP is a positive number. If they move together the GAP is a negative number.

b. If the rail is broken the distance between the rail ends is the GAP.

c. If there is one joint and the rail ends are not touching, remove the joint bars. The distance between the rail ends is the GAP.

d. If there are multiple openings in the rail, remove any joint bars and add up the total length of all of the openings; this is the GAP.

2. Determining PULL

a. Before pulling or applying heat to the rail, make marks on the rail head just outside the location to be pulled.

b. Repair the rail.

c. The distance that the marks move together is equal to the **PULL**.

d. If the rail is not pulled or heated to close an opening, then the **PULL** is equal to 0.

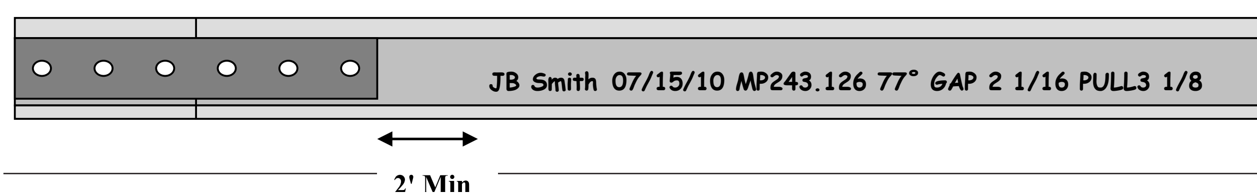
3. Recording GAP and PULL on the Rail

a. Bolted Joints

1) If a location is repaired using bolted joints, label one of the bolted joints within the repair location with the first initial, middle initial, and last name of the EIC; date; milepost location; rail temperature; GAP; and PULL.When labeling a joint, make sure the writing does not fall within 2 feet of a joint bar. This ensures that there is enough space for the welder to make the necessary marks when the rail is welded later.

2) If the repair area contains a plug rail, it is preferable to write the rail joint information on the plug rail.

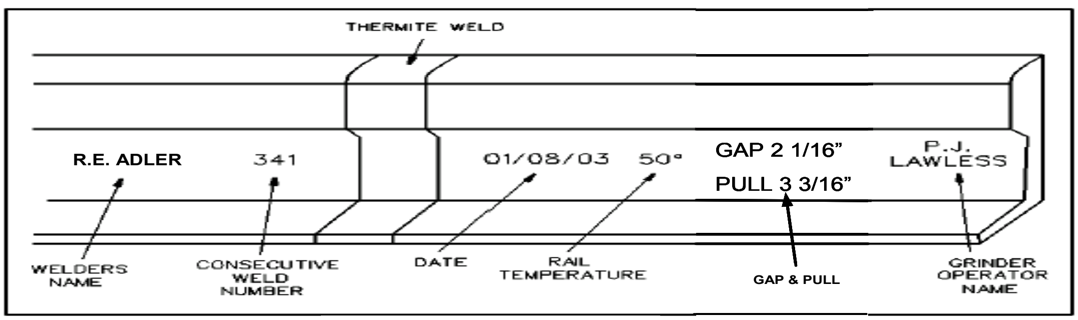
3) Record the information on the rail along with the rail position, for later entry into PARS.



b. **Welds**

1) Use a ball-point paint yellow marker to legibly print the following information in the web on the field side of the rail on each weld.

   - Welder's initials and full last name
   - Year-to-date consecutive weld number
   - Weld date (month/day/year)
   - Rail temperature
   - GAP and PULL
   - Grinder's initials and full last name

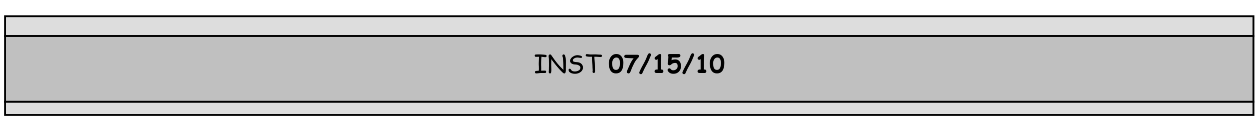


2) If there is more than one weld at a location, the first weld will show the gap value as determined above and a pull value of 0. The last weld will have a gap value of 0, with a pull value as determined above. Intermediate welds will have a GAP of 0 and a PULL of 0.

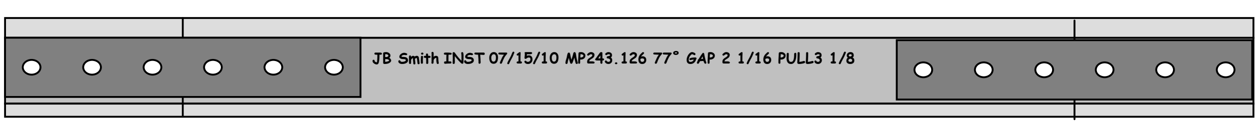
3) Record the information on the rail, along with the milepost location and rail position, for later entry into PARS.

H. Marking Replacement Rails

1. Mark each replacement rail with the installation date of the replacement rail.
2. Place the label in the field side web, in the center of the replacement rail.



3. If the replacement rail is bolted in place, combine the joint marking and replacement rail label into a single entry by adding the word "Installed" or "INST" between the EIC name and the date.



4. If the replacement rail is welded in place, mark the replacement rail with just the word “Installed” or “INST” and the date.

5. If the installation date is removed from a length of replacement rail in-track, label each remaining piece of the rail with the original installation date.

I. Marking Rail Added Locations Using Rail Anchors

If rail is added (GAP is greater than PULL), apply rail anchors on the field side to at least the first three ties on each end of the replacement rail, including replacement rail in concrete tie or Pandrol fastener territory (see Figure 6-8).

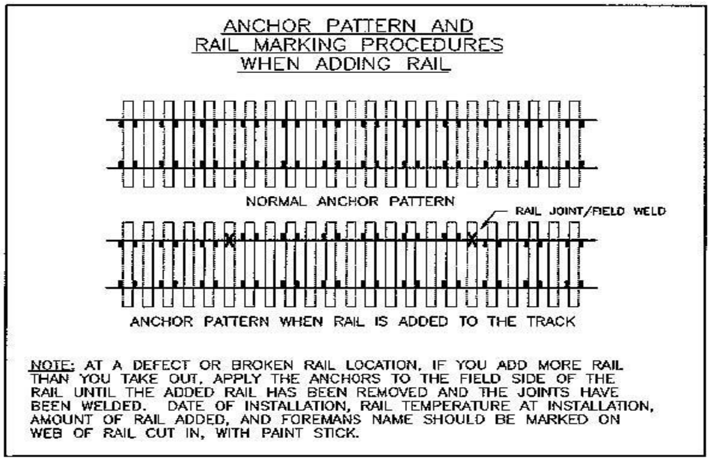


Figure 6-8. Anchor Pattern and Rail Marking When Adding Rail

1. Report the amount of rail added when you report the detected defect removed, or service failure repaired.

2. Adjust the rail according to the BNSF CWR policy. Return anchors to the gage side of the rail.

   Note: Anchors added in concrete tie and Pandrol fastener territory do not need to be applied to the gage side of the rail after adjustment.

3. Record adjustments to rail in PARS and in the Rail Adjustment Record (Form 16430-N; see Figure 6-4). Maintenance Support will enter the remedial action information into the rail record database to fulfill FRA rail inspection record requirements. Report remedial action information accurately and promptly to Maintenance Support.

J. Identifying and Removing Scrap Rail

1. If any rail must not be reused and must be scrapped due to a detected defect, service failure, or other condition:
   a. Paint with red enamel paint on top of the ball for the entire length of the rail. If paint is not available, use an oxy-acetylene torch or rail saw to cut the rail at least 1/4 inch deep across the top of the ball of the rail approximately 4 inches from each end of the rail removed from track.
   b. Write "SCRAP" on the top of the ball of the removed rail approximately at mid-point of the rail. Do not cut or torch the top of the ball of the rail at the half point.
   c. Before leaving the work site, complete the painting or permanent damage to the top of the ball of defective rail removed from track. The same day of detection, complete painting or permanent damage to the top of the ball of defective rails detected in replacement rail stockpiles.
2. When changing rail in the field, such as behind a detector car:
   a. Make every effort to take the old rail to the appropriate scrap storage area when the work is complete or at the end of the shift. If this is not possible, move the rail to a location on the right-of-way that is not in the walkway but is accessible for recovery with a boom truck.
   b. Remove rail left in other than a scrap storage area as soon as possible. Do not leave pieces of rail shorter than 12 feet unattended in areas with trespasser activity or environmental sensitivity.

K. Installing Temporary Rail Bridge

A temporary rail bridge is designed to allow train movement over a broken rail section with a *maximum 6-inch gap* until maintenance crews can install new rail.

1. Stop the train in advance of the broken rail. *Do not install the bridge before the train is completely stopped*.
2. Remove all ballast from the broken rail section and ties so the bridge lays flat on the rail.
3. Position the bridge over the broken rail as close to center as possible. Screw the handles in by hand to hold the bridge in position.
4. With a 1/2-inch ratchet, screw the handles all the way in until the springs are fully collapsed and you feel the bridge come up tight to the rail. (Do not over tighten, but make sure the spring is fully collapsed.)

5. Slowly move power over the bridge. *Then, stop the train*. This forms the bridge to the rail.
6. Re-adjust the clamps to ensure that the springs are collapsed fully.
7. Start the train over the bridge at 5 or 6 MPH. It is recommended that speed be kept in this range for the extended life of the bridge. At the installer's discretion, speed may be increased up to 10 MPH.

WARNING: This bridge can give a clear signal indication.

8. Remove the rail bridge immediately after the train passes to ensure accurate signal indication.

6.7.6 Damaged Rail

A. Damaged Rail Head

In the past, after a broken wheel or other incident severely damaged rail, the practice was to request an immediate test by an ultrasonic rail detector car. This response is not necessary. Broken or flat wheels or other high-impact loadings do not immediately introduce new internal defects into the rail; they are essentially a form of destructive testing for existing defects. Disrupting a detector car's test schedule to make a special test puts the car out of position, extends testing cycles, and increases the probability of rail service failures.

When the rail head has sustained significant damage from a broken wheel or other incident, initiate slow-order protection as follows:

1. Place a 10-MPH temporary speed restriction until the Roadmaster, Track Supervisor, Track Inspector, or Track Foreman visually inspects the rail from the ground, looking for cracks at impact locations in rail and welds in the head, web, and base.
2. If judged safe after this inspection, raise the speed restriction to 25 MPH.
3. Visually inspect the rail from the ground after 24 hours, looking for cracks at impact locations in rail and welds in the head, web, and base. If safe, return to normal speed.
4. Request the Manager Rail Detection to schedule an ultrasonic rail defect inspection to be completed as soon as possible, but in no more than 30 days.

B. Rail Base Repair Grinding

You may grind repair anchor nicks on the rail base caused by derailments. Make the repairs *only* by grinding. Repairs made within 30 days of the date of damage (derailment) require only a careful visual inspection of the repaired area, looking for transverse cracks. Repairs made after the 30-day limit require a dye penetrant inspection on each area where nicks have been removed.

Perform rail grinding as follows:

1. Do not excessively heat the rail base. Discoloring it is not allowed.
2. Grind so grinding marks on the rail base are parallel with the length of rail.
3. Do not allow the grinding depth to exceed .060 inches.
4. Ensure that no grind marks exceed .020 inches in depth. Remove sharp edges and blend the ground surface smoothly into the rail base profile.
5. If grinding is done 30 days after the rail is damaged, include a dye penetrant inspection per the penetrant manufacturer's recommendations.

C. Cutting Damaged Rail and Joint Bar Bolts

When cutting twisted rail, bent rail, or rail that has been subjected to intense heat, take precautions to prevent personnel from being struck by severed sections. Internal stress in the rail can result in an unpredictable release of energy when the rail or joint bar bolts are cut. You must take the following precautions when cutting twisted rail, bent rail, or joint bar bolts that may be under abnormal stress.

1. Do not use welding or cutting equipment at the scene of a derailment until the person in charge of re-railing operations advises that it is safe to do so. Material leaking from damaged cars may be explosive or highly flammable and the use of open flames must be controlled.
2. Use heavy equipment to stabilize the rail before cutting and during the entire cut, unless you are absolutely sure that it can be cut safely without its use. Before making the cut, all personnel not involved in making the cut shall be outside the "circle of safety". The dimensions of this safety zone are established during risk assessment and communicated during the job safety briefing.
3. Make the cut away from any visible twist, bend, or heat discoloration in the rail, when possible.
    - The person making the cut should be positioned on the undamaged end of the rail to be cut so as not to become caught between the rail and other objects if the rail shifts.
    - When using a cutting torch, the Operator should consider choosing a long cutting torch to increase the distance away from the location of the cut.

