Alaska Railroad Maintenance of Way

CWR Standard Operating Procedures

Proper Longitudinal Stresses in Continual Welded Rail (CWR)

Rail expands (lengthens) when heated and contracts (shortens) when cooled. The temperature of the rail in track exposed to weather may wary from as high as 145° F to as low as -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 the 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.

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 and not because the rail temperature changes.

Alaska Railroad Corporation (ARRC) requires that CWR be laid and maintained at the target neutral temperature of 85° F. 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 railroad. Track can withstand more tensile forces than compressive forces 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 then the TNT. Well-maintained track can withstand compressive forces in the rail up to the maximum temperature the rail will attain.

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

Temp. Diff. In Deg. F	Length of Unrestrained Rail						
	400’	600’	800’	1000’	1200’	1400’	1600’
5°	¼”	¼”	¼”	½”	½”	½”	½”
10°	¼”	½”	½”	¾”	1”	1”	1 ¼”
15°	½”	¾”	1”	1 ¼”	1 ½”	1 ¾”	1 ¾”
20°	½”	1”	1 ¼”	1 ½”	1 ¾”	2 ¼”	2 ½”
25°	¾”	1 ¼”	1 ½”	2”	2 ¼”	2 ¾”	3”
30°	1”	1 ¾”	2 ¼”	2 ¾”	3 ¼”	3 ¾”	4 ¼”
35°	1”	1 ¾”	2 ¼”	2 ¾”	3 ¼”	3 ¾”	4 ¼”
40°	1 ¼”	1 ¾”	2 ½”	3”	3 ¾”	4 ¼”	5”
45°	1 ½”	2”	2 ¾”	3 ½”	4 ¼”	5”	5 ½”
50°	1 ½”	2 ¼”	3”	4”	4 ¾”	5 ½”	6 ¼”
55°	1 ¾”	2 ½”	3 ½”	4 ¼”	5 ¼”	6”	6 ¾”
60°	1 ¾”	2 ¾”	3 ¾”	4 ¾”	5 ½”	6 ½”	7 ½”
65°	2”	3”	4”	5”	6”	7”	8”
70°	2 ¼”	3 ¼”	4 ¼”	5 ½”	6 ½”	7 ¾”	8 ¾”
75°	2 ¼”	3 ½”	4 ¾”	5 ¾”	7”	8 ¼”	9 ¼”
80°	2 ½”	3 ¾”	5”	6 ¼”	7 ½”	8 ¾”	10”
85°	2 ¾”	4”	5 ¼”	6 ¾”	8”	9 ¼”	10 ½”
90°	2 ¾”	4 ¼”	5 ½”	7”	8 ½”	9 ¾”	11 ¼”
95°	3 “	4 ½”	6”	7 ½”	9”	10 ¼”	11 ¾”
100°	3”	4 ¾”	6 ¼”	7 ¾”	9 ¼”	11”	12 ½”

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

B. Amount of Rail Adjustment to Change Neutral Temperature

The property of unrestrained steel that causes its length to change when its temperature changes 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 temperature)
L	=	Total length of unrestrained (unanchored or unclipped) rail

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.

- Rail thermometers are used to measure the rail's current neutral temperature to be used with Table 6-3.
- The left column (Temperature differential in degrees F) is the difference between the current neutral temperature and the TNT in degrees Fahrenheit.
- Values in the remaining columns are the rail length adjustments (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 the target neutral temperature is the intersection of the row containing the appropriate temperature differential and the 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.

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 follow:

A. Threading Rail In

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

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 rail thermometers from the Foreman in charge of rail laying.

2. Check the accuracy of the thermometers at least once per day by reading both thermometers placed side by side on the rail. If the readings vary by more than 2° F, compare a third thermometer to the first two.

3. When using a magnetic thermometer, place the thermometer on the shaded side of the rail near the bottom of the web. Leave the thermometer in place at least 10 minutes before reading the temperature.

   Note: Use other temperature-measuring devices, such as infrared heat guns, according to the manufacturer's recommendations.

4. Determine the best location along the rail string to measure the rail temperature .The temperature may not be constant throughout the length of the rail. If necessary, take the 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 is buried in shoulder ballast before being threaded into the track, the temperature of that portion might be different from the exposed rail.

C. Rail Length Adjustment

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. Establish match marks along the length of the rail as follows:

    a. Immediately after measuring the rail temperature, place every 200 feet a match mark across the base of the rail and the tie plate along the length of the rail from the beginning to the end of the string.

    b. Choose tie plates that are solidly affixed to well-ballasted ties so that the plates will not move when the rail moves.

2. Use Table 6-3 to determine how much match-mark offset is required at each 200-foot interval to raise the neutral temperature to the TNT. To find the temperature differential:

    a. Subtract the measured rail temperature from the TNT (85° F).

    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 400 feet, divide this by 2 to find the match-mark offset for the first 200 feet.

