SECTION 20110

BALLAST AND WALKWAY AGGREGATE

PART 1 – GENERAL

1.01 DESCRIPTION

A. Section includes specifications for furnishing and placing ballast and walkway aggregate. For the purpose of this Section ballast refers to ballast for main tracks and walkway aggregate for maintenance of way walkway. Obtain ballast only from the sources or quarries already approved by Owner.

1.02 REFERENCE STANDARDS

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

1. Chapter 1, Roadway and Ballast

B. American Society for Testing and Materials (ASTM International):

1. C29 Test Method for Bulk Density (Unit Weight) and Voids in Aggregate

2. C88 Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate

3. C117 Test Method for Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing

4. C127 Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate

5. C131 Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

6. C136 Test Method for Sieve Analysis of Fine and Coarse Aggregates

7. C142 Test Method for Clay Lumps and Friable Particles in Aggregates

8. C535 Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

9. C702 Practice for Reducing Samples of Aggregate to Testing Size

10. D75 Practice for Sampling Aggregates

11. D3744 Test Method for Aggregate Durability Index

12. D4791 Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregates

13. E11 Specification for Wire Cloth and Sieves for Testing Purposes

C. California Public Utilities Commission (CPUC) General Orders:

1. 118 Construction, reconstruction and maintenance of walkways and control, of vegetation adjacent to railroad tracks

1.03 SUBMITTALS

A. Submit Certificates of Compliance for ballast and walkway aggregate certifying that the materials meet the requirements specified herein including laboratory test results accompanied by a written report from the testing lab. The testing shall not be older than 90 days and performed on samples taken from production stockpile.

B. Submit at least one 150-lb. ballast test sample.

C. Submit name and location of ballast source, production rates, and production logistics.

D. Submit detailed plans and descriptions for shipping, handling, and placing ballast.

1.04 DELIVERABLES

A. Submit a report confirming the readiness of the subgrade for ballast placement including as-built subgrade elevations and compaction test results.

B. Laboratory test results for all tests used in determining minimum property requirements of ballast.

1.05 QUALITY ASSURANCE

A. Refer to Section 01400, Quality Control and Assurance. Ballast is subject to inspection and testing by the Engineer at any time between quarry production and acceptance of track.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Load ballast at the quarry, transport, and unload directly on the track. Engineer may allow transportation by truck if the Contractor can ensure that the segregation, degradation, or contamination of the ballast would not occur as a result of trucking and placing.

PART 2 – PRODUCTS

2.01 MATERIAL PROPERTY REQUIREMENTS OF BALLAST/WALKWAY AGGREGATE

A. Ballast/walkway aggregate production and handling facilities shall conform to the AREMA Manual, Chapter 1, Section 2.5, Production and Handling.

B. Ballast/walkway aggregate shall be crushed stone broken by the crusher and have at least 2 broken surfaces: angular, rough-surfaced, clean and free of sand, loam, clay, flat, elongated, soft or disintegrated pieces, and other deleterious substances.

1. The Ballast/walkway aggregate shall conform to the property requirements shown in the following table.

MINIMUM PROPERTY REQUIREMENTS
BALLAST/WALKWAY AGGREGATE

Property	Minimum	Maximum	Test Method
Bulk specific gravity - Rock	2.75	--	ASTM C127
Degradation	--	20 %	ASTM C535/C131
Durability Test – Procedure A	65	--	ASTM D3744
Percent material passing No. 200 Sieve	--	1.0 %	ASTM C117
Absorption – Rock	--	1.0 %	ASTM C127
Clay lumps and friable particles	--	0.5 %	ASTM C142
Soundness - (Sodium Sulfate), 5 cycles	--	5 %	ASTM C88
Flat and/or elongated particles	--	5 %	ASTM D4791

C. Unacceptable ballast/walkway aggregate materials: Round rocks, boulders, cobbles or gravels.

D. Unacceptable ballast/walkway aggregate parent materials: Carbonates, sedimentary rock, alluvium, sandstone, limestone, and slag.

