CONTINUOUS WELDED RAIL PLAN

For the
Central Florida Rail Corridor

In preparation for

and Central Florida Rail Corridor

Florida Department of Transportation

District 5

EFFECTIVE November 27, 2013

Revision Log

Revision #	Revised By	Date	Issue / Revision Description
--		08/25/11	Original
1.0	LE	10/28/11	Effective Date and addresses revised.
2.0	DS	06/06/13	Contact information and references revised.
3.0	Bombardier	11/27/13	Bombardier Mass Transit Corporation to start Maintenance of Way of the CFRC.

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Introduction

Effective November 3, 2011, Florida Department of Transportation took ownership of an existing and active Class IV passenger and freight railway right of way (ROW) for rail operations. This corridor received the Federal Railroad Administration (FRA) alpha designation Central Florida Rail Corridor or CFRC. FDOT, as the owner, is responsible for maintenance along the entire CFRC railroad corridor. The CFRC is geographically located between M.P. A749.61 and A813.82 such that it operates as a bridge between two sections of the CSXT A-Line abutting to the north and south of the 61.35 mile corridor.

The Florida Department of Transportation (FDOT) – in cooperation with the Central Florida Regional Transportation Authority (LYNX), METROPLAN Orlando, the City of Orlando, and the Counties of Volusia, Seminole, Orange, and Osceola will introduce commuter rail service in the four-county corridor that extends north and south of Orlando, Florida. SunRail was selected as the name for the new commuter rail service that will operate on this corridor and is scheduled to begin full revenue service in spring of 2014.

FDOT is currently contracting the maintenance services along with Phase 1 of the Central Florida Commuter Rail Transit (SunRail) Project construction work to a Design-Build-Maintain (DBM) contract, Archer Western/RailWorks Joint Venture Consortium (AW/RW JV). FDOT has awarded the operations and maintenance of the Corridor and SunRail commuter service to Bombardier Mass Transit Corporation. Maintenance responsibilities will transition from Archer Western/RailWorks Joint Venture Consortium to Bombardier Mass Transit Corporation in the fourth quarter of 2013.

This document details CFRC policy on installing, adjusting, maintaining and inspecting Continuous Welded Rail (CWR) track. Each chapter details how the Railroad applies its standards and procedures to comply with FRA standards.

Buckled track is not a cause but the result of some deficiency in the track structure or track maintenance procedures. A properly constructed and maintained section of track will not buckle from thermal or train loading during seasonal temperature variations. Research of this subject has identified some critical parameters or conditions which directly influence track buckling:

- Track Curvature
- Alignment
- Rail Neutral Temperature
- Track Lateral Resistance
- Track Longitudinal Resistance
- Dynamic Train Loading

The above elements must be controlled and maintained to minimize the potential for buckled

track. Track construction, and inspection and maintenance crews control the first five items and have substantial influence on the last.

CFRC's Contractors are responsible to comply with the applicable portions of 49 CFR Part 213 listed above. Officers of CFRC audit Contractor compliance.

Program Administrators

CFRC Administrator:	CFRC/SunRail Maintenance Assistance Corridor 801 SunRail Dr., Sanford, FL 32771 (407) 325-6931
O&M Contract Provider for Maintenance:	Chief Engineer or his designees

The CFRC CWR Plan became effective November 3, 2011 and is under the authority of the CFRC/SunRail Director of Operations. Any revisions to this plan or sections of this plan will be noted with a revision number. The entire plan will be maintained and available at the office of the CFRC Office located at the CFRC/SunRail Operations Control Center, 801 SunRail Dr., Sanford, FL 32771.

Procedures for the Installation, Adjustment, Maintenance and Inspection of CWR

Chapter 1 CWR Installation Procedures

Continuous Welded Rail (CWR) is defined as rail that has been welded together into lengths exceeding 400 feet. Temperature variations affect rail length. Rail expands (lengthens) when heated and contracts (shortens) when cooled. Rail installed as CWR remains CWR, regardless of whether a joint or plug is installed into the rail at a later time.

1.1 Desired Rail Neutral Temperature

Welded rail will be laid and anchored at a minimum adjusted rail temperature (designated rail laying temperature). Rail neutral temperature is the temperature at which rail is neither in tension nor compression. When laying or adjusting CWR on CFRC, the desired rail neutral temperature is 105°F.

The proper minimum adjusted rail temperature will be used to calculate the actual rail expansion needed. See **Maintenance of Way Instruction (MWI) 1125 Section II** for details.

Unadjusted CWR

If rail is laid at a temperature more than 40°F below the designated rail laying temperature, rail must be adjusted or a speed restriction not exceeding 40 mph must be placed. When tight rail conditions exist, be governed by CFRC MWI 1125.

Welded rail that has not been properly adjusted will be protected by a temporary speed restriction when: (whichever occurs first).

- The ambient temperature is expected to be 85°F or higher or rail temperature 110°F or higher – **maximum 25 mph,**
- Or the rail temperature is 40°F higher than the rail laying temperature – **maximum 40 mph**

When a temporary speed restriction must remain on track over night, the Temporary Warning, Reduce Speed, and End Restriction signs must be displayed.