    Note: For example, assume that you are laying a CWR string near Talkeetna that is 1,440 feet long and the rail temperature as measured with a rail thermometer is 45° F. Since the neutral temperature when the match-marks were made was 45° F and the TNT is 85° F, the temperature differential is:

    85 – 45 = 40 degrees

    - At 200 feet from the beginning of the string, the match mark must move 1/2 inch
    - At 400 feet, it must move 1-1/4 inches
    - At 600 feet, it must move 1-3/4 inches
    - At 800 feet, it must move 2-1/2 inches
    - At 1,000 feet, it must move 3 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, the movement at the end of the string must be about 4-1/2 inches.

3. 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 gauge 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. 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 of 85° F, and the rail will not experience any thermal compressive forces until its temperature reaches 85° F.

D. Installing Transition Rails

When installing 136/115 transition rail:

1. Place the transition 136/115 rails directly opposite from each other.

2. When placing the field welds for the transition rails, ensure that they fall into the same crib to ensure proper support for the transition rail in all 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 the 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

Record of Neutral Temperature
Of Welded Rail as Laid

Division________________________ Subdivn_______________________ Line Segment________________

Relay Between___________________ and __________________________ Recorded by_________________

Target Neutral Temperature = **85° F**

Date Rail Laid	Curve No And/or MP loca	Position		Track Number	Actual Rail Temp.	Temp Diff	Distance to Match mark	Expansion at Matchmark		Length of String	Remarks
		E Rail	W Rail					Required	Actual		

3-part form to be distributed as follows: White – Division Engineer, Canary – Roadmaster, 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, east or west rail, near turnout, road crossing, etc.)

F. Joining Continuous Rail Strings

To permanently join continuous welded rail strings using joint bars, fully bolt the joints and fully box anchor the rail adjacent to the joints for 184 ties in both directions from the joint.

To temporarily join continuous welded rail strings until they can be welded, use 6-hole joint bars applied without drilling the boltholes nearest the rail ends. If the joint will be welded within 60 days, anchor the rail as though the joints were already welded.
Joints that have not been welded within 60 days from date of installation the following guidelines must be followed:

- Install a joint with six bolts; or
- Fully box anchor every tie adjacent to the joint for 184 ties in both directions

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 rail 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 ARRC 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 200 feet from the beginning of the unanchored rail

   c. Subtract the measured rail temperature from the TNT and 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” and dividing this value by 2.

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)

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.

Anchoring CWR

Anchor continuous welded rail as follows:

1. Box anchor the rail anchors for 184 ties 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 184 ties 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 the anchors so that they bear against the edge of either the tie or the tie plate.

Anchoring Bolted Rail

Anchor conventional bolted rail as follows:

1. On all bolted rail track:

a. Box anchor every second ties for eight rail lengths on each side of rail 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 those locations specified above.

3. On bolted rail track carrying less than 10 MGT annually box anchor every fourth tie except 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 and anchor the tie next to the joint.

Transition anchoring

Where conventional bolted rail joins continuous welded rail box anchor the welded rail on every tie for 184 ties from the end of the bolted rail.

Beginning at the end of the continuous rail decrease the number of anchors per panel applied to the bolted rail. Decrease the anchors over a distance of eight rail lengths from the solid box anchor pattern of the continuous welded rail to the existing anchor pattern on the bolted rail.

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.

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 the stringers.

3. On open-deck steel bridges, 150 feet long or less, apply anchors to all ties fastened to the steel structure.

4. On all other structures apply anchors as directed by the Director of Bridge Engineering.

Maintaining Anchors

Maintain anchors as follows:

1. When anchors are applied in the prescribed pattern and rail movement is evident:

    a. Inspect the anchors to ensure that they have full bearing against the side of the ties, are the proper size and dimension for the rail section, and are not defective or weakened by over-driving.

    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 trail base, or excessive longitudinal stress correct these track conditions before deciding to add anchors.

Destressing CWR

Destressing means adjusting the neutral temperature of the rail in track by cutting the rail to adjust the amount of rail in a given length of track.

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” (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 in the ties, and/or the ties creeping in the ballast.

Rail creepage has the following characteristics:

- On tracks where the 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 Movement on curves

Curved track tends to move laterally in response to temperature changes. Since rail on a curve may line in (shorten) in cold weather, expect that curved rail may have a low neutral temperature and therefore develop high compressive forces as the rail temperature increases. If needed, set offset stakes at 50-foot intervals around a curve and use the offset measurements to monitor any lateral movement of the track that might change the neutral temperature. Surfacing track through curves will always adjust the neutral temperature of the rail in the curve toward the existing temperature of the rail at the time of surfacing.

5. Longitudinal Stresses Caused by 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.
- Lining curves 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 the rail (while installing repair plugs, insulated joints, track panels, turnouts, etc.) can allow the rail to move longitudinally.

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. Determine how many track feet of rail to destress at a time by considering the size of the work force, available track time, rail temperature, and track conditions.

   a. Do not cut 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. Cutting Rail

After determining the amount of rail to be destressed in the first pull, cut the rail at the midpoint of that length as follows:

1. Before cutting the rail, use a paint stick to make two marks on top of the 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. Be extra careful when cutting tight rail.

D. Eliminating Longitudinal Stress in Rail

To neutralize the thermal forces in the rail:

1. 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."

a. If the rail was cool and in tension when cut, the rail ends will gap wider as the anchors are removed.