4. Do not cut or remove joint bar bolts on twisted, bent, or heat damaged rail unless absolutely necessary. A thorough risk assessment and job safety briefing must be completed prior to starting this work task.
   - When rail is bent or otherwise stressed and bolts must be cut to remove angle bars, cut the rail first to relieve stress, and then cut the track bolts.
   - Remember that rail that is twisted, bent, or under pressure may move in unexpected directions and often will break before it is completely cut.
   - Watch for track bolts and joint bars that can fly through the air for a significant distance if the track bolts are cut when the rail is under stress or bent.
   - Restrain or block bars before cutting the track bolts. Joint bars may be wrapped with a chain to secure their position.
5. Consult with your Supervisor should you have any doubts or concerns.

6.7.7 Rail Condition Exception Reporting

A. Dead Zone Locations

Rail in the following locations may be in a Dead Zone (see section 2.5.1):

- Some locations on turnout ties
- Ends of sidings from behind turnout up to insulated joint at clearance point
- Rail crossing diamonds
- Puzzle switches
- Road crossings next to flange rails
- Next to guard rails in advance of switch points
- Long bond locations
- Insulated joints from end post to track wire

Rail in any of the above locations with conditions such as shells, spalls, corrugation, or heavy head checking that prevent a valid search for internal defects will be classified as defective using defect code type 24, Shelled/Spalled/Corrugated (S/S/C). BNSF remedial action for an S/S/C in a Dead Zone is found in Table 6-7, which in part states, “Within 'Dead Zones', turnouts, or crossovers: within 5 days FRA-qualified exempt maintenance officer must also visually inspect rail and if judged necessary further limit operating speed.”

B. Rail Outside of Dead Zones

Whenever rail conditions such as shelled or spalled rail, heavy head checking, grease, or extreme wear interferes with the quality of the ultrasonic rail test outside of a Dead Zone, the condition will be classified as a Shelled/Spalled/Corrugated BNSF defect type 24, if less than 40 feet in length, and as a Rail Exception BNSF defect type 27, if greater than 40 feet in length.

C. Division Responsibility for Rail Exceptions

1. See Table 6-7, BNSF Remedial Actions. An exempt maintenance officer must visually inspect within 14 days. After inspecting, report remedial action as code "X." If judged necessary, limit operating speed until rail is removed (code "R"), or until the condition is corrected and a valid search for internal defects is conducted (code "T"). For the search to be valid, the Detector Car Operator must be informed that he or she is testing a previously identified rail exception. If the search is valid, the Operator will mark the base of rail as follows: VT (for valid test) – test date – car ID. Do not show condition corrected and retested (Code "T") unless Operator marks the rail.

2. Initiate whatever action is necessary to address the condition; for example, cutting in replacement rail for short lengths, or requesting rail relay for long lengths. The root cause of some rail surface conditions may be wide gage (especially center-ball spalling on concrete ties), irregular track alignment or surface, or poor tie condition. These conditions should be corrected to keep rail surface from continuing to deteriorate. If the condition is correctable by rail or switch grinding, notify the Supervisor Rail Grinding or the Supervisor Welding when the machine is scheduled for the territory and they request advance information on rail surface conditions.

3. If condition is not corrected and a valid search for internal defects conducted before the required period expires, place the required speed restriction on the location until corrected and a valid search for internal defects is conducted.

   The period between valid tests may not exceed:

   - For Class 4, 5, and Class 3 over which passenger trains operate or which is a key route, the lesser of:
     - 30 MGT accumulated traffic
       or
     - 1 year
   - For Class 3 without passenger trains and not a key route, the greater of:
     - 30 MGT
       or
     - 1 year
   - For Class 1 and 2:
     - No requirement

   Period is the time interval between the last valid test performed prior to rail exception reporting and the date of required track class reduction.

   Report remedial action as code "Y" after placing required speed restriction.

D. System Responsibility for Rail Exceptions

1. Managers Rail Detection will monitor test frequency of excepted rail and notify Roadmaster and Division Engineer when conditions must be addressed to ensure effective test and avoid FRA-required speed restriction.

2. The Manager Rail Maintenance and Manager Track Welding will distribute a list of "open" (code "R" or "T" not reported) rail exceptions to rail grinders and switch grinders. If possible, Supervisors Rail Grinding will preinspect rail exceptions due to poor rail surface condition. Rail grinders and switch grinders will attempt to address conditions correctable by grinding.

6.8 Unloading and Loading Rail

6.8.1 Rail Train Movement

A. Handling Loaded Rail Trains

Follow these requirements for handling loaded rail trains:

1. Do not exceed the maximum authorized speed of 35 MPH. The maximum authorized speed on curves of 6 degrees or more is 25 MPH.

2. Do not let empty or loaded trains be kicked or impacted by kicked cars.

3. Make sure buffer cars are at both ends of a loaded train, except during switching, train make-up, loading, or unloading moves. Tunnel cars with barrier doors eliminate need for buffer cars if doors are closed and secured.

4. Do not separate loaded welded rail cars for maintenance or repair unless directed by a Roadmaster or Engineering representative. Do not separate winch and ramp cars from each other unless directed by a Roadmaster or Engineering representative.

B. Rail Train Make-Up

Follow these requirements for making up the rail train:

1. **Single Loaded Rail Trains**

   a. Handle trains without rail movement detectors (RMDs) as follows:

      1) Rail train must be handled in special service.

      2) Rail train must not be required to make setouts and pickups enroute.

      3) The rail train must have suitable cars placed at each end of loaded cars to act as a buffer and idler, unless the tunnel cars have barrier doors in the closed position.

4) When moving between unloading locations and MW personnel are not accompanying movement, the train must have buffer and idler cars placed immediately adjacent to loaded rail cars (for example, if winch and ramp cars are included in the movement, buffer and idler cars will be between the winch and ramp cars and loaded rail cars).

b. Trains with RMDs (see section 6.8.1D) may be handled in trains other than special service under the following conditions:

1) Rail train must be on the head end.

2) Rail train should not be required to make setouts and pickups enroute.

3) Suitable cars must be placed at each end of the loaded rail train to act as a buffer and idler, unless the tunnel cars have barrier doors in the closed position. Rail cars equipped with barrier plates or cars labeled "Buffer/Idler" in addition to other cars taller than the height of the top rails on a loaded train meet this requirement.

4) If cars other than the loaded rail train are included in the movement, and the RMD (such as strobe lights) becomes inoperative enroute, a maintenance representative (rider) must accompany each train during transit, unless the rail train is then moved in special service.

When the RMD is inoperative, each time the train stops the rider must inspect the cars carrying the continuous welded rail for shifted, bowed, or broken rail. Also rider must ensure that each base clamp (tiedown block) is tight. Defective strobe lights must be reported to the Train Dispatcher, who will notify the Manager of the rail facility to document problems and arrange for repairs as soon as possible.

5) Strobe lights at each end ramp car must be observed frequently enroute. When observed flashing, stop the train and inspect all cars carrying continuous welded rail to determine any rail movement. If movement occurs, observe and complete the following:

- If adjacent track or standard clearances are not fouled, you may move the train to clear the main track. Do not exceed 10 MPH.
- If adjacent track or standard clearances are fouled, provide protection. Do not move train until proper personnel inspects it.

If no movement occurs, cancel the flashing strobe lights by pressing the reset button at the control box for 3 seconds. Then the train may proceed at restricted speed.

Note: When the rail train is moving between unloading locations and MW personnel are not accompanying the movement, place buffer and idler cars immediately adjacent to the loaded rail cars (for example, if winch and ramp cars are included in the movement, buffer and idler cars will be between the winch and ramp cars and loaded rail cars.) Buffer and/or idler cars are not required if the tunnel cars have barrier doors and the doors are closed.

2. **Two Rail Trains**

   Follow these requirements for two rail trains:

   a. The two rail trains move together in the same train only when the Manager Rail Complex, Manager Rail Trains, or Director Rail authorizes the movement.

   b. When a movement of two rail trains is authorized:

      1) The Engineering representative will designate which train will be placed in the head end.

      2) The other train must be positioned immediately at rear of first train.

   c. Information in section 6.8.1A and 6.8.1B(1) applies to both rail trains.

   d. Buffer and idler cars must be placed between loaded trains, unless both trains have closed barrier doors on the tunnel cars coupled together.

C. Position of Rail Strings

Ensure that the rail strings are properly positioned as follows:

1. Apply a paint stripe across the top of the rail between the tiedown stands on the center of the rail train tiedown car. Apply the stripe so those at inspection points can determine whether the rail has slipped or shifted.
2. When a rail string ends on the tunnel car, ensure that the rail ends are between the red stripes painted on the car.
3. When rail is suspected of moving, inspect the string at the tiedown car for movement. Hold the train and contact the Manager Rail Complex, Supervisor Rail Complex, Manager Rail Trains, Supervisor Rail Trains, or Director Rail for instructions. Also, notify the Roadmaster.

D. Observing Rail Movement Detectors

Some rail trains may be equipped with rail movement detectors (RMD) to alert train crews if rail strings loosen during movement. The RMD system consists of:

- Electrically activated screens or gates
- Four amber-colored strobe lights
- Controls
- Two 12-volt gel cell batteries charged by solar cells that power the system

RMDs are installed on tunnel cars on each end of rail train. If a rail string loosens and touches the screen, strobe lights begin flashing. Inspect the RMD as follows:

1. RMD must be verified as operative by touching wire to screen and any rail.
    a. If the lights flash, reset the system.
    b. If the RMD system (strobe lights) becomes inoperative enroute:
        1) Have the Roadmaster or the Roadmaster's designated representative accompany the rail train in transit (rider).
        2) Each time the train stops, inspect the cars for shifted, bowed, or broken rails.
        3) If any of the above or other unusual conditions exist, hold the rail train and contact the Manager Rail Complex, Supervisor Rail Complex, Manager Rail Trains, or Director Rail for instructions.
        4) Report the defective strobe lights to the MW desk, NOC desk, and the Manager Rail Complex so the lights can be repaired as soon as possible and Maintenance of Way personnel can be designated to escort the rail train as necessary.
2. Enroute, the train crew must frequently observe end ramp strobe lights at each end of the ramp car. If the lights are flashing:
    a. Stop the train immediately and inspect rail cars to determine rail movement. Provide flag protection on the adjacent track until it is determined that the train is not fouling the adjacent track.
    b. If a rail has moved and it is safe to do so:
        1) Move the train to clear the main track. Do not exceed 10 MPH.
        2) Have the Roadmaster or the Roadmaster's representative inspect the rail train and adjust the rail and tiedowns as necessary.
    c. If a rail has not moved:
        1) Cancel the flashing strobe lights by pushing the reset button at the control box for 3 seconds.
        2) Allow the train to proceed at authorized speed.

6.8.2 Unloading CWR Trains

Prior to the rail train's arrival, complete a pre-job survey. During this pre-job survey, ensure that marking exists where each project will begin and end, and note locations where rail unloaded may need additional support due to roadbed conditions or structures. Examples of where additional support may be required are:

- If the roadbed at the toe of the ballast is not wide enough to keep the rail from sliding down a fill, fence posts may need to be driven into the fill to support the rail until the relay occurs, and to support the rail removed until it is recovered.
- Bridges or overpasses may need ties inserted under the rail and extended to the field side for the rail being unloaded to rest on, or the rail may be chained to the track structure as a means to provide support. *The Supervisor Structures will need to approve either of these methods to support rail on bridges or to have existing walkways support rail.* Alternatively, the rail may be unloaded adjacent to the bridge, in which case the rail gang will need to drag the rail into relay position prior to the relay.

The employee in charge of CWR unloading must have the following qualifications:

- Is MWOR qualified. Knows how to obtain and interpret Engineering Instructions, System General Orders, Superintendent Notices, Track Condition Messages, and System Work Train Policy.
- Has trained to unload CWR by unloading at least three rail trains under the direction of a qualified employee in charge.
- Has working knowledge of the requirements of all MW positions involved in rail unloading.
- Is familiar with rail unloading equipment and rail trains.
- Is able to read and understand rail train loading/unloading diagrams.
- Has working knowledge of oxy-fuel torches and air/hydraulic power tools.
- Has scored 90 percent or higher on online test for employee in charge of CWR unloading. This test is located at the following Intranet site:

  http://topudspd3001.iss.bnr.com/cgi-bin/enme/Safety/dynamic_content.cgi?DIRECTORY=/Special_Programs/Loading%20-%20Unloading%20CWR. Select "Test for Employee-in-Charge Unloading Rail."
- Has excellent verbal communications skills.
- Is familiar with Rail Relay Gang requirements.