1.2 Temperature Differential

The difference between the designated rail laying temperature and the actual rail temperature taken at the time of installation is called the temperature differential. CWR laying and adjusting procedures have been established to compensate for this temperature differential. (Appendix 1)

1.3 Installation of CWR

Follow these general requirements when installing CWR:

- The designated rail laying temperature on CFRC is 105°F.
- Take the rail temperature and calculate the expansion required before making adjustments.
- Record the rail laying temperature, location, and date on approved forms. These records may be retained in an electronic format per CFR Part 213.241.
- Rail does not need to be adjusted when the actual rail temperature exceeds the designated rail laying temperature of 105°F.
- Use rail heaters or rail expanders to adjust the rail to the correct length when the actual rail temperature is less than the designated rail laying temperature. Heat the rail evenly and uniformly so that the rail expansion occurs evenly and uniformly throughout its length. If rail is laid at a temperature more than 40°F below the designated rail laying temperature, rail must be adjusted or a speed restriction of 40 mph must be placed. When tight rail conditions exist, be governed by Chapter 7.1.

Rail will be installed in accordance with CFRC MWI 1125.

These instructions apply to rail laid out of face and curve patching.

- Ties will be adzed with 1/8 inch cant (0.5 degrees to the gage or adze head to cut tie 1/8" deeper on the gage side, measured at the edge of the cut) during out-of-face and curve patch operations and welded rail laid to 56-1/2 inch gage. Ties on open deck bridges will not be adzed without approval of the Chief Engineer or his designees.
- All joints should be welded when the rail is laid. Welding will be done as rail is being laid except when weather conditions prevent adjusting of welded rail for temperature change.
- If it is not possible to weld a joint, the rail will be drilled with two holes in each rail end to accommodate joint bars with two (2) bolts in the outermost holes. This joint is a location of less substantial track structure than a fully bolted 6 hole joint and constitutes a point of potential service interruption from rail pull-aparts, surface irregularities, and loose/missing bolts. The joint should be welded as soon as practicable, but within 60 days, one of the following must occur:

- Weld joint **or**
- Install 6 bolts **or**
- Box anchor CWR on every tie for 130 consecutive ties in each direction

- For joints being left for later welding, the following information must be marked using permanent paint marker on the web of rail:

  - Date of installation
  - Team Identification
  - Adjusted rail temperature

- The **Chief Engineer or his designees** must be notified of the location of the joint and the information noted above.

- Transition of compromise rails are used to eliminate the need for bolted or field welded compromise joints at permanent compromise locations. They are designed to be full rail height on the end that matches the new rail specified for the project; and a varying rail height on the end that ties into the existing rail. When using transition rails:

  - Determine the rail height at the compromise point for the existing rail.
  - Identify that same rail height on the transition rail.
  - Mark and cut the transition rail to match the existing rail height.

See CFRC MWI 507 for additional information on transition and compromise rails.

1.4 CWR Thermal Adjustment

Adjust Continuous Welded Rail (CWR) to obtain proper Minimum Adjusted Rail Temperature (Desired Rail Installation Temperature or Neutral Temperature).

Welded rail being laid with a rail temperature less than stated in CFRC MWI 1125 will be heated and adjusted for length.

The supervisor in charge of rail laying is responsible to see that the rail is properly adjusted for length and anchored as it is laid. The anchoring operation will be no more than 100 feet behind the rail heater. The anchors must be applied only when the rail had achieved the necessary expansion movement and the rail is at or above the desired temperature. The supervisor in charge of rail laying will supervise rail adjustments when rail temperature is less than specified in CFRC MWI 1125.

The supervisor in charge of rail laying will monitor field welding at joints in CWR to ensure that rail length is not increased in the join welding process.

1.5 Recordkeeping for CWR Installation

The Chief Engineer or his designees will ensure that the completed record of laying temperature for Continuous Welded Rail (CFRC MWI 1125) is entered into the CFRC electronic reporting system. (Appendix 2)

Chapter 2 Rail Anchoring

Anchoring must effectively restrain rail movement. Rail must be adjusted or anchors must be added to moving rail that is subject to buckling or where anchors do not have effective holding power.

Standard rail anchor patterns are detailed in **CFRC MWI 703, Rail Anchoring Policy**.

Care must be taken to ensure that all welded rail is anchored to standard.

Where the anchoring function is otherwise provided, rail anchors may be omitted. Anchors may not be applied where they will interfere with signal or other track appliances, where they are inaccessible for adjustment, inspection or on rail opposite a joint. Anchor pattern may be varied as reasonable to avoid placing anchors against deteriorated ties.

Installation

The following anchoring requirements apply to CWR installation on all main track and sidings. These anchoring requirements also apply to all tracks other than main tracks or sidings operating at speeds above class 1.

2.1 Standard Box Pattern

When installing CWR, box anchor every other tie except as outlined in Section 2.2.

2.2 Solid Box Pattern

When installing CWR, box anchor every sound (effective) tie at specific locations listed below to provide additional restraint against rail movement.

Condition	Action
Turnouts Rail crossings Joints where CWR abuts jointed rail	Anchor every tie for 195’ in each direction
Bolted joint installed during CWR installation when using heater, rail stretcher or sufficient ambient temperature	Weld joint within 60 days, **OR** Install joint with 6 bolts, **OR** Anchor every tie for 195’ in each direction

2.3 Bridge Pattern

When installing CWR, follow these bridge anchoring requirements:

1. Ballast deck bridges should be anchored with the same pattern as in Section 2.1 and 2.2
2. All open deck bridge approaches should be box-anchored on every tie for 130 consecutive ties in each direction from the bridge.