Or

b. If the rail was hot and in compression when cut, the rail ends will run toward each other and must be offset or the gap cut wider so that the rail can expand freely.

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.

E. Measuring Rail Temperature to Properly Adjust Length

After eliminating the stress in the rail, accurately measure the rail temperature.

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

Note: For example, if the rail temperature is 65° F, the temperature differential is 20° F (85° F - 65° F). With a temperature differential of 20° F for an unrestrained rail length of 1,000 feet, the adjustment amount is the value under the column heading "1,000 feet" and across from 20° F in the temperature differential column or 1-1/2 inches.

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

   a. If the rail was saw cut initially, cut it again so that the overall rail-end gap is 1-1/2 inches.

   Or

   b. If the rail was torch cut initially, crop the torch-cut ends and, if necessary, install a rail plug that meets the minimum length requirements for repair rail. Saw cut the rail-end gap 1-1/2 inches wider than the length of the plug.

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, cut the rail-end gap 2 inches narrower (per weld) than shown on Table 6-3.

F. Using a 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 ARRC standards. Properly record the total amount of length adjustment on a "Rail adjustment Record" (See figure 6-3) as follows:

   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 at the end of destressing before the rail was cut.
   b. On the web of the rail, near where the rail expander was applied, writer "Adjusted" followed by the date.

7. Report instances of track buckling using the form in Figure 6-4.

RAIL ADJUSTMENT RECORD

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. Milepost where adjustment occurred ______________________
C. Curve or tangent ______________________
D. Weight of rail ______________________
E. Adjustment made to which rail ______________________
F. Rail temperature at time of adjustment ______________________
G. Amount of rail added or subtracted ______________________
H. Rail was cut in, out, or welded ______________________
I. Show specific data recorded on rail ______________________

____

____

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

Figure 6-3. Rail Adjustment Record

Alaska Railroad Maintenance of Way

CWR Joint Bar Inspection Requirements

CWR Joint definition:

- Any joint directly connected to CWR
- Any joint(s) in a segment of rail between CWR strings that are less than 195 feet apart, except joints located on jointed sections on bridges

Minimum inspection requirements:

- Alaska railroad: class 4 track
- Less than 20 million gross tons per year
- Twice per calendar year
- One inspection between January and June
- One inspection between July and December
- Separated by at least 120 calendar days

Exceptions:

- All CWR joints that are located in :
- Switches
- Turnouts
- Track crossings
- Must be inspected on foot monthly consistent with 213.235 and records retained consistent with 49 CFR 213.241

Inspection of joint and track structure:

- Inspect joint and track structure at the joint on foot as required
- In the case of a joint experiencing service failure the following guidelines must be followed:
    1. Weld the joint;

2. Replace the broken bars, replace the bolts, adjust the anchors and, within 30 days weld the joint;
3. Replace the broken bars, replace broken the bolts, install one additional bolt per rail end, and adjust anchors;
4. Replace the broken bars, replace the broken bolts, and anchor every tie for 184 ties in both directions from the CWR joint; or
5. Replace the broken bars, replace the broken bolts, add rail, (consistent with rail added requirements contained within this document), and reapply the anchors.

- Inspect for and record conditions that contributed to or has the potential for joint failure

Inspection must include:

- Loose, bent or missing bolts
- Rail end batter or mismatch that could contribute to joint failure (213.115)
- Evidence of excessive longitudinal rail movement at or near the joint including;
    1. Wide rail gap
    2. Defective joint bolts
    3. Disturbed ballast
    4. Surface deviations
    5. Gaps between rail and tie plates
    6. Displaced rail anchors

NOTE: If these conditions are not corrected at the time of inspection more frequent follow up inspections will be required until the condition is corrected

Follow up inspections:

Follow up inspections will include all inspection criteria, not just the identified deviation

- Inspection will be weekly (not more than 7 calendar days apart)
- Inspection will be on foot
- Inspections are joint specific and are conducted in response to the discovery of a deviation in the joint not immediately repaired

Example for follow up inspections:

- A track inspector identifies corrective action for a bent bolt as “replaced bolt”.
- The joint falls under follow up inspection criteria until the bolt has been replaced.
- After the repair the joint is returned to normal inspection status.

Inspection of inaccessible joints:

Joints that are in highway crossings, passenger walkways, fuel pans or otherwise not accessible should be inspected as follows:

- Remove debris from joint area
- Inspect as thoroughly as possible
- Inspect ties, fasteners, tie plates to the extent possible
- When possible remove joints from these areas

Definitions:

- Remedial action:

Actions required by part 213 to address non-compliant conditions

- Corrective action:

Plan to address the condition that does not meet part 213 actions but does require additional attention. Such as repair, restrictions and additional on foot inspection.

ARRC CWR Joint Inspection Form

Use this form for both required and follow up inspections.