Inspect rail unloading equipment before unloading rail to verify it is working as intended.

Each Roadmaster responsible for rail unloading will complete a Rail Unloader Car Quality Feedback Report and fax it to the next Roadmaster to receive the rail train, the Manager Rail Complex, and the Manager Rail Trains. This Quality Feedback Report will be included with each rail train unloading diagram.

A. Job Briefing

Before unloading continuous welded rail, conduct a job briefing with all train crew and Maintenance of Way team members to review applicable instructions and circumstances that could occur, assess fire risk, and complete a Fire Risk Assessment Form. The standard Job Briefing form is at the following Intranet site:

http://topudspd3001.iss.bnr.com/cgi-bin/enme/Safety/dynamic_content.cgi?DIRECTORY=/Special_Programs/Loading%20-%20Unloading%20CWR.

Cover the following items:

1. **Discuss Communication Requirements**

   Discuss the following communication requirements at the job briefing:

   a. Designate a radio frequency where unloading operations will be uninterrupted.

   b. Have the Brakeman in the lead unit monitor the road channel and obtain lineups for the adjacent track if unloading in multiple track limits.

   c. Distribute and test portable radios.

   d. Establish a radio procedure for "IMMEDIATE STOP" of operation. Radio failure or interference must be considered a Stop signal.

   e. All people involved in unloading must view the video entitled "Unloading Continuous Welded Rail" before unloading each rail train. If the unloading process is extended, the video must be viewed at least weekly until the rail unloading process is complete.

   f. Discuss required tasks and responsibilities to unload rail safely and efficiently.

   g. Make sure the walkways are properly positioned between the rack cars.

2. **Instruct Train Crew**

   Coordinate train crew responsibilities at the job briefing as follows:

   a. Discuss the System Work Train Policy (see section 13.2).

   b. Discuss that when unloading rail, the employee in charge can communicate directly with the Engineer after notifying the Conductor.

c. Instruct Maintenance of Way employees not to access the train's air line to feed the air impact wrenches on trains so equipped. Use the service line to provide the required air for the air impact wrenches.

d. Discuss the procedures for stopping the train and the different methods of moving the train.

e. Instruct Engineer to avoid slack action and unnecessary reverse movements.

f. Instruct the Engineer to move the train only *when authorized by the Maintenance of Way employee in charge.*

3. Discuss Hazards

Listed below are potential hazards of unloading continuous welded rail. Discuss these hazards and others during safety orientations, during job briefings, and when they occur in the field. Hazards other than the following may exist depending on local conditions.

a. Anticipate "slack action" of the rail train at all times.

Note: "Slack action" is car movement under rail caused by couplers, cushioning devices, etc. This movement can create many hazards such as pinch points and bowing of rail.

b. Anticipate rail kinking at any time and at any point during the unloading operation. Secure rail at one point only. Rail secured at two points can kink suddenly and unexpectedly.

c. Stay clear of areas where cable or chains could fail (such as stabber chains or winch cable).

d. When using the winch cable to pull the first rail over the ramps and through the threader boxes, have the train sitting on tangent track to avoid rail rollover. Make sure all employees are clear of the winch cable to prevent injury in the event of cable breaking or moving laterally.

Keep the train stationary when the winch cable is attached to the rail and the rail is tied down at the tiedown car.

e. When unloading up or down a grade, expect the rail to move and take every precaution to avoid rail movement.

f. Expect the rail to roll over at any point during the unloading operation. Keep away from moving rail at all times.

g. Support rail at all times using every ramp on the ramp and tunnel cars. Rail not supported by all ramps tends to roll over.

h. When behind the unloading operation, wait to remove the chain or fishplates until both strings being unloaded are on the ground.

i. Stay clear of a rail being torch cut. If cutting the rail, position yourself to avoid injury if the rail swings out and drops.

j. When a free rail-string end passes through the tunnel cars:

1) Make sure there will be no movement on adjacent tracks until the rail end is on the ground.

2) Keep clear of the tunnel cars.

3) Stay clear of pinch points on winch and ramp cars.

k. Do not use stabber chains with former BN winch/ramp sets. These sets are equipped with constant pressure top roller threader boxes. The constant pressure feature will push the top threader roller into any gap between rail strings being unloaded and the trailing string will hit the top roller, kinking rail, breaking the stabber chain, and damaging the threader box. Use fishplates and bolts to join strings being unloaded with former BN winch/ramp sets.

l. Each time before using a stabber chain, inspect the handles to make sure they are not bent or cracked. Do not use defective stabber chains.

m. Before joining rail strings:

1) Stop train movement.

2) If the train does not stop so that a joint can be made, winch out the rail on the train to make the joint rather than reverse the train.

3) Position your hands to avoid pinching them between fishplates, stabber chains, and the rail.

4) Once the strings are connected, safely clear the area.

5) Do not position yourself between the rails.

n. Do not ride on any car when the train is in motion, except the tiedown car (on the platform with handrails), tunnel car (on the platform with handrails), winch car (between the handrails or in the Operator's chair), engine, caboose, or rider car. This includes both during the unloading operation and while moving between unloading locations.

4. Review Train Loading Diagram

Review train loading diagram with members of unloading crew. Point out rail that are fishplated together and how each fishplated rail will be handled.

B. Train Make-Up

Make up the train as follows for the unloading operation:

1. Use at least two locomotive units equipped with a pacesetter or rheostat control, if available. Additional locomotive units may be required depending on local conditions (grade, etc.).
2. Use this recommended train consist from rear of train to head end:

   Locomotives - winch car - 2 ramp cars - rail cars - tiedown car - rail cars - buffer cars

C. Recommended Employee Positions and Required Equipment

To optimize production it is recommended employees involved in the unloading operation be positioned and have the proper equipment as indicated in Table 6-8.

Table 6-8. Recommended Employee Positions and Required Equipment to Unload Rail.

Position	Employees	Equipment
Lead Unit	Brakeman Engineer	Portable radio Applicable safety equipment
Winch and Ramp Car	Machine Operator Two MW employees Welder or other qualified employee Conductor Employee in charge	Portable radio A-frames Shovels Lining bars Fishplates or chains Nuts and bolts Oxygen, acetylene, and torch
Tiedown Car	One or two MW employees	Portable radio Wrench Lining bars Track jacks Sledge hammer
Ground	Truck driver MW employee	Portable radio Shovels Lining bars Hy-rail

D. Unloading Procedure

Follow this procedure when unloading CWR:

1. **Prepare to Unload CWR**
   a. Once the train consist is properly made up for unloading, position the train as close as possible to where the first rail will be unloaded (on tangent track where possible) and set the brakes.
   b. Hold a job briefing where the first rail will be unloaded. When track time will not allow an onsite job briefing, hold the job briefing at the closest point to the unloading location.

c. Take your position and thoroughly inspect tools, equipment, chains, and cables. Notify the Maintenance of Way employee in charge of defects.

d. If tiedown car is equipped with a compressor, tiedown personnel must perform a pre-start check of the compressor per the manual on the car.

e. If using stabber chains, bolt them to the rail.

2. Thread Winch Cable

After the tool inspection is complete, have the Winch Car Operator begin letting out slack in the winch cable. Do the following:

a. Hand pull the winch cable through the threader boxes and over the ramps to the first rail to unload.

b. Use the approved assembly provided with the rail train to attach the cable to the first rail. Once the assembly is secured through the first bolt hole on the rail end, the rail is ready to be pulled through the threader boxes with the winch.

> **Do not move the train once the cable is attached and the rail is still tied down.**

3. Loosen Rail

When the winch cable is threaded, the Maintenance of Way employee in charge instructs those on the tiedown car to loosen the rail to be unloaded.

a. When possible, start with the outside rail and work inward.

b. Initially, loosen only the bolt; do not remove the block.

c. If the rail does not move under its own weight, fully loosen the bolt and remove the block. On 4x10 trains with three-bolt tiedown block, replace the block between the rail being unloaded and the adjacent rail with a "temporary" block (green) supplied with the train.

d. Use caution when unloading up or down steep grades. Leave the tiedown block in place.

e. Be prepared to re-tighten the bolts, if necessary.

f. Always expect rail to move and be careful to keep clear of it.

4. **Thread Rail**

   An employee on the tiedown car notifies the Maintenance of Way employee in charge when the rail is loose. Thread the rail as follows:

   a. Clear employees from the area. Ensure that they are either on the ground or behind the cage on the winch car.

   b. After employees are in the clear, instruct the Winch Car Operator to use the winch to pull the rail through the threader boxes. On former BN winch cars, where winch and threader box arrangement on the winch car prevents threading the cable through the fixed and swing out boxes:

      1) Pull the rail end to within a few inches of the fixed threader box on the end of the winch car.

      2) Place the rail end in the "funnel" for the fixed threader box. All ramps should be in contact with the base of the rail at this point, with the rail end resting on the floor of the funnel.

      3) Attach the cable a minimum of 30 feet back from the rail end using the supplied rail clamp.

      4) Use the ramps and traversing threader box to steer the rail into the fixed box while pulling the rail with the winch.

      5) Thread rail through all threader boxes to safely unload rail.

5. **Secure Rail**

   Once the rail has been safely pulled through the last guide box, secure the rail to the A-frame, which has been inserted onto the existing running rail for unloading. Have employees position themselves for train movement. If rail was thread through boxes on tangent track, move the train very slowly and smoothly to the A-frame location.

   Note: A-frames are extensions that hook to the inside rail base between the ties and extend outward about 3 feet to the point that the rail string is attached with a clevis or 3- to 5-foot piece of heavy chain or wire rope.

When securing the rail, do not reach over the existing rail in track.

6. **Thread Rail on Opposite Side**

   If unloading rail on both sides, repeat steps 1 through 5 for the opposite side.

7. **Move Train**

   The MW employee in charge notifies employees that the train is preparing to move. Have the Engineer move the train as follows:

a. Begin moving the train at walking speed to unload the rail.

b. If there are no problems with the connections and enough rail is on the ground, increase train speed, but do not exceed 5 MPH.

c. If rail turns over on the train or unloading equipment, unload the rail that is turned and rethread the next rail into the unloading cars. (Repeat steps 2 through 7.)

The MW employee in charge must visually supervise unloading operations over road crossings, bridges, turnouts, and other locations of close clearance and ensure that unloaded rail is clear of the rail train at all times.

8. Unload Additional Rail

The employee on the tiedown car notifies the MW employee in charge when the rail end passes the tiedown car. Tiedown car personnel should place tiedown plates back in position in empty pockets when safe to do so. Hand tighten bolts only. *Do not use impact wrench to tighten bolts in tiedown plates in empty pockets.* Unload additional strings as follows:

a. Instruct the tiedown car to loosen the next rail, taking the same grade precautions outlined in section 6.8.2D(3).

b. Have the employee on the tiedown car notify the MW employee in charge when the next rails are loose and ready to be unloaded.

c. As the rail end approaches the tunnel car, have the train slow to 1 or 2 inches per second. Connect the rail as follows:

1) Stop train as end of rail being unloaded aligns with end of next string to be unloaded.

2) With the train stopped, use fishplates or chains to join the end of the rail being unloaded to the next rail to be unloaded. If it is necessary to move the rail to join the rail ends, you must use the winch or a coffing hoist to draw rail ends together. Never make a reverse movement with the train to make a rail joint.

3) Be careful when placing your hands on the fishplates or chains to avoid pinching your hands or fingers.

4) Once the rail is successfully stabbed or fishplates applied, immediately clear away from the chain and stabbed or joined rail.

5) Follow steps 1) through 4) on the opposite rail.

Note: The train should continue very slowly until the new rail has passed through the threader boxes and is on the ground.

6) Carefully watch the rail connection as it passes over the ramps and through the threader boxes to prevent the rail from being hung up.

7) Once the next rail end is safely on the ground, have the train proceed at a safe unloading speed, but not more than 5 MPH.

8) When both adjoining strings are completely on the ground, remove fishplates or stabber chains; separate and offset string ends; 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. Return fishplates or stabber chains to winch car.

9. Torch Cut Rail

If needed, torch cut rail at road crossings, bridges, and other locations. Try to keep the number of torch cuts to a minimum to reduce installation delays. To torch cut rail:

a. Stop the train and apply the brakes.

b. If cutting between main tracks, place lookouts and obtain train lineup information for the adjacent track.

> **If the rail end is past the tiedown car, secure the rail before torch cutting the rail or moving the train.**

c. Secure the rail, if necessary.

d. Position yourself between the threader box and the torch cut location. Stay outside of the rail and keep your feet clear of where rail will drop.

e. Clear other employees away from the rail before beginning to cut.

f. Cut rail so that the final cut with the torch is on the outside of the rail.

g. Before moving the train to the next location, make sure the rail is secure.