Maintenance or Rail Repair

2.4 Legacy Patterns

On CWR installations completed before September 21, 1998, existing anchoring may remain if rail is restrained to prevent track buckles, but rail must be adjusted (by increasing or decreasing the length of rail, or by lining on curves) or anchors added to rail if restraint is not sufficient. When stripped joints occur in these areas, the joint area must be brought up to the current standard. This means, if a CWR joint becomes stripped in a legacy anchor area, at least every other tie will be box anchored for a distance of 195 feet in each direction unless anchoring is otherwise provided.

2.5 Anchor Pattern after Repair

When repairs result in a joint being added to CWR, the anchor pattern shall match the existing pattern in track. At least every other tie will be box anchored for a distance of 195 feet in each direction unless anchoring is otherwise provided. When repairs are made to a stripped joint or failed joint bar, the adjustment or addition of anchors will be as prescribed in the following table.

Condition	Action
Bolted joint in CWR experiencing service failure (stripped joint) or failed bar(s) with gap present	Weld joint, **OR** Remediate joint conditions (per Chapter 6.5), **and** replace bolts (new, in-kind, or stronger), **and** weld joint within 30 days, **OR**
Gap exists if it cannot be closed by drift pin	Replace failed bar(s), install 2 additional bolts **and** adjust anchors, **OR** Replace failed bars, bolts (if broken or missing) **and** anchor every tie for 195 feet in both directions **OR** 5. Add rail

Chapter 3 Preventive Maintenance on Existing CWR Track

Performing track buckling maintenance reduces the risk of buckles. When tight rail conditions exist, be governed by Chapter 7.1.

3.1 Maintaining Desired Rail Installation Temperature Range

A record of rail neutral temperature will be maintained where rail has pulled apart, broken, or been cut for defect removal. Record the length of the rail end gap and rail temperature in addition to the other required information on the proper form for determining rail neutral temperature.

Rail that has pulled apart, broken, or been cut for defect removal must be readjusted to be within the CFRC's rail laying temperature minus 20° (RLT-20°) safe range. If the rail has not been readjusted to at least RLT-20° before rail temperatures exceed the values in the TABLE below, a speed restriction of 25 mph will be placed, or a speed restriction of 40 mph will be placed with a required daily inspection made during the heat of the day.

Rail break or cut Temperature (°F)	Rail temperature (°F) at which to readjust or apply slow order
60	135
50	130
40	125
30	120
20	115
10	110
0	105
-10	100
-20	95
-30	90
-40	85

After May 31, 2011, known rail neutral temperature locations not adjusted to within the RLT -20° safety range must be adjusted within 365 days of installation.

If rail is added for any reason, measure and record the amount of rail added so that adjustments can be made, if necessary. Where rail has been added to re-establish the desired RLT, this requirement need not apply. This measurement will be made by the use of reference marks. (Appendix 3)

The use of reference marks includes:

- Marking the locations where rail is to be cut
- Marking the rail outside the limits of the joint bars

- Measure the distance between the reference marks and mark it on the rail or otherwise record it
- Install the rail and re-measure the distance between reference marks
- Record the difference and document the location

When welding rail ends together, the required weld gap or rail consumption must be taken into consideration when determining the amount of rail adjustment.

3.2 De-Stressing Rail

Rail can be de-stressed by cutting rail out or by re-aligning a curve. When cutting rail out, use this procedure:

1 Use a designated safe procedure to cut rail if it's possible that the rail is under compression and may move unexpectedly. Cut rail to be de-stressed.
2 Remove or reposition anchors or clips for a minimum of 195 feet in both directions from the cut or up to a restriction that prevents rail movement (i.e. bridge, switch, etc.).
3 Wait until the rails stop moving. The rail ends may need to be trimmed more than one time to allow for expansion.
4 Take the rail temperature away from cut.
5 Use change in rail length due to change in temperature (attached as Appendix 1) to compare the rail temperature with the designated rail laying temperature for the territory. This is known as the temperature differential.
6. The temperature differential must be within limits in **CFRC MWI 1125** and be recorded per **CFRC MWI 1125.**
7 Weld the joint or apply joint bars.
8 Replace the rail anchors or clips.

Chapter 4 Monitoring Curve Movement Following Track Surfacing and Lining

4.1 Staking of Curves

Before surfacing and lining a curve on main tracks, stake curve if it is 3° or more and the rail temperature is more than 50°F below the designated rail laying temperature (or is forecasted to be in the next 24 hours).

To stake a curve prior to surfacing and lining, place at least 3 reference points uniformly spaced around the curve. These reference points shall be no more than 200 feet apart.

4.2 Inspecting for Curve Movement

Inspect for curve movement periodically after the work, especially during periods of large temperature changes. Where curve has been staked per Section 4.1 and curve has shifted inward more than a maximum of 3 inches, the curve must be lined out prior to ambient temperatures above or forecasted above the designated temperature of 105°F. If curve is not lined out or de-stressed, a speed restriction of 40 mph or less must be placed. When tight rail conditions exist, be governed by CFRC MWI 1125 and 1109.

