Addendum 4
May 12, 2023
South Jersey Port Corporation (SJPC)
Request for Sealed Bids

SJPC-22-49RB BALZANO MARINE TERMINAL RAIL INFRASTRUCTURE REHABILITATION

NOTICE

This Addendum is considered part of this Request for Bids and must be acknowledged with your submission.

The following page(s) contain:
Formally submitted questions and SJPC responses.

FORMALLY SUBMITTED QUESTIONS AND SJPC RESPONSES:

Q1. Regarding Typical Pavement Sections 1 , 2 , and 3 on Sheet C-503 and Section 1 on T-20 – Is there a minimum dimension where intermediate or base course would be required? We can foresee a situation where the track box is replaced with asphalt and the remaining asphalt is milled 2" and then re-paved without removing any intermediate asphalt for the pipe cleaning debris that is required to be removed and disposed of.

A1. Full depth asphalt pavement (as shown on Detail 1 on C-503) is needed at all new track as indicated on Detail 1 on Drawing T-20.

Full depth asphalt pavement (as shown on Detail 1 on C-503) is needed where existing pavement has been removed for access to underground utilities or removal of track or other items.

Mill & Overlay (as shown on Detail 2 on C-503) shall be performed adjacent to full depth pavement sections and at asphalt grade changes to tie into existing adjacent surfaces as necessary.

Q2. Reference Addendum #2 – Question #8 inquired about settlement issues with the use of steel ties and the answer states steel ties are only to be used in concrete embedded sections. This conflicts with Specification Section 341129, subsection 2.1.B which states CWR track is to be constructed with steel crossties and Specification Section 341116.22, subsection 1.8.C which states steel ties are to be used in "ALL AREAS" and notes "N/A FOR FULLY EMBEDDED TRACK". Additionally Drawing T-23 shows steel ties in ballast at the transition from embedded to

ballasted track. Please provide the following information if the specification is being revised for the use of wood ties in ballasted track:

- Spacing of wood ties
- Type of tie plates and fasteners to be used
- Details of Restraining Rail plate to be used on Shed 1-2 Track

A2. Refer to the attached revised specifications sections 341129, 347210 & 347220.

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TECHNICAL SPECIFICATIONS:

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SECTION 341129 – CONSTRUCT CONTINUOUSLY WELDED RAIL TRACK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Construction of continuously welded rail (CWR) ballasted track located on compacted subgrade utilizing steel or timber crossties, including the furnishing of new rail, OTM, crushed stone ballast, placement and tamping of crushed stone ballast, installation and thermal adjustment of rails, and furnishing, placement and finishing of reinforced concrete and bituminous pavement as shown on the drawings.
2. Construction of continuously welded rail (CWR) **track** fully embedded **in reinforced concrete slab formed and placed** on **top of** compacted subgrade utilizing steel crossties or other approved means and methods of setting the alignment, grade and gauge of rails, grading, and compaction of subgrade, furnishing of new rail, OTM, welding and thermal adjustment of rails and the furnishing, forming, placement and finishing of reinforced concrete embedment and pavement as required by the drawings.
3. Construction of continuously welded rail (CWR) direct fixation track **embedded in reinforced concrete and** located on the existing reinforced concrete pile supported deck portion of the deepwater berths of the Marine Terminal, including drilling and setting of embedded rail plate anchors, installation and grouting of rail base plates and direct fixation hardware, placement of track rails, thermal adjustment of rails the furnishing, installation and finishing of reinforced concrete embedment and pavement as required by the drawings.

B. Related Requirements:

1. Section 024119 - Selective Demolition: for removal of embedded track located on the pile supports reinforced concrete deck of the Marine Terminal berths.
2. Section 033000 - Concrete: Concrete for fully embedded sections of track, pavement, rail base plate grout.
3. Section 032000 – Concrete Reinforcing: Steel and fiber reinforcing materials.

4. Section 321216 – Bituminous Pavement: Pavement adjacent to newly constructed embedded track.
5. Section 341110.00 – Continuously Welded Rail: Running rails and Restraining rail.
6. Section 341193 – Track Appurtenances and Accessories: **S**witch stands for Sliding Derails, Track Bumper, **Signage** and attachment hardware
7. Section 347205 – Construct Turnouts: Double Tongue Switch type turnouts.
8. Section 347201 – Track Layout: Setting alignment and grade of tracks.
9. Section 347210 – Field Weld Rails: Thermite or Flash Butt Welding of track rails.
10. Section 347215 – Rail Connections: Temporary or permanent bolted rail connections.
11. Section 347220 – Other Track Materials. **Rail fastening components for use on timber crossties and other miscellaneous hardware.**
12.

C. DEFINITIONS

1. DRFF – Direct Rail Fixation Fastener
2. OTM – Other Track Material

1.3 MEASUREMENT AND PAYMENT

A. Measurement shall be the number of feet of track constructed and in place, as measured along the center line of the track.

B. Payment shall be at the unit price bid.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Design Data: Submit manufacturer's latest published literature. Include illustrations, installation instructions, maintenance instructions, parts lists and shop drawings.

C. Manufacturer’s Certificates: Submit Statement of Compliance, supporting data, from material suppliers attesting that all components meet or exceed applicable A.R.E.M.A. Standards and specification requirements.

D. Submit Certificates of Compliance for all OTM. Include material qualification test reports for materials, components, and assemblies.

1.5 REFERENCES

A. American Railway Engineering and Maintenance of Way Association (AREMA):

1. Manual for Railway Engineering
2. Portfolio of Trackwork Plans
3. Specifications for Special Trackwork

B. American Welding Society (AWS):

1. AWS B2.1: Standards for Welding Procedures and Performance Qualifications
2. AWS D1.1: Structural Welding Code

C. American National Standards Institute, Inc. (ANSI)

1. ANSI B1.1: Unified Inch Screw Threads
2. ANSI B1.3M: Screw Threads Gaging System for Dimensional Acceptability
3. ANSI B18.22.1: Plain Washers

D. American Society for Testing of Materials (ASTM)

1. A36: Standard Specifications for Carbon Structural Steel
2. A123: Standard Specification for Zinc (Hot-Dip-Galvanized) Coating on Iron and Steel Products
3. A325: Standard Specifications for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
4. C881 - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
5. F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

PART 2 - PRODUCTS

2.1 MATERIAL

A. Rails shall be New 136RE rail section welded into strings in accordance with the requirements of Section 341110 - Continuously Welder Rail, of these specifications.