> **Do not secure the rail at two locations at the same time.**

E. Preparing Train for Movement Between Unloading Locations

Secure all rail before moving to the next location. Trains with strings not long enough to reach the tiedown car near the center of the train may have an additional tiedown car placed near the unloading end by the rail complex. Use this tiedown car only when rail is not long enough to reach the tiedown car near the center of the train. Follow these requirements.

1. When MW forces do not accompany loaded train movement, you must switch buffer cars in immediately adjacent to loaded rail cars, unless train is equipped with barrier doors on the tunnel car. If tunnel car is equipped with barrier doors, those doors must be closed and secured.
2. When MW forces accompany movement from one unloading location to another, you may leave the train in the unloading configuration.

F. Unloading Rail on Bridges

When unloading rail on bridges contact the Structures Supervisor in advance of the work to approve the best method to support the rail on the bridge.

The preferred method of unloading rail near a bridge is to stop short of the bridge or lay the rail adjacent to the bridge and move the rail into position during the relay to minimize damage to the bridge. When this is not possible use these guidelines:

- On bridges with walkways, the rail can be unloaded onto the walkway; however, the rail must be uniformly supported across the entire length of the walkway to avoid point loading and damage to the walkway. Do not allow equipment on the walkway.
- On open-deck bridges without walkways, install supports between the ties to unload the rail onto.
- On ballast-deck bridges without walkways, a support should be added to unload the rail onto, or the rail should be unloaded adjacent to the existing track structure depending on the span type.
- Install rail supports that prohibit movement of the rail and support members during normal train operation. Remove all temporary supports from the structure as soon as practical.
- Direct questions on the design of rail supports to the Structures Engineering Department.
- Do not leave unsecured rail ends on bridges.

In all cases it is important to handle the rail in a manner that does not damage the structure around it. If damage does occur to the bridge or walkway, protect the area and report it immediately to the Structures Supervisor.

6.8.3 Unloading Rail With Herzog Rail Unloading Machine

Before unloading rail with any equipment, complete a pre-job survey identifying how unloading rail will be handled around or through obstructions such as road crossings, bridges, turnouts, etc. Instead of cutting the rail at these locations, consider unloading the full string of rail on one side or the other of these locations. If unloading rail up to or through road crossings, refer to Engineering Instruction 1 Safety, specifically section 1.11, for flagging requirements.

Unloading rail with the Herzog rail unloading machine (RUM) requires one BNSF employee in charge at the machine to direct Herzog where to unload the rail, and at least one BNSF employee on the tiedown car to untie CWR strings. If the rail unloading plan calls for rail to be torch cut, either the employee in charge or another BNSF employee at the machine must be torch-qualified to cut rail. If torch cutting rail, use only BNSF equipment, following the requirements of Engineering Instruction section 11.17, BNSF Safety Rules, and the Track Welding Manual.

The Roadmaster or designee should contact the Herzog representative designated on the rail train shipping notice to advise of the unloading plan for that train.

Everyday before commencing work, the BNSF employee in charge will review Herzog's operational checklist to confirm that Herzog employees have performed the required inspection and maintenance procedures. At the end of the workday, the employee in charge will also review and signify agreement with a daily production form maintained by the Herzog Operators by signing form in the space provided.

The necessary work train consist for unloading with Herzog RUM is Locomotives - Kit Cars (if unloading OTM in same operation as rail) - Rail train - Herzog RUM.

- Equipment and tools the unloading crew needs to supply are:
- Cutting torch, including hoses, regulators, and full bottles (if required)
- Two 1-1/2-inch track wrenches to remove fish plates (if unloading fish plated rail)
- One pinch bar (for tiedown car)
- One sledge hammer (for tiedown car)
- Portable radios (at least two) with spare battery

A job safety briefing entitled "Unloading CWR with the Herzog Rail Unloading Machine" may be found on the Engineering Safety Web page.

During the unloading process, BNSF EIC should monitor the height of RUM threader boxes, ensuring that rail is not forced into a severe vertical curve. If the rail is not supported by the tunnel or the first roller on the train beyond the tunnel, stop and have operators adjust the threader boxes to provide a smooth transition of the rail from train to ground.

If any pusher roller slip or smoking is detected, stop unloading operation immediately and determine cause. Inspect the rail where slippage and/or smoking occurred and work with Herzog Operators to correct problems before continuing the unloading process.

A. Torch Cut Rail

If needed, torch cut rail at road crossings, bridges, and other locations. Keep the number of torch cuts to a minimum to reduce installation delays. To torch cut rail:

1. Stop the train and apply the brakes.
2. Notify Engineer you are going to be "In Between" and wait for response of "Set and Centered" from the Engineer before approaching rail to begin the cut.
3. Have Herzog Operator lower all threader boxes as low as possible.
4. Have Herzog Operator isolate the controls at the seat.
5. If cutting between main tracks, place lookouts and obtain train line-up information for the adjacent track.
6. Position yourself between the threader box and the torch cut location. Stay on the field side of the rail and keep your feet clear of where rail may drop and turn over.
7. Place spark shields, one between the rail to be cut and the Herzog RUM and the other to the field side of the rail to be cut.
8. Clear other employees away from the rail before beginning to cut.
9. Cut rail so that all sparks are directed away from the Herzog RUM, with the final cut on the field side of the base of the rail.
10. Have Herzog Operator re-activate controls at the seat and position threader boxes so rail is positioned to not contact track structures or other obstacles.

Do not secure the rail at two locations at the same time.

B. Preparing Train for Movement Between Unloading Locations

Herzog RUM may be used to restrain rail movement between unloading locations. Rail must be clamped in powered boxes. Be careful to ensure that the trailing end (opposite end from RUM) of rail string is at least 10 feet from the nearest support.

6.8.4 CWR in Open-End Gondolas

A. Precautions

Trains handling open-end gondola (including barricaded flat cars) consists loaded with short lengths of welded rail are governed by these transportation instructions:

1. Do not exceed 45 MPH.
2. Do not kick an open-end gondola consist loaded with welded rail or allow other kicked cars to strike it.
3. Do not uncouple any cars in an open-end gondola consist while loaded.
4. Handle a loaded open-end gondola consist within 25 cars of the head end unless authorized otherwise by the Manager Rail Complex, Supervisor Rail Complex, Manager Rail Trains, or Director Rail.

B. Loading Requirements

When loading welded rail into an open-end gondola consist:

1. The maximum safe length of rail to ship is 410 lf. Actual maximum length of rail to ship is based on number of gondolas used and sum of car lengths.
2. If using flat cars with barricades with open-end gondolas, make sure they are not the end cars. In addition, the outboard rails on these flats must be continuous in length loaded on the flat car.
3. Support continuous lengths of welded rail on hardwood timbers that are at least 8 inches wide by 6 inches tall extending across width of the gondola.
    - There should be four of these timbers per car.
    - The outboard or car end timbers (referred to as "delimit timbers", 2 each) are constructed with mechanical barriers or fenders to prohibit rail contact with sharp edges of the gondola.
    - The inboard timbers (referred to as "bearing timbers", 2 each) are equally spaced through the length of the gondola.
    - All timbers are secured to the gondola to prevent displacement.
    - Timbers will provide friction to limit rail shifting and contact with car.

4. Do not load continuous lengths of welded rail more than one layer high.
5. Make sure the width of the layer is no more than 67 percent of the inside car width of the narrowest gondola.
6. Spot the rail ends far enough into the gondola consist to accommodate coupler slack based on the number of cars used. In addition, the ends of each rail string must be positioned over/from timbers likewise.
7. Barricade the outboard ends of the open-end gondola consist with drop ends or array of timbers after loading. The barricade must be higher than the rail.
8. Secure all car couplers to keep them from opening accidentally. Use suitable devices (e.g. gag and lock or pinned bar in rotor lift pin, chained cut lever).

C. Shipping Notices

When billing an open-end gondola consist carrying short lengths of welded rail, the shipper must notify the MW Desk of the shipment advising that it is governed by System Special Instructions #7, Rule 36 (paragraph "Open-end Gondola Consist").

This information also must be included in the bill of lading for the Waybill Center so that it can be noted on the billing to enact all movement restrictions.

6.8.5 Loading Rail With Pickup Unit

Conduct a job briefing as outlined in section 6.8.2A where applicable. The standard Job Briefing form is available at the following Intranet site:

http://topudspd3001.iss.bnr.com/cgi-bin/enme/Safety/dynamic_content.cgi?DIRECTORY=/Special_Programs/Loading%20-%20Unloading%20CWR

When loading strings of jointed or welded rail with a pickup unit onto a rail train, the employee in charge of CWR loading must have the following qualifications:

- Is MWOR qualified. Knows how to obtain and interpret Engineering Instructions, System General Orders, Superintendent Notices, Track Condition Messages, and System Work Train Policy.
- Has trained to load rail strings by loading at least three rail trains under the direction of a qualified employee in charge.
- Has working knowledge of the requirements of all MW positions involved in rail loading.
- Is familiar with rail loading equipment and rail trains.
- Has working knowledge of oxy-fuel torches, air and hydraulic power tools.

- Has scored 90 percent or higher on online test for employee in charge of CWR loading. This test is located at the following Intranet site:

  http://topudspd3001.iss.bnr.com/cgi-bin/enme/Safety/dynamic content.cgi?DIRECTORY=/Special_Programs/Loading%20-%20Unloading%20CWR. Select "Test for Employee-in-Charge Loading Rail."

- Has been approved as qualified to load rail by the Manager Rail Trains.
- Has excellent verbal communications skills.
- Is familiar with Rail Relay Gang requirements.

The employee in charge will communicate with the following:

- Loader train personnel
- Engineer
- Loader Car Operator
- Tiedown car person

Good communication is essential for successful loading operations.

A. Rail Train Description

The rail train usually consists of 27 to 30 cars that include 2 buffer cars, a tunnel car on the unloading end, and a tiedown car in the middle. Buffer cars are not required if the tunnel cars have barrier doors.

A five-car loading unit is designed to load rail simultaneously from both sides of the track. The loading unit consists of a power car, tool car, threader car, two companion cars, and a threader unit.

Tunnel Cars. The tunnel cars have an adjustable ramp that is raised or lowered by hydraulics or a chain hoist. The cars also have stripes painted on them to help employees position the rail.

Tiedown Car. The tiedown car is in the middle of the train. The rail is fastened to the tiedown car with a friction plate on tiedown stands to keep the rail from moving. Do not restrain or secure the strings at more than one point.

Power Car. The power car can positively engage the head and base of a rail between two large double flange wheels for the head and two flat wheels for the base. The car also can move the rail in either direction and load two strings, one on each side, at the same time while the train is moving or standing still.

Tool Car. The tool car is a converted boxcar equipped with parts and accessories, tools, and supplies essential for pick-up operations.

Companion Cars. The companion cars:

- Have stationary threaders on one end and movable threader boxes on the other end
- Must remain permanently coupled to the power car
- Function as a transition from the threader car to the power car and from the power car to the rail train

Threader Car. The threader car guides the rail from the ballast section up to the deck, then onto the companion car. The threader car works in either direction and has movable and stationary threader boxes on either end. The movable boxes can move laterally and rotationally to line up with a turned rail. The threader car also has a hydraulic crane to lift and position rails being picked up.

The rail loading train consist includes:

- Locomotives (two are recommended, facing opposite directions)
- Tool car
- Threader car
- Companion car
- Power car
- Companion car
- Rail rack cars

Employees involved in the rail recovery unit train consist and manpower placement *should be* positioned as shown in Table 6-9.

The most important safety rules on the rail recovery unit are:

1. **Never allow personnel between two rails.**
2. **Keep personnel on the outside of the rail, clear of any part of the train where they may be pinned if the rail kinks.**
3. **Never allow anyone on the deck of the tunnel car while loading rail.**

Table 6-9. Rail Recovery Unit Train Consist and Suggested Manpower Placement.

	Locomotive	
	Locomotive	
	Tool car	
Employee in charge, Foreman, and two men work at forward end of threader car making rail joints and breaking rail joints when string of rail is fully loaded.	Threader car	
	Companion car	
	Power car	
Red side	Companion car	Blue side
Two employees (point men) guide rail from tunnel car to end of train. Point man	Tunnel car	Point man
	About 13 or 14 rail track cars	
Secure rail for tiedown stands.	Tiedown car One employee	
	About 13 or 14 rail track cars	
	Tunnel car	
	Buffer car	
	Buffer car	
	Caboose	

Note: Ideally a completed string of rail will have each of its ends in the exact center of the last car. If rail ends are stopped too close to the tunnel or rollers, rail will kink in three places on the forward tunnel car and must be torch cut out of the train. Kinking is caused by slack action.