Chapter 5 Placing Temporary Speed Restrictions Due to Work

Place a temporary speed restriction anytime the roadbed or ballast section is disturbed as required in Section 5.4, except where the maximum authorized speed of the track is equal to or less than the required restriction.

5.1 General Requirements

Speed restrictions ensure safe train operations until the affected track stabilizes. Restrictions need to stay in place to allow the ballast to consolidate, rail compressive forces to equalize, and the sub grade to compact. Take more restrictive measures when conditions warrant.

5.2 Responsibility for Placing Speed Restrictions

During the work or before returning the track to service, the supervisor or foreman in charge must ensure that:

Gage, surface and alignment have been established. Crib and shoulder ballast is in place or lateral constraint is otherwise provided. The rail is anchored per Chapter 2.

5.3 Speed Restriction Length

To minimize running rail and other dynamic forces, trains must have time to brake and adjust slack before entering the disturbed track. For heavy grades, sharp curves, or substandard track conditions, extend speed restrictions farther from the work limits, if needed.

5.4 Speed Restrictions for Track Work

When the following track work has been performed, place a speed restriction that complies with the guidelines below.

When rail temperature is above or forecasted above railroad designated temperature of 105°F within the next 24 hours:

Activity	Maximum Speed	Minimum Duration
Out-of-face installation of ties Undercutting Laying track/switch panels Constructing track Out-of-face surfacing and lining	30 mph freight 40 mph passenger	1 Tonnage Trains at 10 MPH10 Tonnage Trains at 25 MPH 10 Tonnage Trains at 50 MPH

Spot Maintenance • Installing ties (no more than 5 ties in 39 ft. and no more than 3 consecutive ties) • Surfacing/lining (maximum length of 19'6")	30 mph freight 40 mph passenger	1 Tonnage Trains at 10 MPH 10 Tonnage Trains at 25 MPH 10 Tonnage Trains at 50 MPH
Mechanically stabilized track performed after any of the activities listed above	30 mph freight 40 mph passenger	1 train

When rail temperature is below and is forecasted to remain below railroad designated temperature within the next 24 hours of 105ºF:

Activity	**Maximum Speed**	**Minimum Duration**
Out-of-face installation of ties Out-of-face surfacing and lining Undercutting Laying track/switch panels Constructing track Exception: Spot maintenance does not require a speed restriction	30 mph freight 40 mph passenger	1 Tonnage Trains at 10 MPH 10 Tonnage Trains at 25 MPH 10 Tonnage Trains at 50 MPH
Mechanically-stabilized track performed after any of the activities listed above	40 mph freight	1 train

When ambient temperature is less than 50°F, a speed restriction is not required.

An inspection must be conducted before releasing the speed restriction to ensure the track is safe for higher speeds.

Chapter 6 Rail Joint Inspection

CWR Joint means any joint directly connected to CWR.

6.1 Class of Track

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

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

6.2 Frequency of Inspections

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

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

4X = Four times per calendar year, with one inspection in each of the following periods: January to March, April to June, July to September, and October to December; and with consecutive inspections separated by at least 60 calendar days.

3X = Three times per calendar year, with one inspection in each of the following periods: January to April, May to August, and September to December; and with consecutive inspections separated by at least 90 calendar days.

2X = Twice per calendar year, with one inspection in each of the following periods: January to June and July to December; and with consecutive inspections separated by at least 120 calendar days.

1X = Once per calendar year, with consecutive inspections separated by at least 180 calendar days.

[1]Where extreme weather conditions prevent a track owner from conducting an inspection of a particular territory within the required interval, the track owner may extend the interval by up to 30 calendar days from the last day that the extreme weather condition prevented the required inspection.

[2]Where a track owner operates both freight and passenger trains over a given segment of track, and there are two different possible inspection interval requirements, the more frequent inspection interval applies.

6.3 Identification of Joints

Each CWR joint requiring action as outlined in Section 6.5 shall be identified in the field with a highly visible marking. In addition, such joints shall also be identified as to location by specifying the subdivision, milepost, track number and rail (north, south, etc.).

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

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

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

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

At cross-overs:
- All joints in track between switches.

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

At lift rail assemblies or other transition devices on movable bridges:
- All joints immediately attached to the rail assembly or transition device.

If a cracked or broken joint bar is discovered during the monthly inspection of any of the above locations, a Fracture Report must be completed as per Section 6.7.

6.5 Rail Joint Conditions

When inspecting CWR joints on foot in track listed in 6.1, inspectors must watch for (but not be limited to) the following rail joint conditions outlined in the table below. When such conditions are found, they must be noted on an inspection report and the appropriate action must be taken as outlined.