B. Steel crossties shall be provided in accordance with the specifications set forth under Section 341133.22 Railroad Steel Crossties, of these specifications and include a positive restraint rail fastening system provided by the manufacturer of the steel crossties specifically designed to be used with the steel crossties supplied.

C. Treated Timber Crossties shall be provided in accordance with the specifications set forth under Section 341133.00 Timber Crossties, of these specifications.

D. Rail joint bars and hardware shall conform to Section 347215-Rail Connections,

E. Ballast and tamping shall conform to Section 347230.00-Railroad Ballasting, of these specifications and other parts of this specification section.

F. Rail Field Welds: As specified in Section 347210 - Field Weld Rails.

G. **Fully Embedded Track** Rail Fixation and Fastening Assemblies: Fabricate, furnish and supply rail alignment and track gauge setting fixtures in accordance with that shown on the project plans, or furnish and supply commercially manufactured product(s) designed specifically for setting the alignment and gauge of track rails employed in construction of track embedded in concrete. All materials furnished shall be designed and manufactured to work collectively as a system and shall conform with the requirements of the Project Specifications and drawings.

H. Non-Shrink Epoxy Grout: For use under rail base plates of portions of track located on the pile supported reinforced deck of the marine terminal berths shall be Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and non-staining, mixed with water to consistency suitable for application and a 30-minute working time. Provide grout with a compressive strength of 3,500 psi at 1 day, 5,000 psi at 3 days and 6,800 psi at 28 days.

I. Epoxy Adhesive: Provide a two-component 100% solids non-sag epoxy adhesive suitable for anchoring threaded anchor rods into hardened concrete. Epoxy adhesive shall meet the requirements of ASTM C881, Type IV, Grade 3, and C. Two-component system shall come in prepackaged cartridge systems with a static mixing attachment. Cartridges shall be designed specifically to be used with drop-in dispensing guns. The minimum compressive strength, prior to load application to the anchor rods, shall be 5000 psi.

J. Hardware: Furnish and install high strength bolts, nuts, nutlocks, embedded anchors, and other miscellaneous hardware necessary for use in construction direct fixation embedded trackwork in accordance with the details shown on the Contract Drawings.

K. Rail Fastening Components: Furnish and install positive restraint rail fasteners, rail shoulders, restraining rail spacer blocks, track bolts, washers, nuts, locknuts and other miscellaneous hardware as indicated on the contract drawings.

L. Concrete: As specified in Section 033000 - Concrete.

M. Concrete Reinforcing: As specified in Section 032000 Concrete Reinforcing.

2.2 PREPARATION

A. The contractor shall notify the Engineer a sufficient time before starting the work so that adequate arrangements can be made to progress the work of each phase in accordance with the approved schedule.

B. The contractor shall commence construction of each section of track only after completing the following work of each Phase as applicable:

1. The selective demolition and removal of existing pavements, track or embedded rails is complete and condition of the area where new track is to be installed is prepared to receive new construction.
2. All underground utilities including new stormwater drainage infrastructure, water supply system modifications and casing pipes have been properly installed and tested in accordance with the specifications and found to be functioning properly.
3. The contractor has performed track layout in accordance with Section 347201, Track Layout, of these specifications.
4. The area to receive new track has been inspected by the Engineer and approved for installation of new track.

PART 3 - EXECUTION

3.1 PLACEMENT OF BALLAST

A. Ballast shall be distributed, placed and compacted for track constructed in all areas in accordance with Section 347230.00, Ballast. This requirement does not apply to track located on the pile supported reinforced concrete deck of the Marine Terminal ship berths as shown on the plans.

1. Before placement of ballast all trash and debris must be removed from subballast.
2. Subballast shall be clear of voids and tire ruts; subballast shall be compacted and graded to promote drainage in accordance with the contract drawings.
3. Subballast shall be inspected and approved by the Construction Manager before placement of subballast.
4. Uniformly distribute a base layer of ballast over the subballast and compact before tie distribution.
5. Compact initial layer of ballast over the entire ballast section as indicated on the contract drawings.
6. Limit the base layer to a total compacted depth that will establish the track surface between 4 and 6 inches below the final grade.
7. Each lift of ballast within the base layer shall not be greater than a 6 inch compacted depth and shall be uniformly spread and compacted with not less than four passes by either a self-propelled, pneumatic tired roller or vibratory compactor.

a. The self-propelled, pneumatic –tired roller shall have a gross weight of not less than 9 tons, and the vibratory compactor shall have a weight of not less than 5000 pounds and shall be capable of applying a dynamic load of not less than 18000 pounds.

8. The minimum depth of ballast from the bottom of tie to the top of the subballast shall be as shown on the Contract Drawings.

3.2 PLACEMENT OF CROSSTIES

A. Except as modified herein, handle, transport and store timber crossties in accordance with the current AREMA standards.

B. Place Timber Crossties as follows:
1. Use only approved lifting and handling devices that will not damage crossties or switch timbers.
2. Transport and distribute the crossties from the storage area to the work area and place center to center distance in accordance with the following:
   a. Tangents and curves < 12˚24” centers.
   b. Curves ≥12˚ - ≤16˚ 22” centers
   c. Curves > 16˚ 20” centers
   d. Ties should be placed in track with the kerf up, the wider wood heart face down and square to the proposed line of the rail with center of the crosstie centered on the centerline of the track alignment or PGL.
   e. Tie plates shall be installed centered about the width of the tie with the shoulders (raised lips) bearing firmly against the edge base of the rail. The cant (slope) of the tie plate shall be downward to the gage side of the rail unless noted otherwise in these specifications.