B. Hazards

Expect the rail to kink or roll over at any time and at any point during loading operations. Rail guide shoes, wide joints, angle bars, anchors, etc. can hang up on the rail train and cause the rail to kink suddenly.

1. Never allow personnel between two rails. A sudden rail kink could pin an employee between rails.
2. Keep personnel on the outside of the rail, clear of any part of the train where they may be pinned if the rail kinks.

3. Do not load or unload rail without tiedown car, ramp car, burner, and point men all indicating that they are ready to do so.
4. Never allow anyone on the deck of a tunnel car while loading rail. Rail is not held by threaders in this area and is highly susceptible to kinking.

   EXCEPTION: An employee can be on the deck when starting new rail while moving the train under the rail. However, the employee must be positioned outside of the rail string.
5. Have the point man positioned behind and no closer than 6 feet from the end of the rail string, except to place or remove the threading shoe. Have a planned escape route if the rail kinks.
6. When loading up or down grade, expect the rail to move and take every precaution to avoid rail movement.
7. Stay clear of a rail being torch cut. When cutting rail, position yourself to avoid injury in case the rail swings out and drops.
8. Stay clear of all pinch points.
9. When trains are passing on adjacent tracks, do not load rail on the side of the train that is closer to the movement.
10. When moving between loading or unloading locations, do not ride anywhere on the rail pick-up train, except the following positions:
    - Engine (seated or with three-point contact)
    - Caboose (seated or with three-point contact)
    - Tool car (seated or with three-point contact)
    - Threader car (on flat portion of deck with adjacent handrail)
    - Tunnel car (on platform with handrail)
    - Tiedown car (on platform with handrail)
    - Power car (at operator's station)

EXCEPTION: The point man may ride roller rack cars between loading locations if remaining on the roller rack cars is less hazardous for the employee than moving to one of the above approved riding locations. The maximum distance that the point man may ride on roller cars between loading locations is 2 miles.

C. Threading Loading Unit

Thread rail by one of the following two methods:

1. **Thread by Winch Lines**

   Hoist the rail to the correct level as follows (winch lines will be used only to thread rail that is between 220 feet and 300 feet long):

   a. Swing the crane perpendicular to the car.

b. Hook the rail 1 or 2 feet back from the crane toward the locomotives. This hookup will allow the rail to enter the threader box without binding the chain hookup. Do not attempt to pick up rail beyond the reach of the crane. If rail to be picked up is more than 12 feet from the nearest rail in track, use the winch in the tool car (if equipped) to help move the rail toward the threader car to thread rail into the first threader box.

c. Hoist the rail to the correct height and hold it there.

d. Line up the movable box on the threader car with the rail to be threaded.

e. Use the winch line to pull the rail into the movable box.

f. Unhook the rail from the hoist and continue pulling the rail through the loader unit until the power car can positively engage the rail.

g. Unhook the cable.

h. Position the rail to thread it into the rail stands or to attach it to the string already on the train.

2. Thread by Train Movement

Thread by train movement as follows (initial string must be standing up on its base):

a. Position the train with the rail just short of the front threader.

b. Line up the movable box of the threader car with the rail to be threaded. The end of this rail should be short of the box by inches.

c. Advance the train slowly while swinging the crane, allowing the string end to enter the movable guide box. Stop movement to remove crane attachments and to make minor adjustments.

d. Continue advancing the train until the rail end is within inches of the next fixed guide box. Use the crane to adjust the rail alignment to enter the fixed box.

e. Advance the train slowly to thread the rail into the fixed guide box.

1) Continue to the traversing guide box on the companion car.
2) Stop the train short of the rail entering.
3) Achieve alignment by moving the various guide boxes.

f. Advance the train, allowing the rail end to enter the traversing box. Repeat step e at the entry of each guide box or pusher wheel thereafter.

g. When the rail end is sufficiently beyond the pusher, stop train movement. Clamp the pusher to the rail for further threading into remaining guide boxes.

Note: Coordinate these steps for threading the unit with all personnel to ensure they are safely positioned when the rail is moving.

D. Propelling Rail Onto Train

Use one of the following three methods to propel rail onto the rail train:

- **Preferred Method:** Keep the train stationary and propel the rail onto the train using the power car pushers.
- Set independent brakes, release the train brakes, and propel the rail onto the train using the pushers. The pushers also pull the train. Have Engineer adjust independent brakes as necessary to control train movement.

  or

- Have the locomotives pull the train under the rail while pushers assist to propel the rail onto the train. This is the least preferred method and should be avoided when possible.

E. Loading Rail

Load rail as follows:

1. Assign a Foreman and three people to the threader car, along with the help of the anchormen, to do the following:
   a. Angle bar and bolt the rail joints at the ends of the strings as they are picked up.
   b. Knock off any anchors left on the rail.
2. Assign two point men on the train (one for each string) to follow the free rail end and guide it into the proper slots. After the first two rails are threaded, use the rail guides to help guide the adjacent free rail ends.
3. Assign one or two people to the tiedown car to secure the rail at tiedown stands when the string is completely loaded.
4. To handle the rail once the loading has stopped:
   a. Have the Operator check with the tiedown car to see that the rail is in the proper location and no joint bars are interfering with the tiedown plates.
   b. Tie down the rail and anchor it. Have the point man remove the point, stow it safely, and return to the head end.
   c. When the Rail Train Supervisor instructs, have the Engineer make an emergency application of air to prevent slack from running in or out before the rail is cut at the proper location.
   d. *All* personnel must have permission from the Power Car Operator before occupying the deck of the tunnel car. This applies to the deck on both ends of the tunnel.

e. The Rail Train Supervisor must ensure that the rail is properly aligned before the burner begins to cut the rail. This requires that the Supervisor be present at the tunnel car prior to, during, and after the rail is cut. The Operator must have companion car boxes aligned with the rail loaded on the train as straight as possible. The ramp on the tunnel car should be lowered to allow the rail to adjust laterally. Raise the ramp until it just contacts the rail, and then raise the ramp two inches.

f. Have the burner cut the rail properly, burn a hole in the next rail, and apply the point for threading the rail onto the train. The Rail Train Supervisor must ensure that the proper point is applied to the next rail to be loaded. Two fire lookouts are required, one on each side of the train, anytime hot work is in progress.

g. Paint a stripe on the rail at the center of the tiedown car for reference.

5. Proceed with the loading after the tiedown man secures the rail and clears with the loading Supervisor, who checks with the point men, Power Car Operator, Ramp Car Foreman, and burner to see if everyone is clear and ready.

F. Joining Two Rail Strings

Join a new rail string on the ground to the rail threaded through the threader as follows:

1. Keep the loader unit threaded with rail for the entire pickup operation for each relay.
2. Spot train where rotating threader is near the rail-string end on the ground.
3. Position the crane on the post perpendicular to the car. Hook the rail tongs to the rail on the ground and raise the rail 1 to 2 feet. Apply safety chain around rail. Do not attempt to pick up rail beyond the reach of the crane. If rail to be picked up is more than 12 feet from the nearest rail in track, use the winch in the tool car (if equipped) to help move the rail toward the threader car and line up with the rail already threaded.
4. When making a joint, use the power car to mate the rail ends. Make sure the joint has two bolts with lock washers at each end. *Be aware of pinch points.*
5. If necessary, torch cut holes into rail ends as follows:

   a. Blow the torch-cut holes in the correct location no larger than 1-1/2 inches in diameter. Do not make sharp corners. Two bolts ("back") are required per rail end when using 6-hole bars. Position two employees, one on each side of the train, with proper tools and equipment for fire protection.

b. Have the holes cut out at the welding plant or in the field after the rail is unloaded.

All rail joints must have at least two bolts with lock washers per rail.

G. Securing Rail on Tiedown Car

To secure the rail:

1. Remain in the clear when the rail is being moved. Avoid pinch points when using tiedown tools and equipment.
2. To clamp the rail at the tiedown car properly, ensure that the rail is clear of joints, welds, or other obstructions.
3. Before tightening the rails, center them between the tiedown plates to ensure equal clamping forces.
4. Properly tighten tiedown plate bolts.
5. If tiedown plates are single-bolt, apply two rail anchors on each side of the rail on each side of the stanchion. Multi-bolt tiedown plates do not require anchors.

H. Unloading Rail With Pickup Unit

The basic procedures and safety guidelines outlined in section 6.8.5 apply to unloading rail with a pickup unit. Complete the steps in reverse and follow the same general practices.

The train consist includes:

- Locomotives pulling the rail train with pickup unit cars on the rear
- On the head end, two locomotives (preferably each facing the opposite direction)-buffer cars-rail train-2 ramps-power/threader car-rear end
- Locomotives pushing the rail train with pickup unit cars in between the rail train and the locomotives

The head end includes:

- Locomotives (preferably each facing the opposite direction) - pickup unit cars - rail rack cars - buffers - caboose (recommended)

6.8.6 Loading Conventional Bolted Rail

A. Gondolas

When shipping conventional rail to the rail complex for cropping and welding, load the rail in gondolas when possible.

1. Load rail, except scrap rail, ball up with a minimum of three 1-inch by 4-inch wood strips between layers.
2. Taper each layer by using at least one rail less than the previous layer.
3. Stay within the weight limit of the car.

   Note: For example, a 70-ton gondola can safely carry 3,250 lineal feet of 132-pound rail; 3,680 lineal feet of 115-pound rail; or 4,650 lineal feet of 90-pound rail.

4. If rail will be handled in interchange movement, load it in closed-end gondolas only.

B. Flat Cars

When loading conventional rail on flat cars for movement in trains or by switch engines, unless otherwise governed by AAR loading rules:

1. Load the rail ball up with a minimum of three 1-inch by 4-inch wood strips between layers and with a maximum of four layers.
2. Taper each layer by using at least one rail less than the previous layer.
3. On flat cars loaded with rail:
   a. Place heavy bridge timbers or ties on the ends, supported by stakes in the end stake pockets, with the top of the timbers at least 3 inches above the top of the rail.
   b. Use enough timbers or ties to provide contact blocking at both ends of the rail.
   c. Place on each side of car five stakes securely wedged in side stake pockets.

6.9 Rail Friction Management

The purpose of rail friction management is to:

1. Extend rail and other track material life.
2. Extend wheel life.
3. Improve steering performance.
4. Increase locomotive fuel efficiency.

The Division Engineer will coordinate with the Manager Roadway Planning to develop the budgetary requirements to support the rail friction management program for each Division.

This program will be developed jointly by the General Director Maintenance, Division Engineer, Director Roadway Planning, and Manager Roadway Planning to address the Division's requirements based on system standards.

6.9.1 Wayside Gage Face Lubricator

A. Definition

1. **Gage face lubricator.** A wayside system designed to dispense grease to the gage face of the rails on curves.
2. **Grease.** A petroleum-based material designed to lower the coefficient of friction (CoF) between 0.1 and 0.2.

B. Location

In accordance with the Division's rail friction management program as described above, install the wayside gage face lubricator as follows:

1. Preferably 300 feet in advance of the PS of a curve.
2. Preferably so it is accessible by road.
3. Preferably at locations with adequate sunlight for solar power.
4. If closer than 2,640 feet from a signaled crossing equipped with flashing lights and/or gate, contact the local Signal Supervisor for assistance before installing. However wayside gage face lubricator shall not be installed less than 1,320 feet from a physical road crossing equipped with flashing lights and/or gates.
5. Do not install the wayside gage face lubricator less than 250 feet from any non-signaled crossing.
6. Do not install wayside gage face lubricator less than 100 feet from insulated joints, wayside detectors, switch heaters and other signal equipment.

7. Install the wayside gage face lubricator away from the following locations:
   - Fouled ballast condition
   - Poor tie condition
   - Poor surface conditions
   - Excessive vertical rail head loss (If the rail head has an overflow in excess of 1/8 inch on gage side, the overflow must be ground to less than 1/8 inch.)
   - Spalling and/or shelling at location or other rail surface conditions
8. Install the unit on a 6-foot by 6-foot by 6-inch concrete slab. Use aggregate fines (1/2 inch minus non-washed) to level the slab and to address footing issues around the site. Do not use sand or material that is susceptible to wind or water erosion.

C. Identification

1. All wayside gage face lubricators will be labeled with an identification number by milepost and tenth (for example, a gage face lubricator at Milepost 65.3 would be labeled 65.3).
2. On the track chart, gage face equipment will be labeled milepost and tenth followed by GF (for example, a gage face lubricator at Milepost 65.3 would be labeled 65.3GF).