Rail Joint Condition	**Action**[1]
Visible cracks in joint bar	Replace bar
Loose bolts	Tighten bolts
Bent bolts	Replace bolts or Re-inspect as per 6.2
Missing bolts[2]	Replace bolts
Tie(s) not effectively supporting joint	Tamp tie(s) Replace or repair tie(s) OR Conduct follow-up inspections every other week until repaired/removed
Broken or missing tie plate(s)	Replace tieplate(s) OR Conduct follow-up inspections every other week until repaired/removed
Deteriorated insulated joint	Replace/repair joint OR Conduct follow-up inspections every other week until repaired/removed
Rail end batter (More than 3/8" in depth and more than 6" in length measured with a 24" straight-edge)	Repair by welding joint, or removing rail, OR Conduct follow-up inspections every other week until repaired/removed
Rail end mismatch reaches limits specified by 49 CFR 213.115	Weld or grind
Longitudinal rail movement greater than 2"	Add or adjust rail anchors, tighten bolts, add or remove rail at appropriate time, OR Conduct follow-up inspections every other week until repaired/removed
Wide rail gap greater than 1.5"	Adjust rail gap and secure joint OR Conduct follow-up inspections every other week until repaired/removed

Joint vertical movement (profile) that exceeds 75% of the allowable threshold for the designated class, or track	Surface joint OR Conduct follow-up inspections every other week until repaired/removed
Joint lateral movement (in a curve, or spiral) that reaches ¾"	Correct lateral movement OR Conduct follow-up inspections every other week until repaired/removed

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

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

6.6 Embedded Joints

Permanently Embedded Locations

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

Temporarily Embedded Locations

Joints may sometimes be temporarily buried (e.g., where ballast or similar material is in the middle of the track and along the track) and therefore unavailable for inspection. Where CWR joints are buried (e.g., by ballast), wait for the completion of the track work before conducting joint bar inspections. Locations that have been buried for an extended period of time must still be inspected.

6.7 Inspection Records

On-Foot Periodic and Follow-up Inspection Reports (Appendix 4)

Document each on-foot periodic and follow-up inspection on the date of the inspection by noting the following information:

- Date
- Limits of the inspection
- Location and nature of CWR joint conditions specified in Section 6.5
- Corrective or remedial action
- Name and signature of inspector

Fracture Reports

Track subject to inspections under 213.119(g)(5)(i) must have a Fracture Report completed for every cracked or broken CWR joint bar that is discovered during the course of an inspection conducted to comply with:

- Track inspections (213.233)
- Inspections of switches, turnouts, track crossings, lift rail assemblies, or other transition devices on moveable bridges (213.235)
- Periodic and Follow-up CWR Joint Inspections (213.119(g))

The Fracture Report shall be prepared on the date the cracked or broken joint bar is discovered. (Appendix 5)

Chapter 7 Extreme Weather Inspections

For purposes of forecasting or initiating extreme weather inspections and conversions of rail temperature in relation to ambient temperatures, use the following conversions:

- In hot weather, rail temperature is equal to ambient temperature plus 30°F.
- In cold weather, rail temperature is equal to ambient temperature.

7.1 Hot Weather Inspections

On main tracks, hot weather inspections must be performed as directed by the **Chief Engineer or his designees** when the temperature is forecast to exceed the 95°F**.**

Perform inspections during the heat of the day – primarily between 12 noon and 6 p.m. When tight rail conditions exist, a speed restriction of **25 mph or less** must be placed or the track must be removed from service.

Inspectors will inspect for signs of tight rail conditions, including:

- Kinky or wavy rail
- Rail canting or lifting out of tie plates
- Shiny marks on the base of the rail including that the rail is running through anchors and spikes
- Gaps in ballast at the ends of ties
- Churning ballast and ties

When tight rail conditions are present such as above, a speed restriction of 25 mph or less must be placed or track removed from service until repair or adjustment is made.

Inspectors will pay special attention to the following locations:

- Recently disturbed track
- Track at the bottom of sags
- Locations where heavy braking occurs
- Fixed track structures, such as turnouts and bridges
- Locations where rail has been repaired or welds made

7.2 Cold Weather Inspections

On main tracks, cold weather inspections must be performed as directed by the **Chief Engineer or his designees** when the ambient air temperature is forecast to change 40 ° in a 24-hour period.

Inspectors will inspect for:

- Broken rails

- Pull-aparts
- Curve movement
- Wide gap between rail-ends
- Bent bolts
- Cracked or broken joint bars (conventional and insulated)
- Canted rail

Chapter 8 Training

Annual training is required for those individuals designated under §213.7(c) as qualified to supervise the installation, adjustment, and maintenance of CWR track and to perform inspections of CWR track. Each individual subject to this CWR Plan, upon completion of training, must demonstrate a basic knowledge of the rules and procedures related to on-track safety through testing as may be determined by the CFRC. Each individual subject to this CWR Plan will be provided a copy of these procedures and ALL accompanying documents.

The CFRC Safety and Security Manager or qualified designee is responsible for the CFRC CWR training program and will ensure that written or electronic records of each worker who is trained or qualified in on-track safety is maintained. Each record shall include the name of the worker, the type of qualification made, and the most recent date of qualification. The CFRC office is located at 801 SunRail Dr., Sanford, FL. Training records shall be available for inspection and photocopying by the FRA during regular business hours.

Compliance with the CWR Plan shall be verified by safety observations and auditing by teams. The results of the audits shall be reported to the CFRC Safety and Security Committee.