C. Place Steel Crossties as follows:
1. For installation in tracks at locations other than track to be fully embedded in reinforced concrete slabs or in turnouts, place ties in accordance with the manufacturers instructions and at center to center distance in accordance with the following:
   a. Tangents and curves < 12˚24” centers
   b. Curves > 16˚ 20” centers

D. Steel ties can be distributed directly on the finished subgrade. In order to reduce the number of surfacing passes required, a four inch (4”) to five inch (5”) layer of ballast can be distributed and compacted prior to steel tie distribution and track assembly. Eight inches (8”) to ten inches (10”) of ballast is required under steel ties. Ballast depth shall be as specified on the plans. If a layer of ballast is distributed and compacted prior to steel tie distribution, final ballast depth under the ties will be eight inches (8”) or more.

3.3 CONTINUOUSLY WELDED RAIL (CWR) TRACK INSTALLATION

A. The contractor shall supply and utilize rollers for the handling and distribution of the welded rail. The type of rollers used and their application must be approved by the Engineer prior to their use.

B. The contractor shall place the welded rail onto the DRFF assemblies or on the steel crossties by use of a machine with a threader or rail tongs designed exclusively for that purpose. Under no circumstances shall rail be handled using a Prentiss log loader or "split-bucket" type excavator or loader. The rail shall be placed without expansion gaps.

C. The bottom of the rail and the top of the fastener plate or rail seat shall be clean and free of dirt and other foreign substances when the rail is laid.

D. The bottom of the rail and the top of the DRFF plate shall be clean and free of dirt and other foreign substances when the rail is laid.

E. The contractor shall perform field welding of running rails in accordance with Section 347210.00 – Field Weld Rails, of these specifications. Bolted rail connections shall conform to Section 347215 - Rail Connections, of these specifications.

F. The **CWR strings may be field butt** welded **by an approved process into long lengths in** all **classes of tracks. Where necessary to use a short rail to connect CWR strings, that rail should** be **at least 14-feet long.**

G. If it becomes necessary to apply joint bars temporarily, the end bolt hole in each rail must not be drilled to permit subsequent prompt field welding. It may be necessary to apply rail anchors to a portion of the existing rails to which new track is to connect in order to prevent pull apart prior to field weld being made. These additional anchors may be removed after field welds have been made.

H. Except where field butt welded, CWR strings are to be fastened to each other or to buffer rails with fully bolted rail joints, except as provided in paragraph (G) above.

3.4 SURFACING AND ALIGNING TRACK WITH TIMBER CROSSTIES

A. After the track has been installed, place ballast in the tie cribs and shoulders of the track to restrain movement of the ties due to temperature changes in the CWR. Unload ballast in sufficient quantities to form a high shoulder and fill the tie cribs and provide an adequate amount of ballast for the initial track lift, plus a surplus to continue to hold the track in line after the initial track lift.

B. Track surfacing will be by means and equipment that shall prevent the undue bending of the rail, straining of joints, and damaging or loosening the clip fastenings. The amount of track lift shall not exceed 2 inches nor endanger the horizontal or vertical stability of the track. The track shall be surfaced so that the final lift is not less than 1 inch nor greater than 2 inches. Under no circumstances may the track be raised to elevations above the design elevations.

C. Perform surfacing with a squeeze type vibratory type power tamper. Control of the power tamper's tamping cycle shall provide the maximum uniform compaction of ballast along the track.

D. Tamp the outside and the inside of the running rail on each tie, on both sides. Complete final surfacing after the track has been initially surfaced and aligned, fasten and join together track by the specified method.

E. After the track has been surfaced and lined to its final vertical and horizontal position the rails shall be refastened within the zero thermal tolerance stress temperature range. All clips, fasteners, plates and ties shall be thoroughly cleaned and inspected and any material damaged in the installation process shall be replaced by the Contractor at no expense to Owner.

F. The final raising and lining operations shall include filling the tie cribs to a point equal to the top of the tie.

G. Discontinue surfacing when the ambient temperature exceeds 95 degrees or the rail temperature exceeds 115 degrees.

H. Compact ballast using an approved vibratory ballast compactor designed specifically for that purpose.

I. After final surfacing and lining, dress the ballast to conform to the contract drawings in preparation for placing the paving materials.

3.5 SURFACING AND ALIGNING TRACK WITH STEEL CROSSTIES

A. The contractor shall handle and place steel crossties as specified in Part 3.2 of this specification.

B. Do not subject the steel crossties to locomotive or railcar loads including ballast trains unless the steel crossties are well supported under the rail with a gap in the center of the crosstie to distribute wheel loads and prevent the steel crosstie from being center-bound.

C. Dump ballast and surface the track to within 1 inch of final elevation. Ballasting and tamping shall be in accordance with Section 347230.00

Railroad Ballasting, of these specifications. For new construction, ballast should be unloaded and regulated such that the ballast is level with the top of the rail and should extend twelve inches past the ends of the steel crossties.

D. A tamping machine equipped with traversing vibratory work heads and sixteen tamping tools MUST be used for surfacing steel tie track. The tamping tool paddles (or blades) must be in good condition. Paddles worn beyond normal wear limits must be replaced before surfacing steel tie track. Worn blades will not move sufficient ballast to fill the pods on the underside of the steel crossties, nor will they provide sufficient compaction to consolidate the ballast under the steel crossties.

E. For surfacing steel crossties, the maximum depth of insertion of the tamping tools must be adjusted such that the top of the tamping tool blade is ½"- ¾" below the bottom of the steel tie. Depth of tool insertion should be carefully checked before surfacing steel ties. There is approximately a 2½" difference between the depth of a wood tie and a steel tie. The limit switches on the tamper should be adjusted so that the depth of insertion for steel ties is 2½" less than the depth of insertion for wood tie surfacing. This is critical for proper steel tie surfacing and lining. If tamping tool insertion is set too deep (not adjusted from the setting for wood tie construction), proper compaction of the ballast under the steel ties will not be achieved.