D. Operation

1. **Current Standard Wayside Gage Face Lubricator Equipment**
   - **L. B. Foster**
   - **Lincoln**
2. **Approved Lubricants**

Wayside Gage Face Rail Lubricants		
Application General Description	**BNSF-Approved Wayside Grease**	**Recommended Working Temperature Range**
Summer grease	Whitmore's LF-2 Shell Gadus -2	+ 50° F and above
Winter grease	Whitmore's LF-1 Shell Gadus -1	+ 20° F to + 60° F
Extreme winter grease	Whitmore's LF-0 Shell Gadus - 0	– 30° F to + 30° F

a. New install recommended settings are:
   1) 0.25 seconds every 64 wheel (L.B. Foster).
   2) 2 seconds every 32 wheel (Lincoln).

   Note: New wayside gage face lubricators should be installed with low grease output settings (low pump time and high wheel counts). Gradually and incrementally adjust the pump time and/or wheel count settings to protect curves and minimize waste.

b. Existing wayside gage face lubricator recommended settings are:
   1) Pump time and wheel counts settings should be changed over time and seasonally to ensure optimum carry distance throughout the curve(s). Settings may need to be adjusted as grades of grease are changed.
   2) For L.B. Foster equipment during seasonal operations:
      a) Temperatures below 40° F may require doubling grease output by either:
         - Increasing pump time.
         - Decreasing wheel count.
      b) Temperatures above 40° F will require that the unit be reset back to above 40° F settings.

3. Equipment Operation

a. Turn off equipment when performing maintenance.

b. Turn off equipment if not functioning as intended until equipment can be repaired.

c. Do not turn off any gage face equipment earlier than required by the activity. Restore equipment to service within 72 hours after the activity is complete.

d. Reduce grease output to ensure clean rail surface prior to rail detector car operation. Restore equipment settings after rail detector car inspection is complete.

e. Remove bars, hoses, wheel sensors, track mat etc. prior to track maintenance activities such as rail relay, surfacing, etc. and replace within 72 hours of completion of maintenance activities.

E. Maintenance

1. Roles and Responsibilities

a. Manager Roadway Planning
   1) Inspect effectiveness while making inspections. The inspection must evaluate the effectiveness of the equipment and ensure that all systems are working as intended.

2) Provide education and training to the field regarding accepted friction management practices and policies.

3) Establish a budgetary requirement to support the designated friction management program for each Division.

b. Roadmaster

1) Inspect lubrication results on respective territories at least once a month. Inspections must evaluate the effectiveness of the rail lubrication in terms of carry and coverage, and ensure that all lubrication units are working as intended. Findings should be recorded on a lubricator checklist (see Figure 6-9). **The Roadmaster must monitor the curves to ensure that a visible and detectable amount of gage face lubricant is applied to the rails.**

2) If equipment is not working as intended, take the necessary corrective action to repair equipment as soon as possible.

Wayside and Hy-Rail Gage Face Lubricator Effectiveness Checklist
Name: (Roadmaster/Inspector/MRP) ______________________

BNSF RAILWAY

Date	L/S	Equip ID	Unit Working Y/N	Curves Lubricated	Comments

Figure 6-9. Lubricator Effectiveness Checklist (available here):

http://udprd.bnsf.com/cgi-bin/enme/enmeDYNAM.cgi?DIRECTORY=/Rail%20Lubricators&root_dir

c. Track Inspector

1) Ensure that all wayside gage face lubricators passed during the course of inspections are working as intended. When a problem is identified which cannot be immediately repaired, convey the information to the Roadmaster.

2) **The Track Inspector must monitor the curves to ensure that a visible and detectable amount of gage face lubricant is applied to the rails.**

3) If needed, adjust the pump and/or wheel count settings of the lubrication unit to achieve proper lubrication coverage.

Note: Increase lubrication output either by increasing the pump time or decreasing the wheel count, or both. Decrease lubrication output either by decreasing the pump time or increasing the wheel count. Make small incremental adjustments to the pump and wheel count settings.

d. Lube Maintainer

1) Is responsible for inspecting and maintaining lubrication equipment to perform as intended. Inspections should be completed every 30 days.

2) Make appropriate documentations in the Rail Lubricator Log Book (see Figure 6-10) that identifies the activities associated with inspecting and maintaining wayside friction modifier.

Rail Lubricator Log Book—Unit No.______________

Name & Company	Date	Pound/Gals Added	Brand & Grade	TRK	Working @ departure	Pump Setting	Wheel Setting	Wheel Count #/#	Defect Descriptions, Action taken, Comments	Est. Return to Service
Nick Dryer BNSF	14-Jul	500#	Shell 52	1	Y	0.25	12	55523/14000	Filled, adjusted pump	---
				2	N	0.25	12	13000/60000	broken bar, unit turned off	17-Jul

Figure 6-10. Rail Lubricator Log Book (available here):

http://udprd.bnsf.com/cgi-bin/enme/enmeDYNAM.cgi?DIRECTORY=/Rail%20Lubricators&root_dir

2. Environmental

a. Bulk Storage

1) Installing a bulk storage container for a rail friction control system with a capacity greater than 55 gallons might require that the Spill Prevention, Control and Countermeasure Plan (SPCC) be modified.

2) Coordinate the addition or deletion of bulk storage containers or tanks with the Manager Environmental Operations for the location.

http://bnsfweb.bnsf.com/departments/envhaz/staff/OperationsTeamMapSept20_2012.pdf.

b. Track Mat

1) Install geotextile fabric/track mat on the track in the area around the lubricator to reduce contamination of the ballast section. Refer to the table below for installation instructions.

2) On wood tie areas, screw down fabric to ties "sandwiched" in with one-by-four lumber.

3) On concrete tie areas, place two-inch by four-inch pieces of lumber under the rails and "sandwich" the fabric between a one-by-four and two-by- fours. Use washer headed screws to fasten the track mat to the timber.

Track Mat Main Line and Siding Installation Instructions	
Product	**Length of Required Track Mat**
Approved Geo-Textile (L.B. Foster Catch-all Track Mat)	30 feet each side of applicator bars

4) Coordinate the disposal of the contaminated track mat with the Environmental Department.

http://bnsfweb.bnsf.com/departments/envhaz/staff/OperationsTeamMapSept20_2012.pdf

6.9.2 Hy-Rail Gage Face Lubricator

A. Definition

1. **Hy-rail Gage Face Lubricator.** A mobile system designed to dispense grease to the gage face of rails, and mounted on hy-rail equipment.

2. **Grease:** A petroleum-based material designed to lower the coefficient of friction (CoF) between 0.1 and 0.2.

B. Location

Install hy-rail gage face lubricators at locations determined by the Manager Roadway Planning and Director Roadway Planning.

C. Identification

All hy-rail gage face equipment will be assigned an identification number by vehicle number followed by manufacturer initial.

- L.B. Foster equipment (example 12345F)
- K&M equipment (example 12345K)
- Robolube /RBL equipment (example 12345R)

D. Operation

1. Current Standard Hy-Rail Gage Lubricator Equipment

- **K&M Specialty**
- **Robolube / RBL**

2. Approved Lubricants

Hy-Rail Gage Face Rail Lubricants		
Application General Description	**BNSF-Approved Wayside Grease**	**Recommended Working Temperature Range**
Summer grease	Whitmore's LF-2 Shell Gadus -2	+ 50° F and above
Winter grease	Whitmore's LF-1 Shell Gadus -1	+ 20° F to + 60° F
Extreme winter grease	Whitmore's LF-0 Shell Gadus - 0	– 30° F to + 30° F

3. Application

a. Apply lubrication to the gage face of the rail, 5/8 inch below the top of the rail.

Note: On curve track consider lubricating curve closer rails in turnouts and trailing curves behind turnout.

b. Frequently monitor nozzle position, speed, and application rate to ensure the grease is applied properly. Proper application is a continuous bead of grease 1/8 inch wide by 1/8 inch thick throughout the length of the curve 5/8 inch below the top of the rail.

c. When approaching road crossings equipped with flashing lights or gates, stop applying lubricant at the whistle post prior to the crossing. Resume application past the whistle post on the opposite end of the crossing.

4. **Frequency**

Apply lubrication according to the following table:

Weekly Frequency of Lubrication With Hy-Rail Gage Face Lubrication (For territories without wayside gage face lubrication)					
Annual MGT	**Degree of Curvature**				
	OD 30M-1D 59M	**2D 00M-3D 59M**	**4D 00M-5D 59M**	**6D 00M-7D 59M**	**8D 00M & Over**
1-5	0.00	1.00	2.00	3.00	4.00
5-15	1.00	2.00	3.00	4.00	5.00
15-30	2.00	3.00	4.00	5.00	6.00
30-50	3.00	4.00	5.00	6.00	7.00
50 and up	4.00	5.00	*	*	*

* Must be protected with a wayside lubricator.

Note: Follow these interval requirements:

- **When weekly frequency is 2, the maximum interval between applications will be 3 days.**
- **When weekly frequency is 3, the maximum interval between applications will be 2 days.**
- **When weekly frequency is 4 or 5, the maximum interval between applications will be 1 day.**

If a hy-rail vehicle is equipped with a gage face lubrication system, it is **required** that the system be utilized per frequency chart shown above. The employee is responsible to develop and maintain his or her own tracking sheet, based on the frequency chart above.

E. Maintenance

1. Roles and Responsibilities

a. Manager Roadway Planning

1) Inspect effectiveness while making inspections. The inspection must evaluate the effectiveness of the equipment and ensure that all systems are working as intended.

2) Provide a standardized friction management report over the Roadmaster's territory by rail inspection trip.

3) Send the report to the Roadmaster, Division Engineer, Director Roadway Planning, and General Director Maintenance for the territory.

4) Provide education and training to the field regarding accepted friction management practices and policies.

5) Establish a budgetary requirement to support the designated friction management program per Division.

6) Review hy-rail frequency compliance tracking sheet as necessary.

b. Roadmaster

1) Inspect lubrication results on respective territories at least once a month. That inspection must evaluate the effectiveness of the rail lubrication and ensure that all lubrication units are working as intended. Findings should be recorded on a lubricator checklist (see Figure 6-9). The Roadmaster must monitor the curves to ensure that a visible and detectable amount of gage face lubricant is applied to the rails.

2) If equipment is not working as intended, take the necessary corrective action to repair equipment as soon as possible.

3) Develop a hy-rail frequency compliance tracking sheet per the frequency table in section 6.9.2D(4).

c. Track Inspector

If the Track Inspector also operates a hy-rail lubricator, the Inspector must identify curves lubricated and date of lubrication in the tracking sheet created and maintained by the employee. The Track Inspector must monitor the curves to ensure that a visible and detectable amount of gage face lubricant is applied to the rails.

d. Lube Maintainer

If the Lube Maintainer also operates a hy-rail lubricator, the Lube Maintainer must identify curves lubricated and date of lubrication in the tracking sheet created and maintained by the employee. The Lube Maintainer must monitor the curves to ensure that a visible and detectable amount of gage face lubricant is applied to the rails.

2. Environmental

a. A bulk storage container for grease with a capacity greater than 55 gallons might require that the Spill Prevention, Control and Countermeasure Plan (SPCC) be modified.

b. Coordinate the addition or deletion of bulk storage containers or tanks with the Manager Environmental Operations for the location.

http://bnsfweb.bnsf.com/departments/envhaz/staff/OperationsTeamMapSept20_2012.pdf

c. Keep the bulk storage container in environmental compliance. If equipment is malfunctioning or leaking, notify the Roadmaster.

6.9.3 Wayside Top of Rail Friction Modifier

A. Definition

1. **Top of Rail Friction Modifier.** A wayside system designed to dispense a friction modifier material to the top of the rail.
2. **Friction Modifier.** A material designed to create a desired coefficient of friction (CoF) between 0.3 and 0.35.

B. Location

In accordance with the BNSF's rail friction management program, install the wayside top of rail friction modifier:

1. Preferably 300 feet in advance of the PS of a curve.
2. Preferably so it is accessible by road.
3. At a location with adequate sunlight for solar power.
4. Preferably no less than 1,320 feet from a physical road crossing equipped with flashing lights and/or gates.
   a. If closer than 1,320 feet, contact the local Signal Supervisor for assistance before installing; see note below.
5. Do not install the wayside top of rail friction modifier less than 250 feet from any non-signaled crossing.