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 of track work
- Rail joint inspections
- Insufficient ballast
- Extreme weather inspections
- Recordkeeping
- Fracture reports
- Action items

Chapter 9 Recordkeeping

9.1 Report of CWR Installations

Rail temperature, location and date of CWR installations must be recorded on the prescribed form and must be retained for at least one year after installation. (Appendix 2)

9.2 Report Maintenance Work in CWR

Because track maintenance can disturb the lateral and longitudinal resistance of the track, records of the following must be kept until corrections or adjustments are made:

- Rail that is added for any reason, including repair of broken or defective rail, pull-aparts and welding of rail joints. (Appendix 6)
- Where curve has been staked and has shifted inward more than a maximum of 3 inches. (Appendix 7)
- CWR installation or maintenance work that does not conform to these written procedures. (Appendix 7)
- A record of rail neutral temperature will be maintained where the rail has pulled apart, broken or been cut for defect removal. (Appendix 7)

Chief Engineer or his designees must monitor these records to ensure necessary corrections and adjustments are made.

APPENDICES

Appendix 1 – Change in Rail Temperature Due to Change in Temperature

C = 12 X 0.0000065LT

C = CHANGE IN LENGTH IN INCHES

l = LENGTH OF RAIL IN FEET

T = CHANGE IN TEMPERATURE IN DEGREES

CHANGE IN RAIL LENGTH DUE TO CHANGE IN TEMPERATURE

LENGTH OF RAIL - FEET	CHANGE IN TEMPERATURE IN DEGREES FAHRENHEIT															
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80
100	0	0- 1/8	0- 1/8	0- 1/8	0- 1/4	0- 1/4	0- 1/4	0- 3/8	0- 3/8	0- 3/8	0- 3/8	0 - 1/2	0 - 1/2	0 - 1/2	0- 5/8	0- 5/8
200	0- 1/8	0- 1/8	0- 1/4	0- 3/8	0- 1/2	0- 1/2	0- 1/2	0- 5/8	0- 3/4	0- 3/4	0- 7/8	0- 7/8	1	1- 1/8	1- 1/8	1- 1/4
300	0- 1/8	0- 1/4	0- 3/8	0- 1/2	0- 5/8	0- 3/4	0- 7/8	1	1	1- 1/8	1- 1/4	1- 3/8	1- 1/2	1- 5/8	1- 3/4	1- 7/8
400	0- 1/8	0- 3/8	0- 1/2	0- 5/8	0- 3/4	0- 3/4	1- 1/8	1- 1/4	1- 3/8	1- 1/2	1- 3/4	1- 7/8	2	2- 1/8	2- 3/8	2- 1/2
500	0- 1/4	0- 3/8	0- 5/8	0- 3/4	1	1- 1/8	1- 3/8	1- 1/2	1- 3/4	2	2- 1/8	2- 3/8	2- 1/2	2- 3/4	2- 7/8	3- 1/8
600	0- 1/4	0- 1/2	0- 3/4	0- 7/8	1- 1/8	1- 3/8	1- 5/8	1- 7/8	2- 1/8	2- 3/8	2- 5/8	2- 3/4	3	3- 1/4	3- 1/2	3- 3/4
700	0- 1/4	0- 1/2	0- 7/8	1- 1/8	1- 3/8	1- 5/8	1- 7/8	2- 1/8	2- 1/2	2- 3/4	3	3- 1/4	3- 1/2	3- 7/8	4- 1/8	4- 3/8
800	0 - 3/8	0- 5/8	1	1- 1/4	1- 1/2	1- 7/8	2- 1/8	2- 1/2	2- 3/4	3- 1/8	3- 3/8	3- 3/4	4	4- 3/8	4- 5/8	5
900	0 - 3/8	0- 3/4	1	1- 3/8	1- 3/4	2- 1/8	2- 1/2	2- 3/4	3- 1/8	3- 1/2	3- 7/8	4- 1/4	4- 5/8	4- 7/8	5- 1/4	5- 5/8
1000	0 - 3/8	0- 3/4	1- 1/8	1- 1/2	2	2- 3/8	2- 3/4	3 1/8	3- 1/2	3- 7/8	4- 1/4	4- 5/8	5- 1/8	5- 1/2	5- 7/8	6- 1/4
1100	0 - 3/8	0- 7/8	1- 1/4	1- 3/4	2- 1/8	2- 5/8	3	3- 3/8	3- 7/8	4- 1/4	4- 3/4	5- 1/8	5- 5/8	6	6- 3/8	6- 7/8
1200	0 - 1/2	0- 7/8	1- 3/8	1- 7/8	2- 3/8	2- 3/4	3- 1/4	3- 3/4	4- 1/4	4- 5/8	5- 1/8	5- 5/8	6- 1/8	6- 1/2	7	7- 1/2
1300	0 - 1/2	1	1- 1/2	2	2- 1/2	3	3- 1/2	4	4- 5/8	5- 1/8	5- 5/8	6- 1/8	6- 5/8	7- 1/8	7- 5/8	8- 1/8
1400	0 - 1/2	1- 1/8	1- 5/8	2- 1/8	2- 3/4	3- 1/4	3- 7/8	4- 3/8	4- 7/8	5- 1/2	6	6- 1/2	7- 1/8	7- 5/8	8- 1/4	8- 3/4
1440	0- 1/2	1- 1/8	1- 5/8	2- 1/4	2- 3/4	3- 3/8	3- 7/8	4- 1/2	5	5- 5/8	6- 1/8	6- 3/4	7- 1/4	7- 7/8	8- 3/8	9
1500	0- 5/8	1- 1/8	1- 3/4	2- 3/8	3- 7/8	3- 1/2	4 - 1/8	4- 5/8	5- 1/4	5- 7/8	6- 3/8	7	7- 5/8	8- 1/4	8- 3/4	9- 3/8
1600	0- 5/8	1- 1/4	1- 7/8	2- 1/2	3- 1/8	3- 3/4	4- 3/8	5	5- 5/8	6- 1/4	6- 7/8	7- 1/2	8- 1/8	8- 3/4	9- 3/8	10
1700	0- 5/8	1- 3/8	2	2- 5/8	3- 3/8	4	4- 5/8	5- 3/8	6	6- 5/8	7- 1/4	8	8- 5/8	9- 1/4	10	10- 5/8
1800	0- 3/4	1- 3/8	2- 1/8	2- 3/4	3- 1/2	4- 1/4	4- 7/8	5- 5/8	6- 3/8	7	7- 3/4	3- 3/8	9- 1/8	9- 7/8	10- 1/2	11- 1/4