E. Obtain ballast/walkway aggregate material from one quarry source throughout the duration of the Contract.

2.02 GRADATION REQUIREMENTS OF BALLAST

1. Ballast (AREMA Size No. 4A) shall fall within the following gradation requirements:

Nominal Sieve Size (Square Opening)	% Passing by Weight
2-1/2 inch	100
2 inch	90-100
1-1/2 inch	60-90
1 inch	10-35
3/4 inch	0-10
3/8 inch	0-3
No. 4	0-0.5

2. Walkway aggregate (AREMA Size No. 5) shall fall within the following gradation requirements:

Nominal Sieve Size (Square Opening)	% Passing by Weight
1-1/2 inch	100
1 inch	90-100
3/4 inch	40-75
1/2 inch	15-35
3/8 inch	0-15
No. 4	0-5

2.03 WASHING

A. Wash processed ballast and walkway aggregate to remove fine particle contamination as defined by the specifications prior to delivery.

PART 3 – EXECUTION

3.01 EXAMINATION AND CORRECTION OF SUBGRADE

A. Prior to placing ballast on track subgrade, perform a final check of the condition of the track subgrade as to line, grade, cross section, and compaction.

1. Verify that track subgrade or subballast does not vary more than 1/2 inch from the design elevations and the line cross sections.

2. Repair uneven or settled subgrade with aggregate base or material approved by the Engineer in accordance with the requirements of Section 02310, Aggregate Base Courses, and Section 02300, Earthwork.

3. Compact subgrade in accordance with the requirements of Section 02310, Aggregate Base Courses, and Section 02300, Earthwork.

4. Prior to the placement of ballast, submit a report listed under Deliverables herein confirming the readiness of the subgrade.

B. Do not place ballast on soft, muddy areas. Repair the unsuitable area for approval by the Engineer.

3.02 GENERAL

A. At any time ballast is found to not conform to these specifications, stop ballast operations until ballast that does not conform to these specifications is removed and replaced.

B. Remove and replace ballast that becomes contaminated with fines or other deleterious material with new ballast.

3.03 BALLAST DISTRIBUTION

A. Obtain Engineer's approval of subgrade prior to distributing ballast.

B. Unload ballast directly from rail cars onto the track. Distribution by truck or loader is subject to the approval of the Engineer.

C. When distributing ballast, prevent forming of ruts that would impair proper drainage of the subgrade surface. Level and re-grade ruts to drain prior to placing ballast.

D. Unload ballast as close as possible to the point of use so to prevent unnecessary handling. Do not handle ballast more than two (2) times from the quarry to the track unless otherwise approved by the Engineer. Pick up excess ballast and ballast that is mixed with soil or fouled during distribution and replace with new ballast.

E. Place ballast to the lines and grades as shown on the Contract Drawings.

F. Salvaged excess or fouled ballast shall not be used as backfill, bedding or as fill materials unless otherwise approved by the Engineer.

3.04 WALKWAY AGGREGATE DISTRIBUTION

A. Distribute walkway aggregate and place in areas of walkways in track and special trackwork as required by CPUC General Order 118 and in other areas as shown on the Contract Drawings and as described in Section 20500, Special Trackwork. Also place walkway aggregate around non-track underdrains and other areas as shown on the Contract Drawings.

B. Place walkway aggregate only after ballast on main track has been completely surfaced, tamped, and dressed. Do not mix walkway aggregate with ballast for purposes of tamping of track structure.

C. Place the walkway aggregate only after subgrade and backfill have been completely compacted and cleared of debris.

3.05 QUALITY CONTROL AND TESTING

A. Refer to Section 01400, Quality Control and Assurance. Testing shall be performed by an approved Inspection and Testing Agency retained by the Contractor.

B. Sample and test ballast material, during construction to ensure continued conformance with the requirements of this Section. The laboratory shall transmit test results directly to the Engineer with copies to the Contractor.

C. Perform gradation tests ASTM C136 and C117 at least once every 500 tons, and perform tests in Table 1 of this Section no less than every 5,000 tons. Take ballast samples at the quarry, in stockpiles, in track, and at the Engineer's discretion.

D. Ballast Samples:

1. Perform gradation tests plus all of the tests specified herein on at least five (5) separate ballast samples at the quarry for the first 1,000 tons produced.

2. Test all samples of ballast material for conformance with ASTM D75. Sample sizes shall be sufficient to provide the minimum sample sizes required by the designated test procedures. Reduce test samples from field samples in conformance with ASTM C702.