F. A complete tamping sequence consists of tool insertion, squeeze and withdrawal. To fill the pods on the underside of the steel ties with properly compacted ballast during an initial surfacing lift, four complete tamping sequences (tool insertion, squeeze and withdrawal) are required under the rails. Then the traversing work head must be moved to the center of the Steel Tie, and three complete tamping sequences are needed in the center of the steel crosstie. This must be repeated for each large ballast lift. For larger projects, it is recommended that additional tamping tools be mounted on the tamper in the center of the track. This will achieve center tamping at the same time as rail seat tamping is done. Check with your equipment manager to determine if the equipment in use on your job site can be modified in this manner. Tamper blade spacers (available from the tamper manufacturer) should be installed to space the tamper blades further apart, so that the blades do not contact the ties during the squeeze cycle.

G. The ballast pocket of all steel crossties shall be full to the top of the inspection holes and ballast within the crosstie shall be "tight" (as determined by attempting to move the ballast in the vicinity of the inspection holes with a finger). Check the ballast pocket via each of the four inspection holes. If the ballast pocket is not "tight" re-tamp each crosstie

and dump additional ballast as needed until the ballast pocket is satisfactorily filled.

H. Lining track should be done while lifting and tamping and should be completed prior to the final surfacing lift.

I. Destress (adjust) welded rail prior to the final surfacing lift.

3.6 ADJUSTING RAIL TEMPERATURE: (Destressing)

A. A standard rail thermometer shall be used to measure the rail temperature of all CWR. The thermometer should be laid on the base of the rail, shielded from direct rays of the sun and left there long enough to determine the temperature accurately.
   1. CWR must be anchored at or adjusted for a temperature of 95 degrees Fahrenheit or higher.
   2. When the rail temperature is lower than 95 degrees, an approved rail heating device may be used for expanding the CWR to make proper adjustment.
   3. Where CWR has been anchored at a temperature below 95 degrees, and not adjusted for temperature during the rail laying operation, it should be adjusted as soon as weather conditions have brought the rail to a temperature of 95 degrees or higher.
   4. The Contractor shall be responsible for recording the rail temperature for which each CWR is anchored. He should forward this information to the Engineer, retaining one copy for his record.

B. Adjustment for Other Rail Temperature.
   1. To adjust CWR for a temperature higher than that at which it was anchored, its length or the length of its buffer rails must be decreased. When it is to be adjusted for a temperature lower than that at which it was anchored, the length must be increased.
   2. The number of inches by which a CWR should be decreased or increased to adjust its length for a temperature higher or lower than that at which it was anchored or adjusted may be calculated by taking the difference in degrees Fahrenheit by the length of the CWR in feet and multiplying the product by 0.000078. For example, to adjust the length of a 1450-ft. CWR, anchored at a rail temperature of 50 degrees, to correspond to the length of this rail at 95 degrees, subtract 50 from 95 to obtain a difference of 45 degrees and then multiply as follows:

      45 x 1450 x 0.000078 = 5.1 inches

   3. For practical purposes, the increase of the decrease in length required to adjust selected lengths of CWR for the difference between their actual measured temperatures at time of anchoring or adjustment and a rail temperature of 95°F., may be taken from the following table:

	Length of CWR in feet					
Measured CWR Temp. (degress F)	950-1049	1050-1149	1150-1249	1250-1349	1350-1449	1450-1550
111 to 120	+2”	+2”	+2”	+2”	+2”	+2”
101 to 110	+1”	+1”	+1”	+1”	+1”	+1”
90 to 100	+0”	+0”	+0”	+0”	+0”	+0”
80 to 89	1”	1”	1’	1”	1”	1”
70 to 79	2”	2”	2”	2”	2”	2”
60 to 69	2”	3”	3”	3”	3”	4”
50 to 59	3’	3”	4”	4”	4”	5”
40 to 49	4”	4”	5”	5”	5”	6”
30 to 30	5”	5”	6”	6”	7”	7”
20 to 29	5”	6”	7”	7”	8”	8”
10 to 19	6”	7”	7”	8”	9”	9”
0 to 9	7”	8”	8”	9”	10”	11”
-10 to -1	8”	9”	9”	10”	11”	12”
-20 to -11	9”	9”	10”	11”	12”	13”

Note +Indicates increase: otherwise length is to be decreased. Adjustment for other CWR lengths may be determined by direct proportion.

C. Adjustment By Mechanical Heating

1. Rail may be expanded after it has been laid in the tie plate before or after fastener application but must be expanded before all fasteners are fully installed.
2. CWR should be heated so that expansion is introduced from one end of each string to the other in the direction of rail laying.
3. The number of inches each CWR string should be expanded during the rail laying operation may be by calculation or from the previous table in section B3 of this specification.
4. Space equal to the amount of expansion needed for each string of CWR should be provided between the end of that string and the near end of the next adjacent string. A minimum of 10 ties should have fasteners fully installed on the near end of the adjacent string to hold in place and avoid closing the expansion gap of the string being heated.
5. Heating should be commenced at the beginning of the first CWR string and steadily applied while moving forward until the required expansion has been obtained at the end of the string. Uniformity of

expansion is to be controlled by marking each quarter of the string and introducing expansion as follows:

a. 1/4 point-1/4 of total required expansion
b. 1/2 point-1/2 of total required expansion
c. 3/4 point-3/4 of total required expansion

6. Quarter points should be marked on the rail and the tie plate, so the amount of expansion can be accurately determined. The tie plate used for marking as a reference point must be one that is either doweled by a Dunn-Rite Gauger or has been spiked, so it will not move as rail expands.
7. In the event the first half of the heated CWR string does not have the required expansion at each quarter point, the heater will back over the heated portion, without applying heat, and then reheat the rail until the necessary expansion is obtained.
8. As heating is progressed, a minimum of one (1) pair of fasteners per 39 feet of rail should be applied to the tie that will prevent the rail from losing expansion.
9. At the end of the completely expanded string, a minimum of ten (10) ties should have fasteners fully installed immediately after the gap is closed, to hold the expansion.
10. The entire string of CWR is to have fasteners fully installed in accordance with Section C before trains are permitted to operate over it.