Alaska Railroad Corporation

FRA CWR JOINT INSPECTION REPORT

Date of Inspection ____________________

Name of Inspector____________________ Signature of Inspector____________________

Limits of Inspection: MP__________ to MP__________

ARRC Joint Number	Deviations	Actions

White-Office Yellow-Roadmaster Pink-Inspector

ROADMASTER____________________

DATE____________________

ARRC 2300-002P (03/23/07)

Report Number: (office use only)

Fracture Report

Shall be prepared on the day the cracked or broken joint bar is discovered shall include at a minimum

1. Railroad name
2. Location of joint bar / milepost and subdivision (include ARRC CWR joint number)
3. Class of track
4. Million gross tons for previous year
5. Date of discovery of crack or break
6. The rail section
7. The type of bar (standard, insulated or compromise)
8. Number of holes in the bar
9. General description of crack or break
10. Length of crack in inches
11. Gap between rail ends
12. Amount and length of rail end batter or ramp on each rail end
13. The amount of tread mismatch
14. Vertical movement of joint
15. In curves or spirals: the amount of gage mismatch and lateral movement of the joint

CWR Joint bar fracture report

Complete this form only if the joint bar is cracked or broken.

CWR JOINT BAR FRACTURE REPORT	***TYPE OF INSPECTION*** ☐ PERIODIC JOINT INSPECTION (213.119[g][5][i]) ☐ TRACK INSPECTION (213.233) ☐ TURNOUT INSPECTION (213.235) ☐ OTHER (discovered during other than required inspection)

RAILROAD:	SUBDIVISION:	MILEPOST:
DATE FOUND: ____ /____ /20____	ANNUAL MGT: / TRACK #:	TRACK CLASS:
☐ TANGENT	☐ CURVE ____ degrees ☐ LOW/INNER RAIL ☐ IN SPIRAL ☐ HIGH/OUTER RAIL	RAIL SECTION(S):______ / ______

ANNUAL JOINT INSPECTION FREQUENCY FOR THIS SEGMENT: ☐ 1x ☐ 2x ☐ 3x ☐ 4x ☐ OTHER: __________	DATE OF LAST JOINT INSPECTION: ____ /____ /20____

BAR TYPE (check all that apply)	☐ STANDARD	☐ INSULATED	☐ COMPROMISE
	NUMBER OF HOLES:	☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8	

FIELD SIDE BAR		***GAGE SIDE BAR***	
BROKEN THROUGH Check location of break: ☐ CENTER ☐ INNER BOLT HOLE ☐ OTHER		**BROKEN THROUGH** Check location of break: ☐ CENTER ☐ INNER BOLT HOLE ☐ OTHER	
CRACKED Check location(s) and record length(s):		**CRACKED** Check location(s) and record length(s):	
☐ TOP CENTER	________ inches	☐ TOP CENTER	________ inches
☐ BOTTOM CENTER	________ inches	☐ BOTTOM CENTER	________ inches
☐ INNER BOLT HOLE	________ inches	☐ INNER BOLT HOLE	________ inches
☐ OTHER BOLT HOLE	________ inches	☐ OTHER BOLT HOLE	________ inches
☐ OTHER (describe)	________ inches	☐ OTHER (describe)	________ inches

GAP BETWEEN RAIL ENDS	________ INCHES	
RAIL END BATTER OR RAMP		(Figures 1 and 2)
☐ NORTH or ☐ EAST RAIL END	________ INCHES HIGH	________ INCHES LONG
☐ SOUTH or ☐ WEST RAIL END	________ INCHES HIGH	________ INCHES LONG
TREAD MISMATCH	________ INCHES	(Figure 3)
JOINT VERTICAL MOVEMENT	________ INCHES	

IF JOINT IN CURVE or SPIRAL:			
GAGE RAMP	(Figure 4)	________ INCHES OUT	________ INCHES LONG
GAGE MISMATCH	(Figure 5)	________ INCHES	
JOINT LATERAL MOVEMENT		________ INCHES	

OTHER COMMENTS:

____

____

____

FRACTURE REPORT INSTRUCTIONS & FIELD DESCRIPTORS (DRAFT)

TYPE OF INSPECTION – Indicate the type of inspection being performed when fracture was found. **At least one (1) box in group must be checked.**

RAILROAD – FRA railroad reporting code, (e.g. CSX or NS). **Four (4) character alpha.**

SUBDIVISION – Railroad's subdivision or district. If none enter "system". **Fourteen (14) character alphanumeric.**[1]

MILEPOST – Railroad's designated milepost at the location of the fracture. **7.2 character alphanumeric, e.g., ABC1234.56.**[1]

DATE FOUND – Date the fracture was found. **Eight (8) character numeric, MMDDYYYY.**

ANNUAL MGT – Million Gross Tons (from previous year) for the specific track with the fracture. **4.1 numeric, e.g., 123.4 (allowable range 0 to 999.9 inclusive).**

TRACK CLASS – FRA Class for track with the fracture. **One (1) character numeric, e.g., 3 (allowable range 2 - 6 inclusive).**

TANGENT/CURVE/SPIRAL/INNER/OUTER – Indicate whether fracture found on tangent, curve (include degree of curvature) or spiral and if inner or outer rail, if applicable.

If tangent, check TANGENT. Otherwise check CURVE or SPIRAL and INNER or OUTER. If curve checked, curvature entered as 2.1 numeric, e.g. 2.5.