3. If the ballast consistently fails the gradation test for excess materials passing the No. 4 or No. 200 sieves, fully wash the ballast at the quarry. Consistent failure means three (3) or more failures per 500 tons sampled.

E. Gradation Test:

1. Perform sieve analysis conforming to ASTM C117 and ASTM C136. Sieves shall conform to ASTM E11.

F. Other Tests:

1. Determine bulk specific gravity and absorption in conformance with ASTM C127.

2. Determine percentage of clay lumps and friable particles in conformance with ASTM C142.

3. Perform resistance to degradation of materials test in conformance with ASTM C131 and ASTM C535. Materials with gradations with particles larger than one inch shall be tested in conformance with ASTM C535.

4. Perform soundness test in conformance with ASTM C88.

5. Perform durability test in conformance with ASTM D3744, Procedure A.

6. Determine unit weight in conformance with ASTM C29.

G. Materials Not Meeting Specified Requirements: In the event any individual samples fail to meet the gradation or material requirements specified herein, the Engineer may suspend placement of the ballast and require immediate corrective action be taken to restore the specified gradation and material requirements, prior to resuming ballast placement.

END OF SECTION

SECTION 20120

TRACK APPURTENANCES AND OTHER TRACK MATERIAL

PART 1 – GENERAL

1.01 DESCRIPTION

A. Section includes specifications for other track materials (OTM) for concrete and timber ties. OTM includes rail fastening systems, screw spikes, track bolts, nuts, spring washers, tie plates, tie hole plugging material, rail anchors, standard toeless joint bars, compromise joint bars, and insulated joints.

1.02 GENERAL

A. Section 01005, Contractor's Personnel and Equipment: Includes general requirements and submittals regarding railroad construction equipment used for work of this Section, including adzing equipment.

1.03 REFERENCE STANDARDS

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

1. Manual for Railway Engineering (Manual)

B. American Society for Testing and Materials (ASTM International):

1. A325 Specifications for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

2. F436 Specification for Hardened Steel Washers

C. Caltrain Standard Drawings

1.04 DEFINITIONS

A. Tie Plate: Plate which has a rail seat, either flat or canted, double shoulder parallel to the rail it supports, and with holes for spikes or other fasteners. The bottom of the tie plate is usually flat, but may be ribbed or of other design.

B. Resilient Fastening System: Rail fastening system consisting of clips, insulators and pad on tie plate to fasten rail to ties.

C. Rail Anchor: Device which clamps to base of rail and bears against side of cross-tie (timber tie) to restrain longitudinal movement of rail.

D. Standard Joint Bar: Device used to connect the abutting end of contiguous rails of the same cross section.

E. Compromise Joint Bar: Joint bar used to connect contiguous rails of different cross section.

F. Insulated Rail Joint: Pre-fabricated or field-fabricated joint used to inhibit the flow of electric current between contiguous rails.

1.05 SUBMITTALS

A. Submit plan showing details for installation of OTM. Include manufacturer's installation instructions, where applicable.

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

C. If field fabricated boned insulated joints approved by the Engineer, submit the insulated rail joint installation procedures at least 30 days prior to beginning joint installation work. Include, at a minimum, the following items for insulated rail joints:

1. Contractor performing the field fabrication is certified by the supplier.
2. Care and storage of materials
3. Date of glue manufacture
4. Glue shelf life
5. Rail end preparation
6. Weather and temperature restrictions
7. Mixing and application of glue
8. Installation of insulated joint bar and pin bolts
9. Curing restrictions
10. Detection of glue bond failures

D. Submit product data for kegs proposed for shipping screw spikes.

E. Submit samples of track materials, if requested by the Engineer

1.06 QUALITY ASSURANCE

A. Perform material qualification testing for all materials, components, and assemblies.

1.07 DELIVERY

A. Deliver screw spikes to the work site in Engineer approved containers (kegs).

1.08 EXTRA MATERIALS

A. Any excess materials that are property of the Owner shall be packaged as specified and hauled to stockpile area designated by the Engineer.