Note: Guidance for Signal Supervisors

Top of rail friction modifier units installed between 250 feet and 1,320 feet of any road crossing equipped with flashing lights and/or gates must have a crossing warning system island loss-of-shunt of 2 seconds or greater provided in the crossing circuitry, as in one of the following examples:

- **PMD or HXP with RSI: LOS jumper set to 1 (2 sec.) or 2 (4 sec.).**
- **ElectroLogIXS XP4: Island LOS set to 2 or 4 seconds.**
- **GCP3000 with 802.11 IPI: Inherent 2-second island delay—can be set 0 to 6 seconds longer in A01E or later software versions.**
- **GCP4000: Inherent 2-second island delay—can be set 0 to 6 seconds longer.**
- **DC or Style C track circuit with LOS (e.g., LOS-10, etc.).**
- **GE Island Presence Detector (IPD) installed on other electronic crossing islands (e.g., Safetran 80011, older Safetran equipment, Harmon 3 card island, older Harmon equipment, etc.).**

If the crossing warning system is not configured per the above (or equivalent), a top of rail friction modification unit should not be installed.

6. Do not install wayside gage face lubricator less than 100 feet from insulated joints, wayside detectors, switch heaters, and other signal equipment.
7. Install top of rail friction modifier away from the following locations:
   - Fouled ballast condition
   - Poor tie condition
   - Poor Surface conditions
   - Excessive vertical rail head loss (If the rail head has overflow in excess of 1/8 inch on field side, the overflow must be ground to less than 1/8 inch.)
   - Spalling and/or shelling at location or other rail surface conditions
8. Install it on a 6-foot by 6-foot by 6-inch concrete slab. Use aggregate fines (1/2 inch minus non-washed) to level the slab and to address footing issues around the site. Do not use sand or material that is susceptible to wind or water erosion.

C. Identification

1. All wayside equipment will be assigned an identification number by milepost and tenth on equipment (for example, a top of rail friction modifier at Milepost 65.3 would be labeled 65.3).
2. On the track chart, top of rail equipment will be labeled milepost and tenth followed by TOR (for example a top of rail friction modifier at Milepost 65.3 would be labeled 65.3TOR).

D. Operation

1. **Current Standard Top of Rail Friction Modifiers**
   - Loram
   - L.B. Foster
   - Lincoln

2. Approved Friction Modifiers

Top of Rail Friction Modifiers		
Application General Description	**BNSF-Approved Wayside Friction Modifier**	**Recommended Working Temperature Range**
Summer Friction Modifier	Loram's XTEND	All
	L.B. Foster's Keltrack	+ 20° F and above
Winter Friction Modifier	Loram's XTEND	All
	L.B. Foster's Keltrack LT	+ 19° F and below

Note: Loram's TOR-CL80 is for yard application only.
Note: Do *not* use Keltrack in Loram TOR units.

3. Settings

a. New install recommended settings are:

1) 0.25 seconds every 12 wheel (L.B. Foster) with 3 locomotive skip.

2) 1 pump revolution every 6 axles (Loram) with 18 axle locomotive skip.

b. Settings should not be changed unless directed by TR&D.

4. Equipment Operation

a. Turn off equipment when performing maintenance.

b. Turn off equipment if not functioning as intended until equipment can be repaired.

c. Do not turn off any gage face equipment earlier than required by the activity. Restore equipment to service within 72 hours after the activity is complete.

d. Remove bars, hoses, wheel sensors, track mat etc. prior to track maintenance activities such as rail relay, surfacing, etc. and replace within 72 hours of completion of maintenance activities.

E. Maintenance

1. Roles and Responsibilities

a. Manager Roadway Planning

1) Ensure that all systems are working as intended.

2) Provide education and training to the field regarding accepted friction management practices and policies.

3) Establish a budgetary requirement to support the designated friction management program per System Engineering.

b. Roadmaster

1) Ensure that all top of rail friction modifiers are working as intended monthly.

2) If equipment is not working as intended, take the necessary corrective action to ensure that equipment will work as intended as soon as possible.

c. Track Inspector

1) Ensure that all wayside friction modifiers passed during the course of the inspection are working as intended. When a problem is identified which cannot be immediately repaired, convey the information to the Roadmaster.

2) Do not change settings of friction modifiers unless directed by TR&D.

d. Lube Maintainer

1) Is responsible for inspecting and maintaining rail friction modifier equipment to perform as intended as assigned by the Roadmaster.

2) Make appropriate documentations in the Rail Lubricator Log Book (see Figure 6-10) that identifies the activities associated with inspecting and maintaining the wayside friction modifier.

3) Do not change settings of friction modifiers unless directed by TR&D.

2. Environmental

a. Bulk Storage

1) Installing a bulk storage container for a rail friction control system with a capacity greater than 55 gallons might require that the Spill Prevention, Control and Countermeasure Plan (SPCC) be modified.

2) Coordinate the addition or deletion of bulk storage containers or tanks with the Manager Environmental Operations for the location.

http://bnsfweb.bnsf.com/departments/envhaz/staff/OperationsTeamMapSept20_2012.pdf

3) Install geotextile fabric/track mat on the track in the area around some friction modifiers to reduce contamination of the ballast section. Refer to the table below for installation instructions.

4) In wood tie areas, screw down fabric to ties; in concrete tie areas, place two-inch by four-inch pieces of lumber under the rails and screw the fabric to the two-by-fours. Use washer headed screws to fasten the track mat to the timber.

Track Mat Main Line and Siding Installation Instructions		
Top of Rail	TOR-XTEND	Bio Mat as Required
Top of Rail	Keltrack	No Track Mat Required

3) Coordinate the disposal of the contaminated track mat with the Environmental Department.

6.10 Production Rail Grinding

6.10.1 Safety First

When in doubt, always take the safe course.

All employees working with the grinders, both BNSF and contractor employees, will wear the required personal protective equipment, including safety shoes, hard hat, eye protection, and hand protection.

It is recommended that cotton pants (such as denim jeans) and long-sleeve cotton shirts be worn. A long-sleeve shirt provides better arm protection in fire suppression activities.

6.10.2 Grinder Work Zone

Follow these grinder work zone requirements:

1. Roadway workers must not enter the grinder work zone without first communicating with the Operator to establish safe work procedures.
2. Unless a different understanding is established through a job briefing, this work zone extends from a point 15 feet in front of the grinder to a point 15 feet behind the grinder. The work zone limit on each side of the grinder is 45 feet as measured from the centerline of the track.
3. If the grinder is approaching an individual who is foul of the work zone, the Operator must communicate the danger to the individual. If the work zone is fouled the grinding operation must stop.

6.10.3 Protection Requirement for Maintenance and Tie-Up

A. Maintenance During Work Day

Follow these requirements when changing grinding stones or performing other maintenance/repairs on multiple main track or any other track adjacent to main track or controlled siding where centerline clearance is less than 25 feet:

1. The BNSF employee in charge must check with the Dispatcher to determine train location and direction on the adjacent main track or controlled siding and advise contractor employees.
2. Before leaving the control cab, the Operator must set 40 psi of brake pressure and place lockouts on the controls.
3. A watchman must be assigned to operate the hot-rail warning system, which consists of horns and flashing lights. These lights are at deck levels so that they are at head height for personnel on the ground.
4. Upon hearing horns or seeing lights flashing, contractor personnel must immediately move to a predetermined place of safety as identified in the job safety briefing.

B. Tie-Up Protection

Following Maintenance of Way Operating Rules 6.3.2 (Protection on Other than Main Track) and 6.28 (Movement on Other than Main Track) is required to protect grinding contract workers and the grinder.

1. If the production grinder is the only machine in track and the Dispatcher authorizes the entire track out of service:
   a. Line switches against movement and place locks and out-of-service tags on all switches providing entry to the track.
   b. When unable to line the switch away, place a red flag or light and derail and protect on-track equipment as outlined in Rule 15.4 (Protection when Tracks Removed from Service).
2. If the grinder ties up on the track with other equipment, or if a portion of the track must remain in service:
   a. Advise the Dispatcher how many feet of track is out of service.
   b. Line switches against movement and place locks and out-of-service tags on all switches providing entry to the out-of-service portion of the tie-up track.
   c. Protect the grinder from the in-service portion of tie-up track with a portable derail.

The BNSF employee in charge must ensure that contractor employees have placed wheel chocks and set all hand brakes when tied up. The BNSF employee in charge must also instruct contractor employees to perform maintenance and repairs on the grinder, when tied up, from the field side only unless arrangements have been made to protect maintenance and repair work from movements on the adjacent track.

6.10.4 General Requirements

Rail grinding is an essential part of the track maintenance program. Good rail grinding practices will increase the service life of rail. When grinding cycles are maintained, rail grinding will reduce surface and internal defects by:

- Controlling checking and shelling on the gage corner
- Controlling shelling and spalling on the rail head
- Controlling wheel-rail contact stresses
- Controlling metal flow on the rail head
- Eliminating rail surface corrugation
- Removing certain rail head manufacturing imperfections
- Improving wheel tracking efficiency

Outside influences that affect proper rail head profile maintenance include:

- Substandard subgrade, poor surface, cross level, and elevation
- Poor tie condition and lack of proper rail support
- Lack of lubrication and gage face loss
- Wide gage and false flanging on the low rail

BNSF contracts with a rail grinding contractor to grind the rail.

6.10.5 Schedule Development

The rail maintenance group develops the rail grinding schedules.

6.10.6 Field Support

Local supervision will support the rail grinding as follows:

1. Provide the Grinding Supervisor with a list of areas with new rail, corrugation, and heavy surface conditions. Consider rail replacement where rail is extensively shelled with depths greater than 0.10 inch, or where shelling or corrugation is limited to a single rail length. The grinder is inefficient at addressing battered joints, battered welds, crushed heads, or other such localized deep surface conditions.

2. Provide a rules-qualified escort to obtain track authority for the grinder and to ensure a safe and efficient working environment for the grinder. The escort must:

   a. Be familiar with the territory to be ground. For example, know the location of switches, back tracks, hot box detectors, wayside lubricators, crossings, signal appliances, etc., and communicate the same to the Operator.

b. Know where the grinder can clear for traffic and tie-up. When considering tie-up locations, take into account length, water availability, access for fuel truck, and clearance for machine maintenance activities.

c. Brief with the Operator and know the location and operation of the emergency brake valve. Communicate to the Operator and work group all track authorities obtained and released. The Operator should initial all authorities received. Escort will verify with all members of the work group that workers/equipment are clear before releasing any authority.

d. Be located where the rail grinder is being operated from while it is grinding or traveling.

e. Communicate to the appropriate maintenance desk a request for the next day's work location and track protection.

3. The Grinding Supervisor will notify the Roadmaster as to how many support people will be needed to provide only the number required. Under normal fire conditions, provide (in addition to a machine escort) up to five persons for fire suppression, including a rules-qualified employee to work with and escort the hy-rail water truck. If fire conditions are severe, additional support persons are necessary. The Grinding Supervisor or BNSF employee in charge will determine fire conditions.

4. Provide local support to work with the Grinding Supervisor and/or contractor to determine locations for purchasing water, fuel, and lubricants.

6.10.7 Taking On Water

Local supervision should arrange to purchase water at the tie-up location. Arrangements should be made before the grinder arrives including permission, inspections, deposits, etc. The BNSF employee in charge is responsible for ensuring that permission has been given to access the water before any water is loaded. Send water bills to the Manager Rail Maintenance in Fort Worth. A water invoice cover sheet is available on the grinder. BNSF personnel should fill it out and submit it with the invoice.

To take on water:

1. Pump it from a tank or access a pressurized system. The contractor is responsible to safely load the water.

2. Use back-flow prevention device when accessing municipal water systems.

3. Avoid routing hoses across streets. When they must be routed across streets:

    a. Contact the governing agency to obtain permission and to see what precautions to take.

    b. Use ramps to protect the hose from vehicle traffic.

6.10.8 Lubrication Policy

To reduce lateral forces, extend rail and wheel life, and to lower fuel usage, apply rail lubricant to the gage corner of both rails on tangent and curved track immediately after the final grinding pass. On 3-degree or greater curves that *do not* have elastic fasteners, apply lubrication to the gage corner of the high rail and center it on the top of the ball on the low rail. Apply lubricant by rail grinder or by a hy-rail mounted lubricator.

6.10.9 Quality Control

Follow these quality control guidelines during production rail grinding:

1. The contractor is responsible for maintaining grinding equipment at or above the minimum operation specifications as described in the contract.
2. Rail will be ground as follows:
    a. Grind the top of the rail head profile to an 8-inch radius on tangent and high rails. Grind low rails to a 10-inch radius.
    b. When grinding, center the wheel load over the web of the rail, taking into account gage face worn and transposed rail.
    c. Center the contact band on the finished grind on the rail head. Make it between 1 inch and 1-1/4 inch wide.
3. When assigned to a machine the BNSF Grinding Supervisor is responsible for supervising the daily operations and ensuring that these standards are accomplished in a safe and efficient manner. The Grinding Supervisor must:
    a. By visual inspection, determine the number of passes to make when removing centerball spalling.
    b. Check the electronic profile measuring devises on the grinding equipment with an accurate gauge bar.
    c. Call grinding patterns to arrive at desired results in a timely and cost-effective manner.
    d. Coordinate all daily activities with all involved, including Dispatchers, sectionmen, contractors, etc.
    e. Complete all daily reports and phone-based call-ins.
    f. Verify all work performed by the contractor.
    g. Forward all copies of daily reports to the Manager Rail Maintenance at 2600 Lou Menk Drive, Fort Worth, Texas 76131.
    h. Retain a copy of daily reports on grinding equipment for 1 year.
    i. Conduct safety briefings daily and as necessary with change of support personnel. Ensure that all involved understand all grinding operations.

j. Assume the responsibility of Incident Commander in case of a fire, or appoint a person to do this until relieved by a qualified fire fighter.