D. Adjustment by natural temperature change.

1. When it is necessary to adjust CWR already in track, the required increase or decrease may be found by taking the difference between desired and recorded temperatures of each string of CWR and calculating the amount of adjustment as shown in Section 5 (b) or determined from the table shown in Section 5 (c)
2. All fasteners must be removed from strings of CWR requiring adjustment to permit the desired expansion or contraction. Tie plates should be tapped with a hammer or approved mechanical device used to free the rail. All fasteners must be reapplied immediately after the desired change in rail length has been obtained.
3. Where buffer rails are used between adjacent strings of CWR, the necessary adjustment should be made by removing the buffer rails, cutting at least 18 inches form the end of each affected CWR string, to remove bolt holes, and field welding in rails of required length.
4. When it is necessary to adjust CWR strings in territory where buffer rails have been eliminated the following should be done:
   a. Where each of several adjacent strings need adjustment, it is desirable to make the adjustment for 3 or 4 strings at a time, if possible. For this purpose, a rail cut should be made near the center of the adjustment area.
   b. Where adjoining CWR strings are connected directly by a bolted rail joint, the adjustment for either compression or tension

should be made by cutting out the drilled end of each CWR and field welding in a rail of required length.

c. Where CWR strings are field butt welded together, the adjustment may be made by cutting and butt welding by an approved process or welding in a piece of rail.

5. When the ambient temperature is such that the welded rail cannot be placed in its final position, the contractor shall place it on the tie plates and install sufficient fasteners to permit safe operation of work trains and on-track equipment.

- END OF SECTION -

SECTION 347210.00 – FIELD WELD RAILS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. The work specified in this Section consists of providing labor, materials, equipment and superintendence necessary and sufficient to field weld together abutting ends of railroad rails to create strings of CWR.

B. Related Sections:

1. Section 341126.00 – Ballasted Track Construction
2. Section **341129.00** – Construct **Continuously** Welded **Rail** Track
3. Section 347201 - Track Layout. Includes setting line and grade for track alignment.
4. Section 347205 – Construct Turnouts
5. Section 347215 – Rail Connections

1.2 DEFINITIONS

A. CWR: Continuously Welded Rail.

B. Thermite: A mixture of finely-divided metallic aluminum and ferric oxide that when ignited produces extremely high temperatures as the result of the union of the aluminum with the oxygen of the oxide. The reaction, also called the Goldschmidt process, is used for thermite welding, often used to join rail tracks.

1.3 REFERENCE STANDARDS

A. American Railway Engineering and Maintenance of Way Association (AREMA):

1. Manual for Railway Engineering.
   a. Chapter 4, Part 3
      1) Section 3.10 Specification For The Quality Assurance of Electric-Flash Butt Welding of Rail.
      2) Section 3.11 Specification for Fabrication of Continuous Welded Rail
      3) Section 3.13 Specification For The Quality Assurance of Thermite Welding Of Rail.
2. Specifications for Special Trackwork
3. Portfolio of Trackwork Plans

B. American Society for Testing of Materials (ASTM)

1. E 164, Practice for Ultrasonic Contact Examination of Weldments

C. American Welding Society (AWS):

1. AWS B2.1: Standards for Welding Procedures and Performance Qualifications
2. AWS D1.1: Structural Welding Code

1.4 COORDINATION

A. Section 013100 - Project Management and Coordination specifies requirements for coordination.

1.5 PREINSTALLATION MEETINGS

A. Section 013100 - Project Management & Coordination specifies requirements for preinstallation conferences.

B. Convene minimum one week prior to commencing Work of this Section.

1.6 SUBMITTALS

A. Section 013300 - Submittal Procedures specifies requirements for submittals.

B. Contractor shall prepare for submission to and approval by the Engineer, a detailed specification covering procedures for making welds. A complete description of each of the following items and any other essential characteristics shall be included in the procedure submittal:

1. The manufacturer's trade name for the welding process.
2. The method used for cutting and cleaning of the rail ends. Flame cutting of rails will not be allowed.
3. The minimum and maximum spacing between abutting rail ends.
4. The method to be used for pre-heating, including time and temperature.
5. The tapping procedure, including the minimum time required to cool the weld under the mold insulation.
6. The method used, including a description of the special tools and equipment for removing the upset metal for finishing the contour of the weld.
7. A schedule of field welds to be made, their location in the finished track, including track number, survey station, and field cuts required to finish the weld. Each weld is to be individually and uniquely number in a system as approved by the Engineer. This welding schedule shall be updated daily as the work progresses so that there will be a single consolidated record of all field welds.
8. Quality Control procedures to be followed. This shall include the name, address and telephone number(s) of the independent testing

laboratory to be used by the contractor for testing of the welds. It shall also include field quality control results.

9. Contractor agreement with any subcontractor or vendor employed by the Contractor in performing the work of this Section.
10. At the completion of all welding operations the Contractor shall submit to the Engineer a complete record of all the welds.

C. Qualifications Statements:

1. Submit qualifications certificates issued by the particular welding material and/or equipment supplier for each employee engaged in the performance of the welding process.
2. Submit manufacturer's approval of welding contractor.

1.7 CLOSEOUT SUBMITTALS

A. Section 017700 - Execution and Closeout Requirements specifies requirements for submittals.

B. Project Record Documents: Record weld information as required by this specification using form included at the end of this specification or other approved form.

1.8 QUALITY ASSURANCE

A. Welding shall be done in accordance with the following AREMA Specifications

1. Specification for Quality Assurance of Electric Flash Butt Welding of Rail
2. Thermite Welding – Rail Joints
3. Inspection and Classification of Secondhand rail for Welding
4. Specification for Fabrication of Continuous Welded Rail
5. Recommended Field Repairs to Pressure Butt Weld Failures, except as modified herein.

B. Welding Supervision: All welding shall be performed under the direct supervision of an experienced and manufacturer – qualified supervisor or foreperson.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products and equipment specified in this Section with minimum five years' documented experience.

B. Welding Contractor: Company specializing in performing Work of this Section with minimum five years' documented experience and approved by the manufacturer of the Electric Flash Butt Welding equipment or Thermite Weld Kits.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements specifies requirements for transporting, handling, storing, and protecting products.