1. Place excess new spikes in containers.

2. Palletize and band excess tie plates.

3. Place the excess rail anchors in nylon sacks on pallets.

PART 2 – PRODUCTS

2.01 TIE PLATES

A. Tie plates shall conform to the requirements as indicated in Caltrain Standard Drawings.

B. Tie plates for use with elastic fasteners shall be standard 7-3/4 inches by 16 inches in accordance with Caltrain Standard Drawings.

2.02 TRACK SPIKES

A. Screw spikes shall be new 15/16 inch by 6 inches straight shank screw spikes with a minimum tensile strength of 73,000 psi. Head shall be hot forged and centered relative to the shank in accordance with Caltrain Standard Drawings.

B. Stamp screw spikes with manufacturer's identification and date of manufacture (month and year).

2.03 RAIL ANCHORS

A. Rail anchors shall be Channeloc-type rail anchors manufactured by Chemtron True Temper or Engineer approved equal.

B. Rail anchors shall be sized to conform to the rail section used.

C. Rail anchors shall conform to the AREMA Manual, Chapter 5, Part 7, Section 7.1, "Specifications for Rail Anchors."

2.04 TRACK BOLTS, NUTS AND SPRING WASHERS

A. Track bolts and nuts shall conform to the dimensions specified in the AREMA Manual, Chapter 4, Part 3, Section 3.3, Rail Drillings, Bar Punching, and Bolts

B. Track bolts and nuts shall conform to the requirements of the AREMA Manual, Chapter 4, Part 3, Section 3.5, Specifications for Heat-Treated Carbon-Steel Track Bolts and Carbon-Steel Nuts.

C. Spring Washers shall conform to the requirements of the AREMA Manual, Chapter 4, Part 3, Section 3.6, Specifications for Spring Washers.

2.05 RESILIENT FASTENING SYSTEM

A. Furnish Pandrol E-2055 clip type or equal elastic fastening systems for use on timber switch ties.

B. Furnish modified Pandrol E-2063 or E-2063B clips, painted yellow, for insulated joint locations.

2.06 STANDARD AND COMPROMISE JOINT BARS

A. Standard 36-inch toeless joint bars shall be 6-hole bars, and shall be of the size, shape, and punch necessary to fit the rail sizes, conforming to the requirements in Caltrain Standard Drawings.

B. Compromise joint bars shall be of the size, shape, and punch necessary to fit the rail sizes and sections being joined in conformance with Caltrain Standard Drawings.

C. Compromise joint bars shall conform to the requirements of the AREMA Manual, Chapter 4, Part 3, Section 3.4, Specifications for Quenched Carbon-Steel Joint Bars, Microalloyed Joint Bars, and Forged Compromise Joint Bars.

D. Furnish only factory designed and produced (forged or cast) compromise joint bars for joining rails of different sizes or sections.

E. Make all permanent connections between different sizes of rail by using forged taper rails or compromise field welds.

2.07 INSULATED RAIL JOINTS

A. Furnish pre-fabricated insulated joints unless otherwise noted or approved by the Engineer. Where noted, furnish field fabricated bonded insulated rail joints.

B. Furnish insulated rail joints of the epoxy-bonded type as manufactured by Allegheny Rail Products, Co., American Track Systems, Inc., Portec Rail Products, Inc., Railway Bonded insulated joints, or Engineer approved equal, in accordance with the following:

1. Joint Components: Furnish insulated joints complete with bars, end posts, bushing, washers, pin bolts, collars, washers and adhesives as recommended by the manufacturer for final installation.

2. Furnish new, smooth, straight bars providing full face contact, conforming to the applicable rail section, and fabricated from micro alloyed steel or quenched carbon-steel as specified in AREMA, Specification for Quenched Carbon Steel Joint Bars. The toe of the joint bar shall properly fit against the web of the rail. When elastically fastened, the joint bar shall provide adequate clearance to maintain electrical isolation.

3. Provide pin bolts of ASTM A325 structural steel furnished with the appropriate collar. Provide flat circular hardened steel washers in accordance with ASTM F436.

4. Bolt hole size shall be in accordance with the bonded insulated joint manufacturer's recommendation. If bolt hole diameter is larger than 1-3/16 inches, place ASTM A325 hardened washers between the joint bars and the nut.

C. Insulating paint for use in conjunction with insulated joints: As recommended by the insulated joint manufacturer and approved by the Engineer.