4. The Director Rail may, from time to time, authorize grinding tests that may require variance from these quality control standards.

6.10.10 Wildfire Prevention and Suppression

Rail grinding operations can start fires that if not suppressed could develop into escaped wildfire. BNSF's policy is to conduct rail grinding operations so as to safely contain and control fire to within the boundaries of the railroad right-of-way.

Conduct all rail grinding operations according to the requirements in Engineering Instruction 1 Safety, specifically section 1.7 (Right-of-Way Fires).

6.11 Surplus Rail Sale and Removal

See Engineering Instruction General, specifically section G.5, for disposition of surplus or used rail.

6.12 Ordering Rail

6.12.1 Rail in Work Program

For CG, RP, and TC projects in the Work Program Schedule, rail complexes will arrange for the required rail.

6.12.2 Capital Projects Not in Work Program

To generate rail requests for projects not in the Work Program Schedule, the Supervisor or Engineer in charge of the project should contact Engineering Maintenance Field Support with the description, quantities, requested delivery date, and accounting information for the required rail.

6.12.3 Maintenance Rail

To generate a rail request, the Roadmaster should contact Engineering Maintenance Field Support with the description, quantities, requested delivery date, and accounting information for the required rail.

6.12.4 Emergencies

The Division Engineer, Manager Roadway Planning, or Roadmaster should contact the rail complex as soon as possible. Follow up by contacting Engineering Maintenance Field Support with the description, quantities, requested delivery date, and accounting information for required rail to generate rail request.

6.13 Using Rail Tongs

Rail tongs are a rugged cast alloy steel device designed to lift and move standard AREA "T" rail sections. The jaws are tapered to provide automatic hooking to and detaching from the ball of the rail. The small handle or arm spread allows the rail tongs to be used close to the side of rail cars. These rail tongs have an anti-slip feature, but do not use them for dragging rail.

6.13.1 Appropriate Uses of Rail Tongs

Rail tongs are designed to handle straight, vertical lifts of rail or Maintenance of Way equipment that has a properly designed center balance lifting bail that is within the weight capacity and rating of the rail tongs. Use rail tongs as follows:

1. Do not use rail tongs to handle rail secured to ties, or multiple jointed or continuous welded rail sections that exceed the rail tong capacity.
2. To increase the capacity of the rail that can be safely handled, use rail tongs in multiple sets as with spreader beam assemblies.
3. Do not use a rail tong to pull or drag rail unless the crane is supporting the rail, and the tong only encounters slight longitudinal resistance.
    a. Ensure that the pulling resistance does not require the hoist line to be angled more than 15 degrees from vertical.
    b. If dragging or pulling rail is required for a particular job, use a suitable rail pulling device for the task.

    Note: The forces when lifting rail are approximately 2:1—the ratio or distance measured from the lifting point to the hinge pin vs. the distance from the hinge pin to the jaws holding the rail. When pulling or dragging rail, these forces change to approximately 8:1, with the fulcrum being the top of the gripping jaw instead of the hinge pin. This results in tremendously increased mechanical stresses on the jaw area.

6.13.2 Rail Tong Inspection

Inspect the following rail tong areas to ensure that tongs operate safely and reliably:

1. Look for any signs of lifting bail/ring stresses or mechanical deformation. Rail tongs using symmetrical lifting bails (lifting rings) should not show any signs of deformation including any pear shape appearance.
    - If the bail becomes pear shaped, it indicates that strain has occurred beyond the tong's rated capacity.
    - The lifting bail should be straight along the sides; bending indicates that the rail has been pulled or dragged and will likely adversely affect the capacity rating of the tongs for future lifts.

2. Observe for deep nicks, gouges, or excessive wear at the lifting hood contact point or the contact point of the two shackles. Also observe the entire casting for gouges, nicks, or abrasions that could compromise the safety and integrity of the tongs.

3. Observe the hinge pin area to ensure that there is no more than 1/16 inch total clearance between the component arms and the retaining rings or washers of the hinge pin.

   - More than 1/16 inch clearance or space indicates excessive wear or a strained or deformed hinge pin.
   - This excessive tolerance can also be observed by spreading jaw halves in the opposite direction. If movement exceeds 3/8 inch, replace the tongs.

4. Observe the jaw area that grips or encompasses the rail head.

   - A new unit will have a straight jaw surface across the entire jaw face.
   - Tongs that have been used to pull or drag rail will show rounded or flattened spots at the opposite corners of each jaw.

   Do not allow wear to exceed 3/16 inch at any corner of the jaw segments.

5. Do not weld on castings.
6. Do not heat or cut castings with oxy-acetylene torch.
7. Lubricating tongs is recommended but not required if using tongs regularly.

Note: Refer to MOW Safety Rule 1.2.6 Warning Signs for information pertaining to the use of an Out-of-Service tag.

6.14 Cutting Rail

A. Before Cutting Rail

1. Use a paint stick to make match marks on both sides of the cut location across base of rail where the marks will not be removed during destressing.

2. Measure and record the distance between these two marks to enable you to measure the total length adjustment after the destressing is complete.

3. Determine whether to saw cut or torch cut the rail as follows:

   a. If the rail temperature is cool and the rail is likely to be in tension, saw cut the rail.

   or

   b. If the rail temperature is hot and the rail is likely to be in compression, torch cut the rail. Oxy-propane is the approved method for torch cutting rail. Be extra careful when cutting tight rail.

B. Cutting Rail With Abrasive Rail Saw

1. Wear face shields, safety goggles, leggings, and hearing protection.

2. Before setting up rail saw, carefully remove dirt, grease, or other debris from the rail.
3. Make sure the rail is well supported. If cutting more than 4 feet of the rail end, support the end.

   Note: If you do not support the rail end, the saw could cause higher stresses in the root of the cut, resulting in horizontal split webs or rapid brittle rail fractures before cutting is complete.
4. To cut rail, start the cut near the corner of the head. Be sure to oscillate the blade while cutting. Cut into the side of the head, then cut into the web and base, continuously oscillating the blade to reduce the chance of the blade breaking or glazing and to extend blade life. Do not start on top of the head and attempt to cut straight down.
5. To cut the last portion of rail on the opposite side, do not position the abrasive rail saw vertical or beyond vertical. When you cannot completely cut through the rail from one side:
   a. Shut off the saw.
   b. Remount the cutting guide bracket or reverse the saw.
   c. Move the saw to the opposite side of the rail to complete the cut.

Appendix A

	BNSF PARS Remedial Action Descriptions
Code "A"	• Qualified person visually supervises each operation over defective rail.
Code "B"	• Limit operating speed over defective rail to 10 MPH.
Code "C"	• Within 7 days apply joint bars bolted through outermost holes[%] and • Limit operation over defective rail until removed as follows: ◦ Before joint bars are applied: • Limit operating speed not to exceed 10 MPH. • If joint bars are not applied within 7 days, remove track from service. ◦ After joint bars are applied*: • Limit operating speed not to exceed 50 MPH.
Code "D"	• Within 7 days apply joint bars bolted through outermost holes[%] and • Limit operation over defective rail until removed as follows: ◦ Before joint bars are applied: • Limit operating speed not to exceed 30 MPH. • If joint bars are not applied within 7 days, limit operating speed not to exceed 10 MPH. ◦ After joint bars are applied: • Limit operating speed not to exceed 50 MPH. • After 50 MGT[#] (but not less than 180 days) limit operating speed not to exceed 40 MPH.
Code "E"	• Apply joint bars bolted according to 213.121 D and E and • Limit operation over defective rail until removed as follows: ◦ Before joint bars are applied: • Qualified person visually supervises each operation over defective rail. ◦ After joint bars are applied*: • Limit operating speed not to exceed 50 MPH.
Code "F"	• Limit operation over defective rail until removed as follows: ◦ Limit operating speed not to exceed 50 MPH. ◦ After 30 days limit operating speed not to exceed 10 MPH.
Code "G"	• Limit operation over defective rail until removed as follows: ◦ Limit operating speed not to exceed 30 MPH. ◦ After 30 days limit operating speed not to exceed 10 MPH.

Code "H"	• Apply joint bars bolted according to 213.121 D and E and • Limit operation over defective rail until removed as follows: ◦ Before joint bars are applied: • Qualified person visually supervises each operation over defective rail. ◦ After joint bars are applied: • Limit operating speed not to exceed 30 MPH.
Code "I"	• Limit operating speed as follows: ◦ Limit operating speed not to exceed 50 MPH. ◦ After 15 MGT# (but not less than 30 days) limit operating speed not to exceed 25 MPH.
Code "J"	• Limit operating speed as follows: ◦ Limit operating speed not to exceed 10 MPH. ◦ After 30 days remove track from service.
Code "K"	• Limit operating speed as follows: ◦ Limit operating speed not to exceed 50 MPH. ◦ After 30 days limit operating speed not to exceed 10 MPH.
Code "L"	• Apply joint bars bolted according to 213.121 D and E and • Limit operation over defective rail until removed as follows: ◦ Before joint bars are applied: • Qualified person visually supervises each operation over defective rail. ◦ After joint bars are applied: • No restriction required.
Code "M"	• FRA-qualified exempt officer must visually inspect within 5 days.
Code "N"	• Limit operating speed as follows: ◦ Within "Dead Zones", turnouts, or crossovers: • After 30 days limit operating speed not to exceed 50 MPH. • After 15 MGT# (but not less than 30 days) limit operating speed not to exceed 25 MPH. ◦ All SSCs regardless of location, after 15 MGT# (but not less than 30 days) limit operating speed not to exceed 25 MPH.
Code "P"	• Limit operations as follows: ◦ Limit operating speed over defective bar to 10 MPH after FRA-qualified employee determines operations can safely continue for a period not exceeding 30 days. ◦ Report a 213.9(b) qualifying defect in TIMS. ◦ If bar not replaced within 30 days remove track from service.
Code "Q"	• Limit operating speed over defective bar to Class 2 (25 MPH freight, 30 MPH passenger).
Code "R"	• The defect has been removed.
Code "T"	• Condition is corrected and valid search^ for internal defects is conducted.
Code "X"	• FRA-qualified exempt maintenance officer must visually inspect within 14 days.

Code "Y"	• Limit operating speed as required by section 6.7.7C(3) until rail is removed or condition corrected and a valid search^ for internal defects is conducted.
When using Code "R" or Code "T", select "defect removed" for type of repair, enter the required rail information, then click the "Report Defect Removed" button. When other than Code "R" or "T" is used, select "Temporary Repair" for type of repair; rail information is not required. Click on the "Add /Update Temporary Rep…" button.	
To report additional defects, enter a new defect number and repeat this procedure.	

*** Note: If defect progresses to 100% after joint bars applied, replace rail.**

 # Note: (MGT) main track Million Gross Tons accumulated traffic from date of defect detection. Annual MGT rate to be determined from the 12 months main track traffic previous to the date of defect detection. Tracks other than main (sidings, crossovers, wyes, etc) shall use the main track annual MGT rate at that point. If preceding 12 months main track traffic is not available at that point, a rate of 50 MGT per year shall be used. Accumulated traffic for defects reported prior to 11/1/2013 will start accumulating effective 11/1/2013.

^ Note: For the search to be valid, the Detector Car Operator must be informed that he or she is testing a previously identified defect. If the search is valid, the Operator will mark the base of the rail as follows: VT (for valid test) – test date – car ID. Do not show the condition corrected and retested (Code "T") unless the Operator marks the rail.

% Note: When applying angle bars bolted through outermost holes—Codes "C" or "D"—do not drill the closest bolt holes next to the defect that is being remediated. Ensure that the defect is centered between the innermost holes of the bars. Do not drill next to the defect to prevent the propagation of the crack into the hole closest to the defect. Acceptable drilling arrangements are shown in Figure 6-7a. When applying angle bars bolted per 213.121 D and E—Code "E" or "H"—install at least two bolts on each side of the defect. Ensure that the defect is centered between the innermost holes of the bars.