B. Deliver materials in manufacturer's packaging including application instructions.

C. Store Weld Molds and related materials according to manufacturer's instructions.

D. Protect all Thermite Weld Kits from moisture.

1.11 AMBIENT CONDITIONS

A. Minimum Conditions: Do not perform welding when weather conditions do not comply with specific welding equipment and material manufacturer’s requirements.

1.12 EXISTING CONDITIONS

A. Verify that adequate laydown and material storage areas are available for execution of the work.

B. Performance of the welding will not interfere with existing Owners operations or other construction activities.

1.13 WARRANTY

A. Section 017700 - Execution and Closeout Requirements specifies requirements for warranties.

B. Furnish guarantee of all field welds made in accordance with the requirements of the AREMA Specifications noted in Section 1.8 of this Specification.

PART 2 PRODUCTS

A. FLASH BUTT WELDING EQUIPMENT:

1. Electric flash butt welds shall be made in the field using one of the following portable plants:
   a. Chemetron Portable Welding Plant by Chemetron Rail Products
   b. Holland Portable Flash Butt Welding Plants by Holland Company
   c. Railtech Schlatter AMS Superflex Mobile Welder by Railtech
   d. Or approved equal.

B. THERMITE WELDING EQUIPMENT AND MATERIALS

1. Thermite type rail welds shall be formed using one of the following brands of rail welding kits:
   a. Boutet, as distributed by Railtech Boutet, 25 Interstate Drive, Napolean, OH 43545.
   b. Orgo-Thermit®, 3500 Colonial Drive, Manchester, NJ 08759
   c. Or approved equal.
2. Substitutions: Specified in Section 016000 - Product Requirements, comparable products.

2.2 SOURCE QUALITY CONTROL

A. Section 014000 - Quality Requirements specifies testing, inspection, and analysis requirements.

B. Certificate of Compliance: When Welding Contractor is approved by the manufacturer of the Electric Flash Butt Welding equipment or Thermite Weld Kits, submit proof of certificate of compliance indicating past work performed conforms to Contract Documents.

PART 3 EXECUTION

3.1 THERMITE WELDING REQUIREMENTS:

A. End Preparation: The rails to be welded shall be cleaned of grease, oil, dirt, loose scale and moisture to a minimum of six inches back from the rail ends, including the rail surface, by use of a wire brush, to completely remove dirt and loose oxide and by use of oxygen-acetylene torch under a minimum of 250-degrees Fahrenheit temperature, to remove grease, oil, and moisture. The face of the rail ends shall be aligned and cut at right angles. The rail ends shall be cleaned again to remove scale and rust by use of a power-actuated grinder, with abrasive wheel for two inches on each side of the weld. Rail ends shall show no steel defects, dents, or porosity before welding. Rail that must be cut to length for any reason shall be cut square and clean by means of Engineer-approved rail saws or abrasive cutting wheels in accordance with AREMA Specifications for Steel Rails.

B. Gap: The minimum and maximum spacing between rail ends shall be as specified by the rail welding kit manufacturer and approved procedure required by Paragraph 1.3 B 3 above.

C. Alignment: The ends of the rails to be welded shall be properly gapped and aligned to produce a weld which shall conform to the alignment tolerances below. During thermite welding the rail gap and alignment shall be held without change during the complete welding cycle.

1. Alignment of the rail shall be done on the head of the rail.
2. Vertical alignment shall provide for a flat running surface. Any difference of height of the rails shall be in the base.
3. Horizontal alignment shall be done in such a manner that any difference in the width of heads of rails shall occur on the field surface.
   Horizontal offsets shall not exceed 0.040-inch in the head and 0.125-inch in the base.
4. Surface Misalignment Tolerance: Combined vertical offset and crown camber shall not exceed 0.040-inch per foot at 200-degrees Fahrenheit or less. No dip camber shall be allowed.
5. Gauge Misalignment Tolerance: Combined horizontal offset and horizontal kink camber shall not exceed 0.040-inch per foot at 200-degrees Fahrenheit or less.

D. Rail ends containing holes within 9 inches of the end of rail shall be cut off in accordance with the requirements of Section 02450 of these Technical Provisions.

E. Thermite Weld Preheating: The rail ends shall be preheated prior to welding to a sufficient temperature and for sufficient time as indicated in the approved welding procedure to ensure full fusion of the weld metal to the rail ends without cracking of the rail or weld.

F. Thermite Weld Post-Heating: The molds shall be left in place after tapping for sufficient time to permit complete solidification of the molten metal and proper slow cooling to prevent cracking and provide a complete weld with proper hardness and ductility.

G. Weld Finishing and Tolerances:

1. Rails and joints in the finished track shall be brought to a true surface and alignment by means of a proper grinding or planing machine. An approved flexible shaft cut grinder operated by a skilled worker shall be used for this work. With this machine care must be taken to grind evenly and leave the joints in a smooth and satisfactory condition. Finishing shall eliminate all cracks. The completed weld shall be finished by mechanically controlled grinding in conformance with the following requirements:
2. A finishing deviation of not more than plus 0.010-inch to minus 0.0-inch of the parent section of the rail head surface will be allowed. The sides of the railhead shall be finished to plus or minus 0.010 inch of the parent section. The bottom and sides of the rail base shall have a finishing deviation of not more than plus 0.010-inch to minus 0.010-inch. The web area, underside of railhead and top of rail base shall be finished to a deviation of not more than plus 0.125-inch to minus 0.0-inch.