2.08 TIE PLUGS

A. Tie hole plugging material shall be SpikeFast by Willamette Valley Company, or Engineer approved equal.

2.09 SUPERELEVATION TAGS

A. Furnish metal superelevation tags manufactured from 16-gauge aluminum in accordance with Caltrain Standard Drawings. Stamp tags in 1/4-inch increments from zero to maximum superelevation.

1. Nails for Securing Tags to Timber Crossties: Galvanized No 10.

2. Adhesive for Securing Tags to Concrete Ties must be approved by the Engineer.

PART 3 - EXECUTION

3.01 TIE PLATES

A. Install tie plates as specified in Section 20400, Track Construction.

B. Adze existing ties to receive new ties plates, prior to installing new rail and turnouts. Tie adzing shall only be of sufficient depth to allow for a full level seat for the new tie plate and remove indentation of old tie plate. The width of adze shall be the full width of the tie, and the length of the adze shall extend beyond the width of the tie plate seat by a minimum of one half inch of each side. Install the tie hole plugging material in all open spike holes prior to adzing.

C. Use only approved power operated adzing equipment for adzing, with an approved back-up adzer available on site at all times.

3.02 TRACK SPIKES

A. Install track spikes as specified in Section 20400, Track Construction.

3.03 RAIL ANCHORS

A. Install rail anchors in accordance with the requirements of Section 20400, Track Construction.

3.04 BOLTS, NUTS, AND SPRING WASHERS

A. The various rail drillings and joint bar punches require various lengths and diameters of bolt assemblies. Determine the number of bolt assemblies of each size requires. In general, all bolt diameters shall be the largest possible for a given rail drilling and joint bar punching. Bolts shall be the proper length for the joint bar to allow at least one full bolt thread to extend past the outside of the nut. Spring washers and nuts shall be of a size sufficient to ensure that the spring washer develops its full reactive force and does not jam into the joint bar hole.

B. Install bolt assemblies in accordance with the requirements of Section 20400, Track Construction.

3.05 RESILIENT FASTENERS

A. Install resilient fasteners in accordance with the requirements of Section 20400, Track Construction and Section 20500, Special Trackwork.

3.06 STANDARD AND COMPROMISE JOINT BARS

A. Install compromise joint bars in accordance with the requirements of Section 20400, Track Construction.

B. Temporary bolted joints will be permitted for the Contractor's convenience to facilitate construction, unless otherwise directed by the Engineer. The use of bolted joints during the construction of CWR track shall be kept to a minimum, and all bolted joints shall be replaced by field welds prior to de-stressing.

3.07 INSULATED RAIL JOINTS

A. Install pre-fabricated and field-fabricated insulated joints at locations shown on the Contract Drawings and in conformance with the manufacturer's recommended procedures. Install two insulated joints, on opposite rails at each callout on the Contract Drawing, with a stagger of two (2) cross-tie spacings, unless otherwise noted.

B. Notify the Engineer 24 hours in advance of installation of insulated joints at each location.

C. Test all insulated joints after installation into track in accordance with the requirements in Section 18600, Signal Systems Testing.

1. Remove, replace, and retest any bonded insulated joint that fails the electrical test in track. Obtain Engineer’s approval of insulated joint replacement procedure prior to making replacement.

D. Properly fasten the elastic fasteners to secure the insulated joints in place using Pandrol clips specified herein for resilient fastening at insulated joints. Use overdrive protectors when using E-2063B clips to obtain proper installation. Do not overdrive the clips.

E. Apply insulating paint to the circumference of the rail head and post after assembly and curing of bonded insulated joint adhesive. Apply the insulating paint as a stripe centered on the end post, one inch plus or minus 1/4 inch wide.

3.08 RAIL BONDS

A. Bond all jointed rail, both permanent and temporary, in accordance with the requirements in Section 18400, Rail Bonding.

3.09 TIE PLUGS

A. Plug all spike holes where spikes have been removed in existing ties that are to remain in track and that are to receive new tie plates or new spikes. Use tie hole plugging materials.

B. Install tie hole plugging material in accordance with the manufacturer's instructions. Top of tie hole plugging material shall be flush with top of hole.