RAIL SECTION – Indicate each rail section comprising the joint, (e.g. for a standard bar, enter 136/ or for a compromise bar, enter 132/115). **One (1) or two (2) three character numeric, e.g., 123 or 123 456.**

ANNUAL JOINT INSPECTION FREQUENCY – Number of times per year that walking joint bar inspection is performed. **Two (2) character numeric, e.g. 3 (allowable range 1 – 12 inclusive).**

DATE OF LAST JOINT BAR INSPECTION – Date the last walking joint bar inspection was performed. **Eight (8) character numeric, MMDDYYYY.**

BAR TYPE/HOLES – Indicate bar type: standard, insulated, or compromise bar and number of holes. **Two (2) boxes (one in each group) must be checked.**

BROKEN THROUGH – For each bar, field and gage, check appropriate box if broken completely through and indicate the location of the break (through center, through inner bolt hole or other location).

For each bar, field and gage, there is no requirement to check any box(es) – neither bar is broken through.

CRACKED – For each bar, field and gage, indicate the crack location(s) and corresponding length(s).

For each bar, field and gage, any number of boxes may be checked. If box is checked, crack length is 3.1 numeric, e.g., 2.5. If OTHER is checked, text description can be 64 (128?) character alpha-numeric.

GAP BETWEEN RAIL ENDS – Measure and record the distance between the rail ends. If joint is pulled apart or separated, estimate the gap prior to separation. **5.2 numeric, e.g. 10.25.**

RAIL END BATTER OR RAMP - Measure and record the ***height and length of the batter or ramp for each rail end*** and record even if found to be zero. See Figures 1 and 2 for method of measurement. **Check appropriate boxes (one each of NORTH or EAST and one each of SOUTH or WEST) and enter batter ramp as four (4) 4.2 numeric, e.g., 1.25.**

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[1] This format has been pre-established in FRA's RISPC system for its safety inspectors.

TREAD MISMATCH – Measure and record the tread mismatch. See Figure 3 for method of measurement. **4.2 numeric, e.g., 1.25.**

JOINT VERTICAL MOVEMENT – Record the vertical movement of the rail joint (not track surface) according to 213.13. **4.2 numeric, e.g., 1.25.**

GAGE RAMP – In curves only, measure and record the gage ramp distance out and length. See Figure 4 for method of measurement. **Two (2) 4.2 numeric, e.g., 1.25.**

GAGE MISMATCH – In curves only, measure and record the gage mismatch. See Figure 5 for method of measurement. **4.2 numeric, e.g., 1.25.**

JOINT LATERAL MOVEMENT – In curves only, record the lateral movement of the rail joint (not gage) according to 213.13. **4.2 numeric, e.g., 1.25.**

OTHER COMMENTS: - Other comments, including any other factors or conditions that may have contributed to the fracture of the bar(s). **256 character alphanumeric.**

See following pages for proper measurement methods:

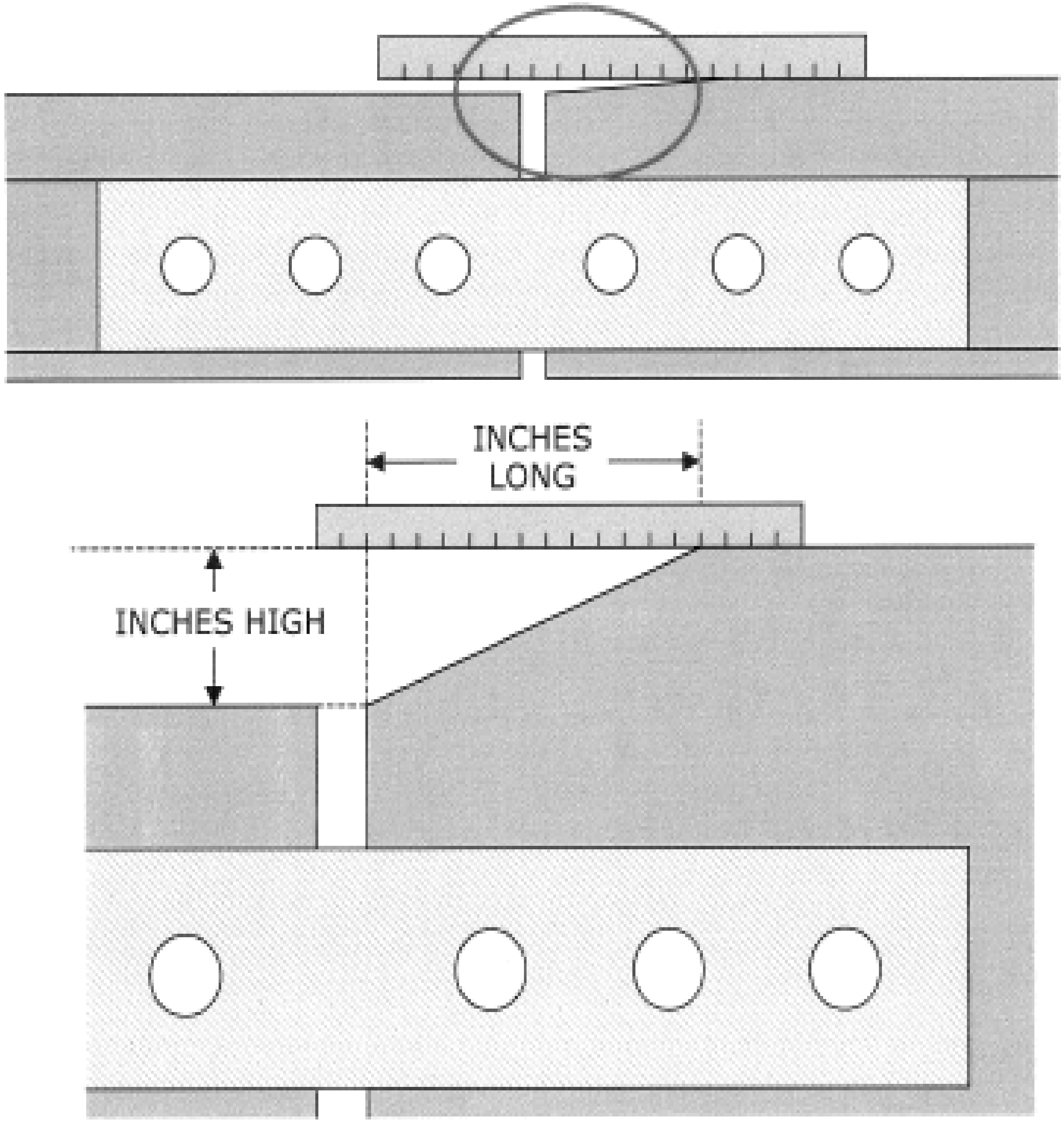

Figure 2. Method for measuring RAIL END RAMP.
(NOT TO SCALE)

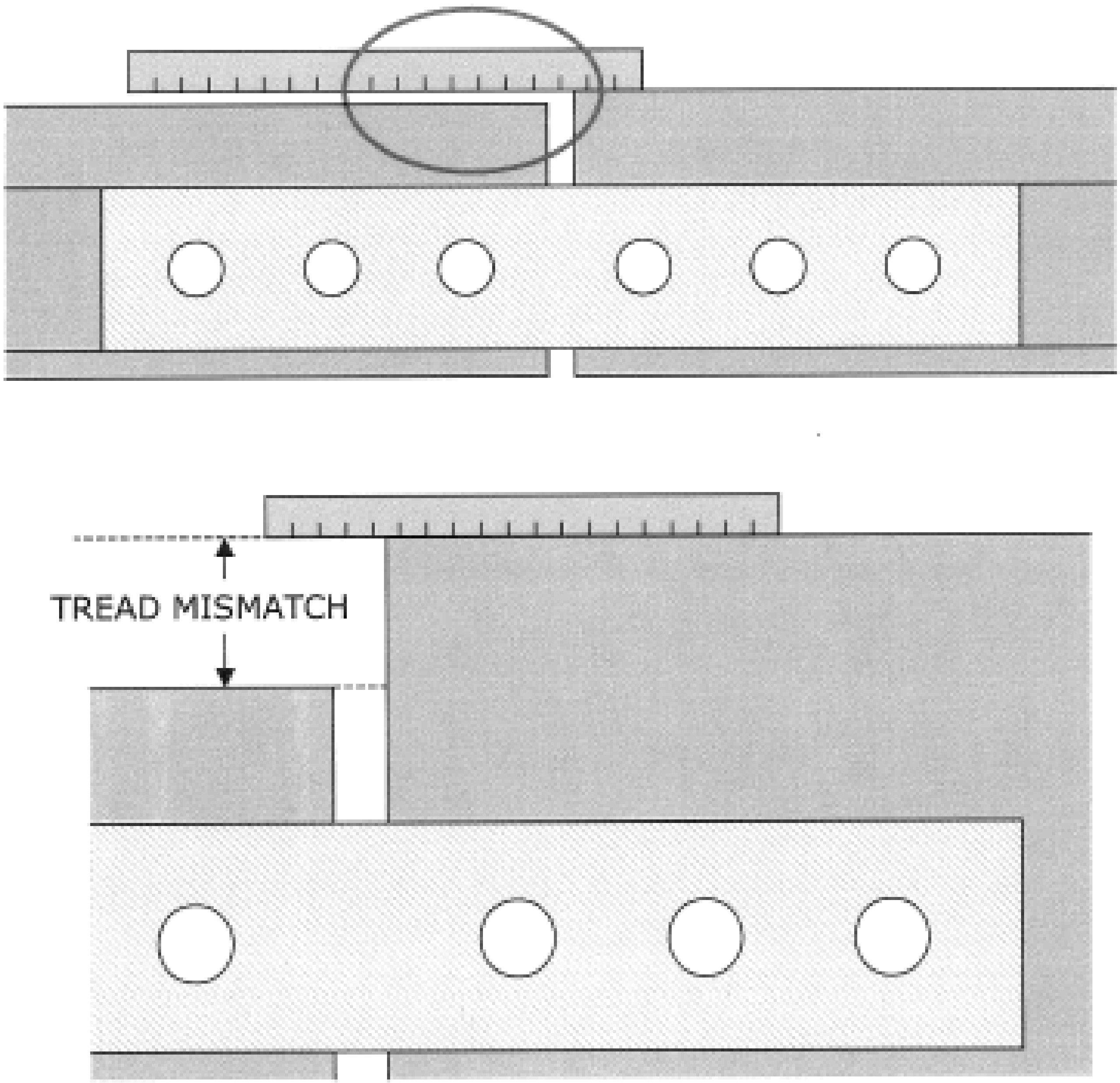

Figure 3. Method for measuring TREAD MISMATCH.
(NOT TO SCALE)