H. **Weld Quality: Each completed weld shall have full penetration and complete fusion and be entirely free of cracks or fissures. Porosity and slag-type defects will be acceptable provided that testing indicates that the largest defect does not exceed more than 3/16-inch in its largest dimension; the total area of the defect does not exceed 0.010-square inch and the sum of the greatest dimension of defects in a line does not exceed 1/2-inch.**

I. **Hardness: The hardness of the weld measured on the head of the rail in the center of the weld shall be equal to the Brinell hardness of the parent metal with a tolerance of plus or minus 20 Brinell hardness numbers. One weld out of each ten will be selected at random by the Engineer for Brinell Hardness testing by the approved independent testing laboratory.**

J. **Weld Numbering: Contractor shall semi-permanently mark a sequential weld number on the rail immediately adjacent to the weld using a quality lead paint marker at the time the weld is made. Welds shall be numbered sequentially in the order in which they are made. Defective welds that are replaced shall be assigned a new sequential number by adding a letter to the defective weld number (i.e., defective weld 23 would be replaced by 23A).**

K. **Weld Testing:**

1. **100-percent of the welds shall be visually inspected and tested by the ultrasonic method specified below. Ultrasonic testing shall be performed after the rail has been installed in track. The weld quality, finishing, and alignment requirements listed above shall apply as standard of acceptance.**
2. **Weld testing shall be carried out by an independent testing laboratory at the expense of Contractor. The testing service and their testing program and procedures are subject to approval by the Engineer as indicated.**
3. **The testing service shall certify whether or not each weld meets the quality criteria detailed in Paragraphs 3.01C, G, H, and I and shall submit reports directly to the Engineer within three working days of testing the weld. The Engineer will forward copies to the Contractor. At the time of testing, the testing service shall mark their findings as to acceptability or rejection on the weld itself.**
4. **Ultrasonic testing shall be done in accordance with the AWS D1.1, Section 6, Part C. At a minimum, the weld shall be scanned from the top and both sides of the railhead and the base. The weld shall be scanned from both sides on the same face for longitudinal and transverse discontinuities using the applicable scanning pattern or patterns described in Section 6.23 of the above mentioned code.**

3.2 ELECTRIC FLASH BUTT WELDING REQUIREMENTS:

A. **Preparation: Rails for electric flash butt welding shall have the scale and raised rolling marks removed down to bright metal in those areas where the welding current-carrying electrodes contact the rail. The weld and adjacent rail for a distance clearing the electrodes shall have a minimum of 95-percent of mill scale removed and rails showing evidence of electrode burns where the metal has been displaced shall be rejected. All rail ends shall be cut clean and square by means of a reciprocating rail saw or abrasive cutting saw. No torch cutting will be permitted.**

1. **Each rail end shall be aligned in the welding machine at the head of the rail. Horizontal alignment shall be made on the gauge side of the head and any deviations in the width of the rail heads shall occur on the field side of the rail. Vertical alignment shall provide an accurately aligned top of rail surface and any difference in rail heights shall be positioned in the base of the rail.**
2. **All electric flash butt welds shall be forged to a point of refusal to further plastic deformation resulting in a minimum upset of 3/8-inch. If flashing of the weld is interrupted with less than 1/2-inch of flashing distance remaining before upsetting, the rail ends shall be re-clamped in the machine and flashing shall be re-initiated.**

B. **Finishing Rail Welds:**

1. **Trimming and grinding of all rail welds shall be performed immediately following welding at an elevated temperature if possible. When grinding must be performed at normal temperature, care shall be taken to avoid grinding burns and metallurgical damage.**
2. **The top and sides of the rail head and bottom and sides of the rail base shall be finished to within 1/32-inch of the parent section.**
3. **The web, top of rail base, and the underside of the head shall be cleaned by using a wire brush. Any weld metal overlapping the edge of the weld shall be removed by grinding.**
4. **Finishing shall remove all cracks visible to the unaided eye and shall produce a smooth area extending 6-inches from each side of the weld free from spatter or rough surfaces that could inhibit weld testing.**
5. **Notches created by rail offset conditions shall be eliminated by grinding to blend variations. Protrusions and gouge marks in the weld areas shall be removed by grinding and the weld area shall be blended into the rail contour.**

C. **Alignment of Rail Welds:**

1. **The crown of the rails at the rail weld shall not exceed 1/16-inch in 36-inches measured from the weld point. The crown tolerance is the combined vertical offset and crown camber measured using a 36-inch straightedge. Surface grinding of the rail crown is permitted to achieve this tolerance.**
2. **The horizontal alignment of the rails at the weld shall not deflect more than 1/16-inch in 36-inches measured form the weld point. The alignment is the combined horizontal offset and kink camber of the rail. Straightening of the rail by means of a hydraulic press is permitted to achieve this tolerance.**

D. **Weld Testing:**

1. **100-percent of the welds shall be visually inspected and tested by the ultrasonic method specified below. Ultrasonic testing shall be performed after the rail has been installed in track. The weld quality, finishing, and alignment requirements listed above shall apply as standard of acceptance.**
2. **Weld testing shall be carried out by an independent testing laboratory at the expense of Contractor. The testing service and their testing program and procedures are subject to approval by the Engineer as indicated.**
3. **The testing service shall certify whether or not each weld meets the quality criteria detailed in Paragraphs 3.1C, G, H, and I and shall submit reports directly to the Engineer within three working days of testing weld. The Engineer will forward copies to Contractor. At the time of testing, the testing service shall mark their findings as to acceptability or rejection on the weld itself.**
4. **Ultrasonic testing shall be done in accordance with the AWS D1.1, Section 6, Part C. At a minimum, the weld shall be scanned from the top and both sides of the railhead and the base. The weld shall be scanned from both sides on the same face for longitudinal and transverse discontinuities using the applicable scanning pattern or patterns described in Section 6.23 of the above mentioned code.**

3.3 REPLACEMENT OF DEFECTIVE WELDS

A. Welds in installed track that the Engineer determines to be unacceptable shall be cut out of the rail and replaced by a section of new rail and two new welds. The minimum length of a new rail shall be 13-feet and shall be installed with rail gaps as specified in Article 3.01 above. Saw cuts shall be made at least six inches from the centerline of the faulty weld. Replacement welds and replacement rails shall be at the sole expense of Contractor. Replacement

welds shall be renumbered as indicated. Replacement welds made in track shall be ultrasonically tested as specified herein.