2.10 SUPERELEVATION TAGS

A. Install tags in accordance with the Contract Documents and Caltrain Standard Plans. At concrete ties, follow adhesive manufacturer's instructions.

END OF SECTION

SECTION 20130

TIMBER CROSSTIES AND SWITCH TIES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Section includes specifications for timber crossties and switch ties in track construction, including special trackwork. Installation of timber ties is specified in Sections 20400, Track Construction, and 20500, Special Trackwork.

1.02 REFERENCE STANDARDS

A. Caltrain Standard Drawings

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

1. Manual for Railway Engineering (Manual)

C. American Wood-Preservers' Association (AWPA):

1. P1 Standard for Creosote Preservative

2. P2 Standard for Creosote-Petroleum Oil Solution

3. P4 Standard for Petroleum Oil for Blending with Creosote

D. West Coast Lumber Inspection Bureau (WCLIB):

1. Standard Grading Rules, Number 17 (WCLIB Rules)

1.03 SUBMITTALS

A. Certificates of Compliance for preservative treatment, ascertaining conformance with the approved preservative within one week of completion of testing.

B. Inspection Certificate from the WCLIB for grading compliance prior to application of preservative treatment.

C. Certificate of Compliance from manufacturer or suppliers certifying that the materials delivered to the site are in compliance with the requirements of this Section. Include supporting test results.

1.04 STORAGE AND HANDLING

A. Handle ties carefully to avoid damage in accordance with the AREMA Manual, Chapter 30, Part 3, Section 3.5, The Handling of Ties from the Tree Into the Track.

B. Stockpile new ties only where directed by the Engineer. Band ties with minimum of two bands in 12-tie bundle, and stack to a maximum of 3 bundles high, with slating between layers of bundles, and at a maximum height of 12 feet.

C. Choose storage locations with proper security, access, and drainage. Stack ties tightly and off the ground for storage to prevent them from becoming warped or damaged.

PART 2 - PRODUCTS

2.01 GENERAL

A. Ties shall be new oak or mixed hardwood with kerf mark to indicate heart wood side.

B. Timber crossties and switch ties shall have a cross-section of 7 by 9 inches, subject to the following:

1. Standard crossties shall be 7-inch, No 1 grade, 9 feet 0 inches long.

2. Transition/grade crossing crossties shall be 7-inch, No 1 grade, 10 feet 0 inches long.

3. Switch ties shall be full length, measuring full thickness and width throughout. Ties up to 1 inch wane or less will be inspected on an individual basis. Ties with more than 1 inch wane will be rejected. Ties with thickness and width more than 1/8 inch thinner or narrower than the specified size will be rejected.

4. Head block switch ties for manual throw turnouts shall be 8 by 12 inches.

5. Head block switch ties for power operated turnouts shall be 8 by 10 inches.

C. Do not use industrial grade crossties.

D. Any special timber ties for open-deck bridges shall be as specified and as shown in the Contract Documents.

2.02 TIMBER REQUIREMENTS AND BASIS OF REJECTION

A. General: Ties shall be fabricated from sound, straight, live timber, free from any defects that may impair their strength or durability, such as bark, splits, shakes, large or numerous holes or knots, pitch seams, pitch rings or other imperfections.

1. Ties with any type of decay or insect damage are not acceptable.

B. Except as specified in this Section, only those imperfections that are within the limits of the AREMA Manual will be allowed.

C. Rejection of ties for holes and knots: Ties with holes and knots (as defined below) between 20 and 40 inches from its middle will be rejected. Ties with these defects outside the rail bearing area may be rejected at the discretion of the Engineer.

1. Large hole: More than 1/2 inch in diameter and 3 inches in depth within, or more than 1/4 of the width of the surface on which it appears, and 3 inches deep outside, the sections of the tie between 20 inches and 40 inches from its middle.

2. Numerous holes: Any number of holes equaling a large hole in a damaging effect.

3. Large knot: One whose average diameter exceeds 1/4 the width of the surface on which it appears.

4. Numerous knots: Any number which, in total, equals a large knot in damaging effect.

D. Shakes which are more than 1/3 the width of the tie will be allowed provided it does not extend nearer than 1 inch to any surface.