MIMIMUM ADJUSTED RAIL LAYING TEMPERATURES: 105°F

EXAMPLE 1. HOW MANY INCHES MUST A STRING OF WELDED RAIL 1300 FEET LONG LAID AT A RAIL TEMPERATURE OF 45 EXPAND TO BE ADJUSTED FOR 105°F.

105° ADJUSTED TEMPERATURE
LESS 45° LAYING TEMPERATURE
60° CHANGE IN TEMPERATURE

GO TO THE TABLE AND READ THE LENGTH GIVEN IN THE COLUMN HEADED BY “60“ WHERE IT IS CROSSED BY THE ROW LABELLED “1300” IN THE “LENGTH OF RAIL” COLUMN. AN EXPANSION OF 6- 1/8 INCHES IS REQUIRED.

EXAMPLE 2. THE ACTUAL RAIL EXPANSION MEASURED WITH THE STRING OF RAIL GIVEN IN EXAMPLE 1 WAS 6- 1/8 INCHES. TO WHAT TEMPERATURE IS THE RAIL ADJUSTED AND IS IT ADJUSTED WITHIN THE REQUIRED LIMITS.

GO TO THE TABLE AND FIND 6-1/8 INCHES ON THE ROW MARKED “1300”. RECORD THE CHANGE IN TEMPERATURE AT THE TOP OF THE COLUMN IN WHICH THE 6-1/8 INCHES APPEARS. IN THIS EXAMPLE, 60”.

45” LAYING TEMPERATURE
PLUS 60” FIELD ADJUSTMENT
105° ACTUAL ADJUSTED TEMPERATURE

NOTE: AT LOCATIONS SUCH AS EXPANSION JOINTS WHERE THERE IS A “FREE END” CONDITION, USE 1 /2 THE AMOUNT SHOWN ABOVE.

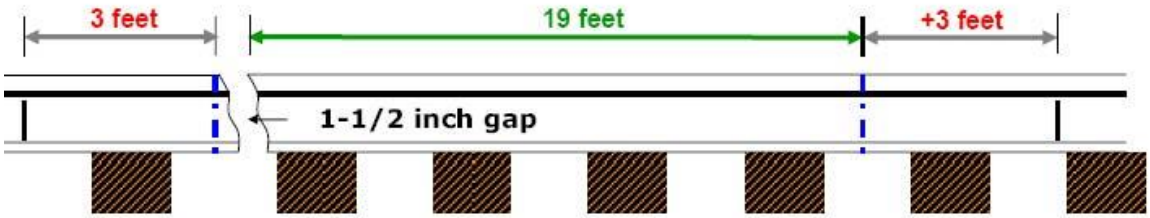
Appendix 2 – CFRC Record of Rail Laying Temperatures for Continuous Welded Rail

CFRC Engineering	RECORD OF RAIL LAYING TEMPERATURES FOR CONTINUOUS WELDED RAIL										
YEAR:		DIVISION:		SUBDIVISION:							
LAYING DATES:				NEAREST STATION:							
RAIL WEIGHT:		TYPE RAIL ANCHORS:		TYPE BALLAST:							
RAIL N S E W	STRING NUMBER	MILEPOST INCLUDING PREFIX		RAIL LENGTH IN FEET	RAIL TEMPERATURE			REQUIRED EXPANSION IN INCHES	ACTUAL EXPANSION OBTAINED IN INCHES	LIST CHANGE IN TEMPERATURE FROM CHART IN APPENDIX	ADJUSTED LAYING TEMPERATURE
					DESIGNED LAYING TEMPERATURE 105°F	COLD RAIL TEMPERATURE	DIFFERENCE IN TEMPERATURE				
		FROM	TO	A	B	C	D	E	F	G	C + G
ADJUSTMENT SUPERVISOR:							RAIL SUPERVISOR:				