B. ATTACHMENTS

1. Record of Field Weld Form

- END OF SECTION -

SECTION 347210.00 – FIELD WELD RAILS

Record of Field Weld				
Project Name:				
Project Location:				
Contractor:				
Weld Number: _____		Weld Type ☐Thermite☐Flash Butt☐Gas		
Date:_____	Time:_____ _	☐AM ☐PM	Track__	Station:_____
Air Temperature:_____°F		Weather:☐Clear☐Overcast☐Rain☐Snow		
Rail Temperature: _____°F		Track Alignment & Construction: _____		
Rail Gap:_____(Nearest 1/16”)		Rail Cut Required? ☐YES ☐NO		
Back Rail: Date Rolled YY/MM_____/____	Heat .:____ –	Rail Type: ☐CC ☐ HT ☐ OH	_____ _ Shop Curved Rail#	
CC = Control Cooled; HT = Heat Treated; OH = Open Hearth, HH=Head Hardened				
Ahead Rail Date Rolled YY/MM_____/____	Heat_____ –	Rail Type: ☐CC ☐ HT ☐ OH☐HH	_____ Other	
Remarks: _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____				
Kit Manufacturer Representative Present: _____		Welding Supervisor _____		
Engineering Representative Present: _____				
Recorder: _____ _ (Signed)		Recorder: _____ (Signed)		

SECTION 347220.00- OTHER TRACK MATERIAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
The contractor shall provide and install other track material. Other track material includes rail fastening system, threaded fasteners and hardware, compromise joint bars, and tie plates both for turnouts and for conventional track.

B. RELATED SECTIONS:
1. Section 347201.00 - Track Layout
2. Section 341129.00 – Construct Continuously Welded Rail Track
3. Section 341133.16 – Timber Crossties
4. Section 341133.22 – Steel Crossties
5. Section 341193.00 – Track Appurtenances and Accessories
6. Section 347205.00 – Construct Turnouts

1.2 MEASUREMENT AND PAYMENT

A. No measurement or payment will be made for this item. Payment will be made under the applicable track or turnout item that requires this work.

1.3 REFERENCE STANDARDS

A. American Railway Engineering and Maintenance of Way Association (AREMA):
1. Manual for Railway Engineering
2. Specifications for Special Trackwork

B. American Society for Testing of Materials (ASTM)
1. A36: Standard Specifications for Carbon Structural Steel
2. A123: Zinc (Hot-Dip Galvanized) Coating on Iron and Steel Products

PART 2 - PRODUCTS

2.1 MATERIALS

A. Threaded Fasteners
1. Contractor shall furnish Track Bolts and nuts that shall be new and conform to the AREMA Manual, Volume 1, Chapter 4, Part 3.4, “Specifications for Heat Treated Carbon Steel Track Bolts and Carbon-Steel Nuts” and applicable for the rail section and joint bars to which they are applied.

2. Contractor shall furnish heat treated Frog Bolts and nuts that shall be new and conform to AREMA Specification M11.
3. Contractor shall furnish Spring Washers that shall be new and conform to the AREMA Specifications for Spring Washers AREMA Manual, Volume 1, Chapter 4, Part 3.6, Specifications for Spring Washers.

B. Rail Fastening System – The rail fastening system for use on treated timber crossties shall be a positive restraint type such as Pandrol® e-Clip or approved equal type positive restraint rail fastening system and incorporate the following components:
1. Canted Tie Plates – Canted tie plates shall be as shown on the plans and be manufactured from rolled or cast steel with the rail seat area designed to orient the running rail when installed at a 1:40 cant towards the centerline of track. The plate shall have a 7 ¾ inch by 16-inch minimum bearing area and specifically designed for application on timber crossties to be used beneath both rails on tangent and curved track. The plate shall be designed with a defined recess or “seat” either milled, cast or formed during manufacture within which the base of the rail shall be fixed and thus prevent the lateral movement of the rail relative to centerline of the track.
2. Flat Tie Plates – Flat tie plates shall be manufactured from rolled or cast steel with the rail seat area designed to orient the base of the running rail when installed at zero (0) degrees to the plane across the top of the rails, or zero (0) cant. The plate shall have a 7 ¾ inch by 16-inch minimum bearing area and specifically designed for application on timber crossties used beneath the outside rail of curved track and 7 ¾ inch by 24-inch for application in timber crossties used beneath the inside rails of curved tracks at locations where the installation of restraining rail is indicated on the plans. The plate shall be designed to provide a defined recess or “seat” either milled, cast or formed during manufacture within which the base of the running rail and restraining rail are designed to fit thus preventing the lateral movement of the rails relative to centerline of the track.
3. Tie Plates shall be manufactured from material in conformance with the AREMA Specifications for Low Carbon Steel Tie Plates.
4. Tie Plates shall be provided with six punched or cast holes for use in attaching the tie plate to the timber crosstie and located in the same general configuration as that shown on the plans or as approved by the Engineer.

C. Screw Spikes
1. Contractor shall furnish new Screw Spikes in accordance with AREMA Plan #1S-12 or #2S-12 with a minimum tensile strength of 73,000 psi. the head shall be hot forged and centered relative to the shank in accordance with and manufactured in accordance with AREMA Specifications for Steel Screw Spikes.

D. Compromise Joints/Joint Bars

1. Contractor shall furnish new compromise joints required for temporary rail connections at locations where the abutting rail ends are of different rail sections. Where such temporary connections are required, the inside bolt hole of both rail ends shall not be drilled in order to permit welding of the joint unless otherwise specified to remain as bolted rail connections as defined in the project documents.
2. Compromise joint bars shall conform to the AREMA Manual Specifications for Quenched Carbon Steel Joint Bars and Forged Compromise Joint Bars and Specifications for Special Trackwork, as applicable.

E. Rail Fasteners
1. Resilient fasteners shall be Pandrol type “e-Clip”, right hand configuration or equal as approved by the Engineer and conforming to the following specifications:
   a. Bar Diameter: 20 mm
   b. Nominal toe load: 2,750 lbs.
   c. Working deflection: 7/16”
   d. Nominal Rail Seat Clamping Force: 5,500 lbs.
   e. Surface Area in contact with insulator or rail: 82 sq in.

END OF SECTION 347220