E. Except in woods with interlocking grain, ties with a slant grain in excess of 1 in 15 will be rejected.

F. A check is a separation of the wood due to seasoning which appears on one surface only. Do not count the end as a surface. Ties with continuous checks whose depth in a fully seasoned or treated tie is greater than 1/4 the thickness and longer than 1/2 the length of the tie will be rejected.

2.03 TIE FABRICATION REQUIREMENTS

A. Ties shall be well sawed on all four sides and cut square at the end to the full dimensions specified. Straight and opposite faces shall be true and parallel.

B. Crossties and switch ties which comply with the following shall be considered straight:

1. Horizontally when it is concave or convex no more than 1 inch.

2. Vertically when it is concave or convex no more than 1/2 inch.

C. A tie will not be considered well sawn when its surfaces are cut into with scar marks more than 1/2 inch deep or when its surfaces are not even.

D. The top and bottom of a crosstie or switch tie shall be considered parallel if any difference in the thickness at the sides or ends does not exceed 1/2 inch.

2.04 END PLATES

A. All crossties and switch ties shall be end plated on both ends.

2.05 SEASONING

A. Crossties shall be seasoned in accordance with AREMA Manual, Chapter 30, Part 3, Section 3.5, The Handling of Ties from the Tree into the Track, and Section 3.6, Wood Preserving.

B. Pre-boring and dapping of crossties and switch ties shall be done prior to treatment to minimize splitting when driving spikes and provide preservative penetration around the spike holes. The boring pattern shall conform to the spiking pattern shown on the Caltrain Standard Drawings. Field boring of switch ties will be permitted if the hole is provided a method of preservative treatment approved in advance by the Engineer.

C. Bore from the top surface of the tie; bore shall not penetrate the bottom surface.

2.06 INCISING

A. Incise crossties and switch ties on all four sides in the pattern specified in the AREMA Manual, Chapter 30, Part 3, Section 3.7, Specifications for Treatment.

2.07 PRESERVATIVE

A. Preservative shall be in accordance with AWPA P3. Petroleum for blending with creosote shall comply with the AWPA P4.

B. Preservative applied to switch ties shall conform to AWPA P1.

C. Pressure treat ties in accordance with the empty cell process with a 50/50 to 40/60 creosote/petroleum base to a minimum retention of 7 pounds per cubic foot of wood, or to refusal retention.

D. Creosote-petroleum treatment solution shall be per AREMA Manual, Chapter 30, Part 3, Section 3.7.2, Treatment, and Section 3.7.4, Preservatives.

E. Apply the preservative only after the ties have a moisture content of 40 percent or less.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Prior to installation, perform a final visual inspection of the ties to ensure all ties to be installed are bored, branded, incised, and without defects.

3.02 INSTALLATION

A. Install ties in accordance with Sections 20400, Track Construction, 20500, Special Trackwork, and 20300, Crosstie Replacement, as applicable.

END OF SECTION

SECTION 20140

CONCRETE CROSSTIES AND RAIL FASTENER ASSEMBLIES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Section includes specifications for furnishing and installing new prestressed, pretensioned monoblock concrete crossties and rail fastener assemblies for use with 136 RE rail.

B. The concrete crossties (standard crossties and grade crossing ties) shall be as shown on the Caltrain Standard Drawings, and as specified in this Section.

C. The concrete crossties shall be compatible to the specified rail fastener assemblies.

D. Crossties for grade crossings shall accommodate precast concrete crossing panels specified in Section 20600, Concrete Grade Crossings.