Placing reference marks

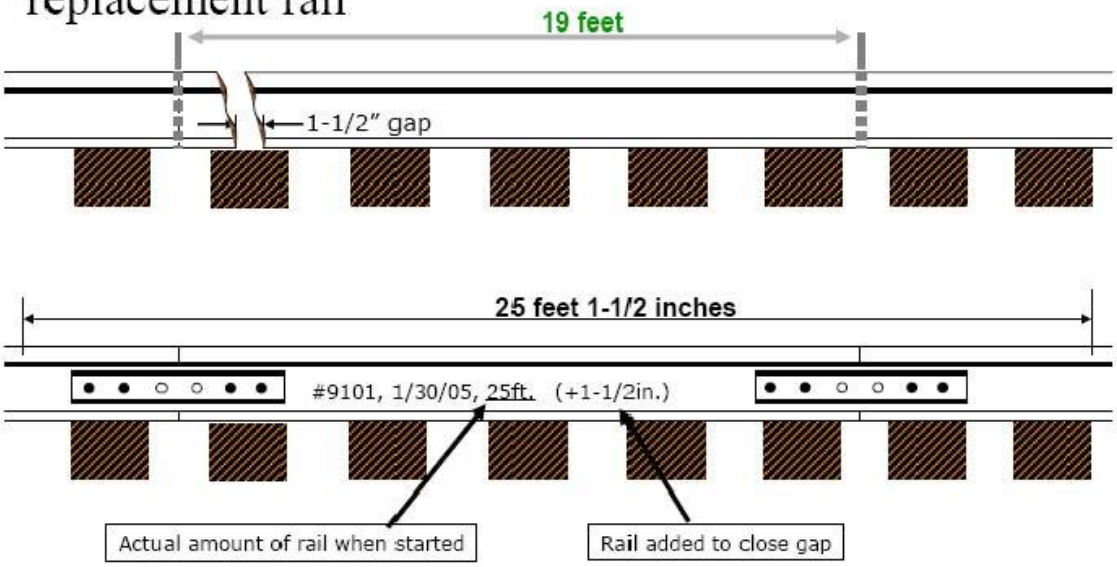
To properly apply reference marks:

- Measure back from one end of the break 3 feet, mark the rail
- Measure in the other direction, from the opposite end of break, the length of replacement rail plus an additional 3 feet and mark the rail



Placing reference marks, gapped joint

Now mark for rail saw cuts, cut rail and install the replacement rail



Appendix 4 – CFRC Walking Joint Bar Inspection Report

Division: _____

Subdivision: _____

Territories Inspected						
Date Inspected	Track No.	Prefix	MP Limits		Inspector's Name	Total Jts. Inspected
			From	To		

Joint Bar Conditions Noted						Action Taken				
Date Found	Track No.	Prefix	MP Location	Rail		Condition Code	Date Repaired	Slow Order	speed	Inspect in 14 days
				North East	South West					Date / Date

Rail Joint Condition Codes:

01 – Visible cracks in joint bar
02 – Loose Bolts
03 – Bent Bolts
04 – Missing Bolts
05 – Tie(s) not effectively supporting joint
06 – Broken or missing tie plate(s)
07 – Deteriorated Insulated joint
08 – Rail end batter > 3/8 inch in depth and > 6 inches in length measured with 24 inch straight edge
09 – Rail end mismatch reaches limits specified by 49 CFR 213.115
10 – Longitudinal rail movement > 2 inches
11 – Wide rail gap > 1 ½ inches
12 – Joint vertical movement (profile) that exceeds PR1 levels (1 class higher) of the allowable threshold for the designated class track.
13 – Fouled ballast in conjunction with Joint vertical Movement (profile) that exceeds PR1 levels (1 class higher) of the allowable threshold for the designated class track.
14 – Joint lateral movement (in curve or spiral) ≥ ¾ inch

Appendix 5 – CFRC CWR Joint Bar Fracture Report

CFRC CWR JOINT BAR FRACTURE REPORT	***TYPE OF INSPECTION*** ☐ PERIODIC JOINT INSPECTION (213.119[g][5][i]) ☐ TRACK INSPECTION (213.233) ☐ TURNOUT INSPECTION (213.235)

CFRC	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:

Appendix 6 – CFRC Rail Cut in CWR Territory Report

Rail Cut in CFRC CWR Territory Report							
Occurrence:				Weather:			
Division:							
Subdivision:							
Date:							
Location:		Track #		M.P.		Conditions:	
Defect/Remarks:				Corrective Action Taken:			

Signature of Inspector

Appendix 7 – CFRC Record of Disturbance of Main CWR Track

Subdivision: _____ Report Date: _____

Date of Disturbance: _____ Reported By: _____

Corrective Action Required? Yes _____ No _____

Location:

Mile Post: _____ to _____

Track No.:: _____

N/E or S/W Rail: _____

Temperatures:

Air: _____

Rail: _____ (Actual)

Rail: _____ (As Adjusted, if applicable)

Type of Adjustment/Disturbance:

_____ Repair Rail Installed Bolted: _____ Welded: Length (ft): _____

_____ Track Panel(s) Installed Length (ft): _____

_____ Turnout Installed

_____ Road Crossing Installed

_____ Ties Installed

_____ Surfacing of Track Inches of Lift: _____

_____ Realignment of Curve

_____ Undercutting

_____ Washout

_____ Buckled Track

_____ Pull-Apart

_____ De-stressing Performed

_____ Other:

Corrective Action:

Date: _____ Air Temp. _____

Rail Temp: _____ (Actual) Rail Temp: _____ (Adjusted)

Description: _____