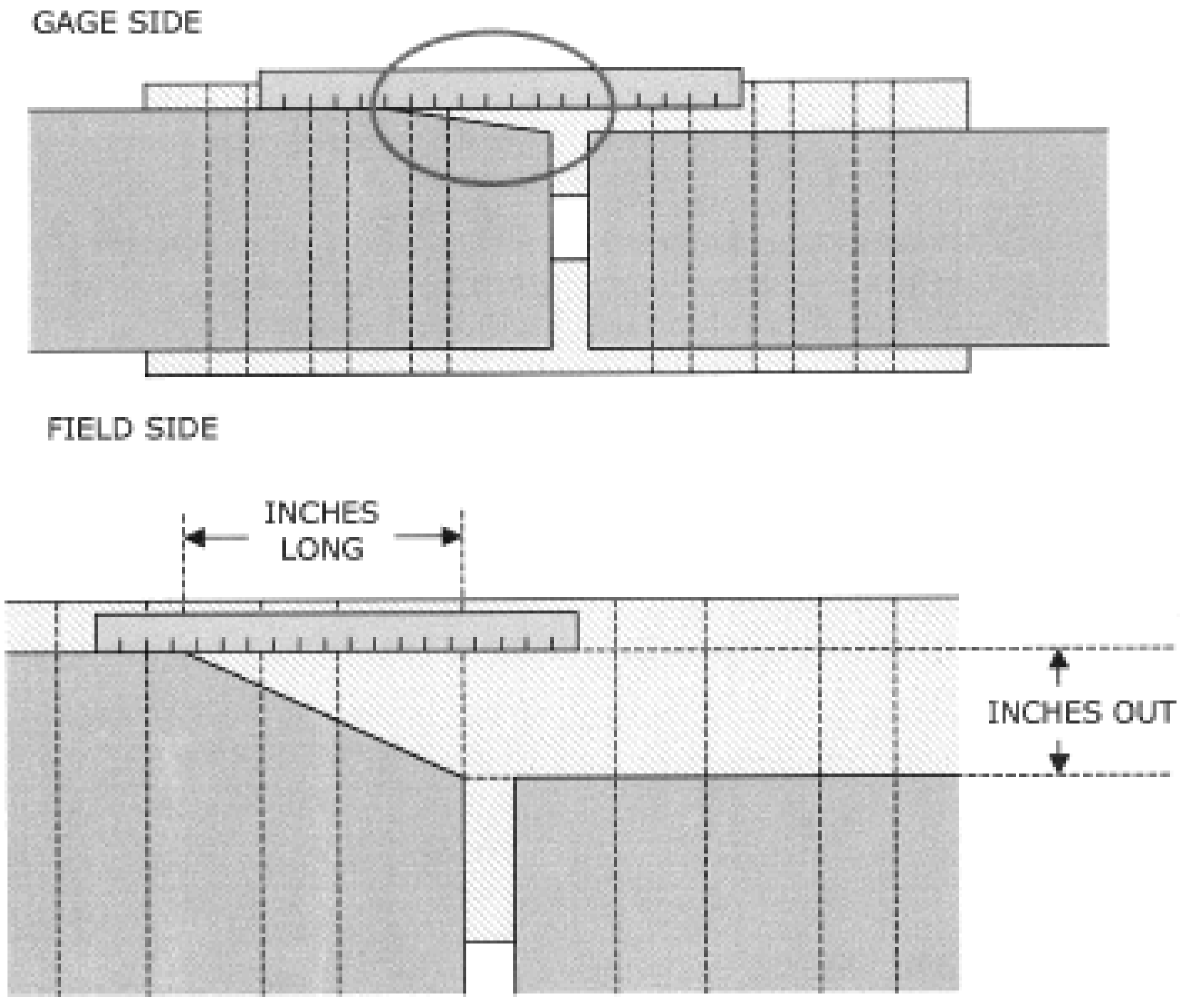

Figure 4. Method for measuring GAGE RAMP.
(NOT TO SCALE)

