ITEM NO. 3

BNSF Engineering Instructions
Revision date May 15, 2001

For immediate assistance or to report problems with the Interactive Voice Response Line, call Engineering Maintenance at 817-352-1984 or 817-352-1985. Order additional instructions through Millennium—the number is 1374103.

6.6.5 Removing Rail Defects

A. Defects That Condemn Entire Rail

1. Scrap any rail (bolted or welded) 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 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 6.6.5F.

2. Rail With Previous Defect

   Completely remove from track, joint-to-joint or weld-to-weld, any rail that has had a defect removed from it previously. Identify and handle scrap rail according to section 6.6.5F.

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, or piped rail. Do not apply joint bars to defects in replacement rail. Identify and handle scrap rail according to section 6.6.5F.

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 track and sidings, completely remove from track, joint-to-joint or weld-to-weld including welds, any "A" rail with a defect. Scrap the entire rail. Identify and handle scrap rail according to section 6.6.5F.

5. Non Control Cooled Rail

   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 main track and sidings, completely remove from track, joint-to-joint or weld-to-weld including welds, any 112# and heavier rail with a defect 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 the entire rail. Identify and handle scrap rail according to section 6.6.5F.

6. Algoma, British, 1987 and 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 in the following brands: Algoma, British, 1987 and 1988 Bethlehem Steelton, Vilru, or Workington. Identify and handle scrap rail according to section 6.6.5F.

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. Identify and handle scrap rail according to section 6.6.5F.

   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 1987 and 1988 (see 6 above).

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 6.6.5F.

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, 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 6.6.5F.

C. Other Defects

Remove defects other than those discussed in 6.6.5A and 6.6.5B 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 6.6.5F.

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 welded into welded rail	16 feet on tangents 18 feet on curves
Flash-butt welded into welded rail	8 feet on tangents and curves

The minimum length of replacement rail installed in bolted rail is 19 feet 6 inches on tangents and curves.

The above minimums 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**

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 track or sidings.

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.

3. If the track carries passenger trains or more than 20 MGT/year, make every effort to use rail known to have accumulated less than 500 MGT, or rail no more than 5 years older than parent rail.

4. Use replacement rail with good surface quality, with no corrugation, head checking, shelling, or spalling.

5. Do not use rail branded "Algoma", "British", "1987 or 1988 Bethlehem Steelton", "Vilru", or "Workington".

6. Do not use Bethlehem fully heat-treated rail (see section 6.6.5A[6]).

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. In main tracks with passenger trains or more than 20 MGT/year, secondhand rail installed for defect removal, service failure repair, joint elimination, and derailment repair must be certified that 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 # (unique number assigned by the Manager Rail Detection)–tester's initials. If new rail or ultrasonically tested secondhand rail is not available and noncertified rail is used, it must be protected with a 40 MPH temporary speed restriction until it is tested in track and marked accordingly.

E. Replacing Rail or Thermite Welding in Cold Weather

When replacing rail in cold weather conditions where the target laying temperature cannot be maintained, use the following procedure:

1. Establish the amount of rail being added by measuring the gap by rail break or, if replacing defective rail, by cut.

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

   - Date
   - Rail temperature
   - Amount of rail added
   - Name of Foreman in charge

3. If rail is added, apply rail anchors to the field side of the plug rail (see Figure 6-6).

4. If the break or defect is in concrete tie or Pandrol fastener territory, apply rail anchors to the field side of the replacement rail (see Figure 6-6).

5. Adjust the rail by removing the rail added using a rail expander and field welding the joints. Use procedures outlined in section 6.2.4.

6. 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.

7. Record adjustments to rail in the Rail Adjustment Record (Form 16430-N; see Figure 6-3). 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.

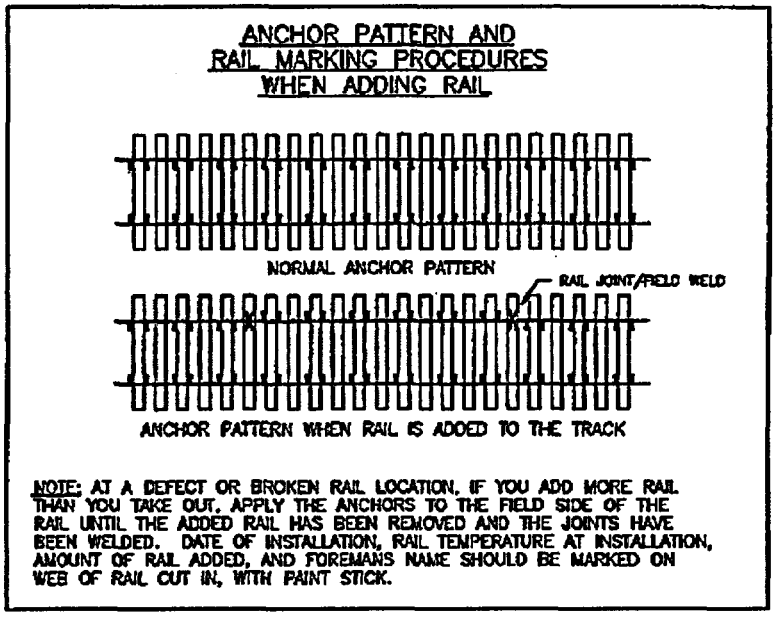

Figure 6-6. Anchor Pattern and Rail Marking When Adding Rail

F. 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, paint with red enamel paint on top of the ball for the entire length of the rail. If paint is not available, cut or torch the

top of the ball of the rail approximately 4 inches from each end of the rail removed from the track. Also, write the word "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 1/2 point. Use an oxy-acetylene torch or rail saw and make the cut across the top of the ball of the rail at least 1/4 inch deep. Before leaving the work site, complete the painting or permanent damage to the top of the ball of the defective rail removed from the track. The same day of detection, complete the painting or permanent damage to the top of the ball of defective rails detected in any replacement rail stockpiles.

2. When changing rail in the field, such as behind a detector car, 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. Remove rail left in other than a scrap storage area as soon as possible.

G. 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. Connect jump wire (shunt) to both rails to maintain correct signal indication.

6. Slowly move power over the bridge. *Then, stop the train.* This forms the bridge to the rail.

7. Re-adjust the clamps to ensure that the springs are collapsed fully.

8. 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.

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

   Note: You must connect the jumper wire (shunt) from one rail to the opposite rail during bridge use.

6.6.6 Damaged Rail

A. Damaged Rail Head

When rail 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.
2. If judged safe after this inspection, raise the speed restriction to 25 MPH.
3. Visually inspect the rail after 24 hours. If safe, return to normal speed.
4. Request the Manager Rail Detection to schedule an ultrasonic rail defect inspection be completed as soon as possible, but in no more than 45 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.