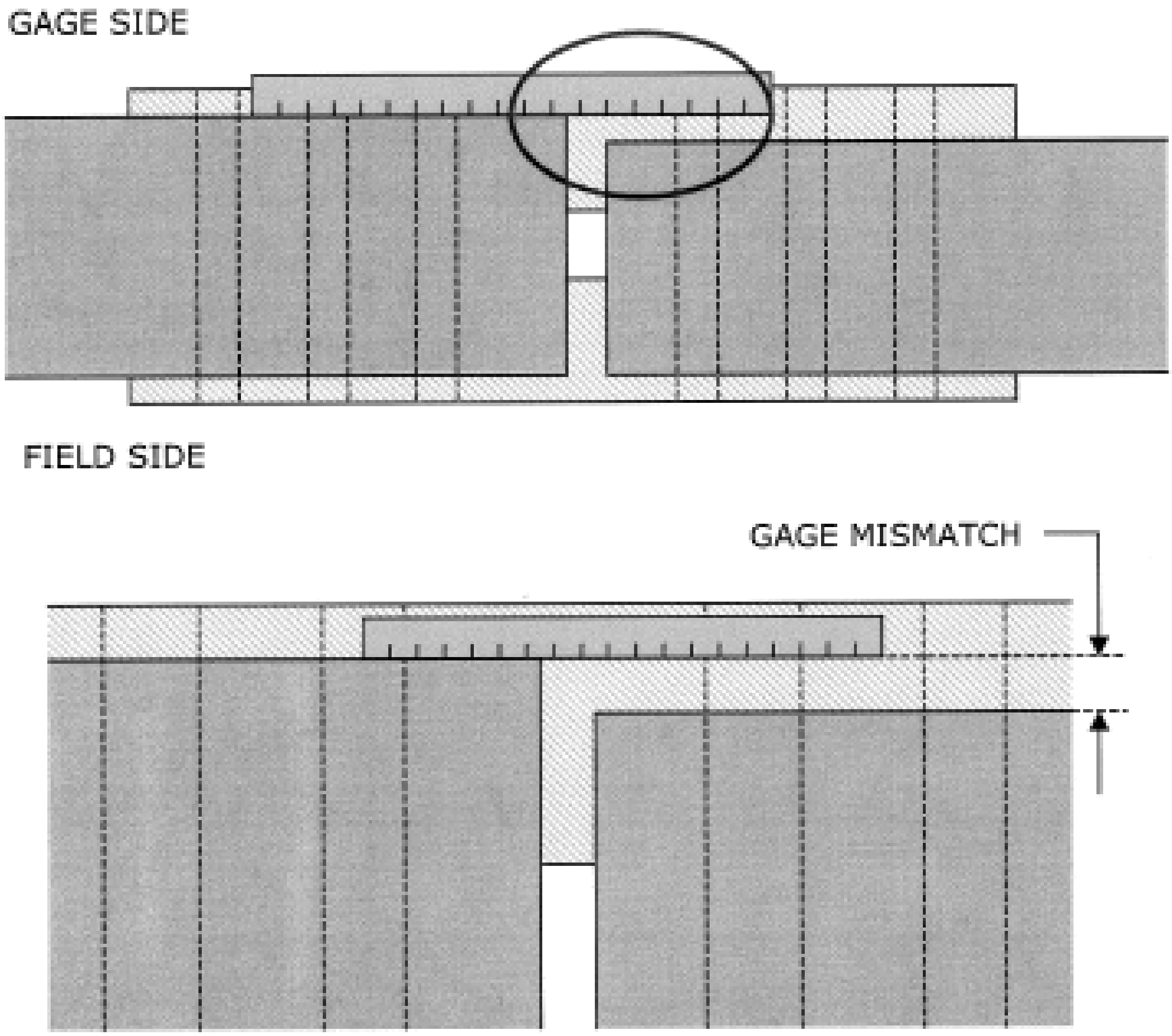

Figure 5. Method for measuring GAGE MISMATCH. (NOT TO SCALE)

Requirements for adding or removing joints in CWR.

When joints are added or removed complete the following form as outlined at the bottom of the form.

CWR Joint Information Form

Joint added or removed? (Circle one) **Added / Removed**

Joint # _**CWRJ-**____________
(Joint number consists of 4 letters and a number; **ex. CWRJ-1385**)

Date: ________________ Employee: ______________________

District _________________ Milepost ________________________

Latitude __________________ Longitude _____________________

East or West rail? (Circle one) **East / West**

Which track? (Circle one) **Main / Siding / Other**

Directions for use

When adding a joint in CWR:

1. Call 265-2446 for the next joint number. Provide at least the date the joint was installed and employee installing.
2. Record joint number on this form and fill out the rest of the information completely.
3. With a paint pen, record the joint number on the rail next to the corresponding joint.
4. Send this form in with the timecards at the end of the week.

When removing a joint in CWR:

1. On this form record the joint number found on the rail next to the joint.
2. Record the date removed and employee removing on this form.
3. Send this form in with the timecards at the end of the week.

Distribution: White Copy – Office Yellow Copy - Roadmaster

Training

All employees responsible for the inspection, installation, adjustment or maintenance of CWR track must complete training on CWR procedures every calendar year. In addition, they shall be provided a copy of these procedures and all accompanying documents. MOW Administration will maintain lists of those employees qualified to supervise restorations and inspect track in CWR territory. The qualified employee lists will be made available to the FRA upon request. Training programs will address, but not be limited to, the following:

- CWR installation procedures
- Rail anchoring requirements when installing CWR
- Preventive maintenance on existing CWR track
- Monitoring curve movement following track surfacing and lining
- Placing temporary speed restrictions account track work
- Rail joint inspections
- Insufficient ballast
- Extreme weather inspections
- Recordkeeping
- Fracture reports
- Action items