1.2 REFERENCE STANDARDS

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

1. Manual for Railway Engineering (Manual)

B. American Society for Testing and Materials (ASTM International):

1. A536 Specification for Ductile Iron Castings

2. A881 Specification for Steel Wire, Deformed, Stress-Relieved or Low-Relaxation for Prestressed Concrete Railroad Ties

3. C31 Practice for Making and Curing Concrete Test Specimens in the Field

4. C33 Specification for Concrete Aggregates

5. C39 Test Method for Compressive Strength of Cylindrical Concrete Specimens

6. C78 Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)

7. C109 Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-inch Cube Specimens)

8. C150 Specification for Portland Cement

9. C172 Standard Practice for Sampling Freshly Mixed Concrete

10. C260 Specification for Air-Entraining Admixtures for Concrete

11. C359 Test Method for Early Stiffening of Hydraulic Cement (Mortar Method)

12. C494 Specification for Chemical Admixtures for Concrete

13. C864 Specification for Dense Elastrometric Compression Steel Gaskets, Setting Blocks, and Spacers

14. D257 Test Methods for DC Resistance or Conductance of Insulating Materials

15. D395 Test Methods for Rubber Property - Compression Set

16. D412 Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension

17. D471 Test Method for Rubber Property-Effect of Liquids

18. D570 Test Method for Water Absorption of Plastics

19. D573 Test Method for Rubber - Deterioration in an Air Oven

20. D648 Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position

21. D732 Test Method for Shear Strength of Plastics by Punch Tool

22. D789 Test Methods for Determination of Solution Viscosities of Polyamide (PA)

23. D1149 Test Method for Rubber Deterioration-Cracking in an Ozone Controlled Environment

24. D1229 Test Method for Rubber Property - Compression Set at Low Temperatures

25. D2240 Test Method for Rubber Property - Durometer Hardness

26. D4066 Standard Classification System for Nylon Injection and Extrusion Materials (PA)

C. American Concrete Institute (ACI):

A. 211.1 Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete

B. 214 Guide to Evaluation of Strength Test Results of Concrete

C. 301-10 Specifications for Structural Concrete

D. Precast/Prestressed Concrete Institute (PCI):

1. MNL 116 Manual for Quality Control for Plants and Production of Structural Precast and Prestressed Concrete Products

E. American Association of State Highway and Transportation Officials (AASHTO):

1. T26 Method of Test for Quality of Water to be Used in Concrete

1.3 SUBMITTALS

A. The following submittals to the Engineer are in addition to the requirements in Section 01300, Submittals and Deliverables.

B. Within 30 days of Notice to Proceed, prior to concrete crosstie and rail fastener assembly qualification testing:

1. Letter with supporting documentation stating that the crosstie manufacturer meets or exceeds the requirements per 1.5 of this Section.

2. Rail fastener manufacturer's approval of rail fastener application in the tie manufacture.

3. Shop drawings for each type of crosstie including all information necessary for fabrication. Include plan, elevation and cross section with prestressing wires, rail fastener assemblies, and embedded items. Show dimensions, details, tolerances, finishes, concrete strength, and material specifications. Indicate part numbers.

4. Letter from the rail fastener assembly manufacturer stating that the concrete crosstie manufacturer's shop drawings and processes are compatible with the rail fastener assemblies.

5. 3 samples each of the complete rail fastener assemblies, including embedded shoulders, rail clips, tie pads and insulators.

C. Within 45 days of Notice to Proceed:

1. Concrete mix design with certified concrete and concrete components qualification test results.

2. Manufacturer's Test Program Plan. The Plan shall, at a minimum, conform to the requirements of this Section and shall provide sufficient detail of the manufacturer's quality assurance program.

D. Within 7 Days after Completion of Testing and Inspection:

1. Certified concrete tie and rail fastener assembly qualification test results prior to crosstie and rail fastener assembly production and after approval of the shop drawings.

2. Certified rail fastener assembly and concrete tie production test results, certified tie pad production test results, and certified material test reports prior to shipping the concrete ties and rail fastener assemblies.

E. At least 30 days prior to shipment, submit method of handling, loading, shipping, unloading and stacking concrete crossties, including working drawings showing the concrete crossties stacking arrangement.

1.4 DELIVERABLES

A. Certificate of Compliance one day after each shipment of concrete crossties. The Certificate shall state that the accompanying shipment of concrete ties fully complies with all the requirements specified in this Section.

B. Inventory records of concrete ties shipped at the time of each shipment.

C. Cement mill certificates.

1.5 MANUFACTURER QUALIFICATIONS

A. Concrete Tie Manufacture's Qualifications:

1. A minimum of 5 years experience, in one location, of the large scale manufacture of pretensioned prestressed concrete crossties by the long line process with 5 to 8 lines per bed.

2. The plants shall be certified under the PCI Plant Certification Program.

3. Has supplied concrete crossties to a Class 1 Freight or Commuter Railroad within the last 5 years.

4. The Certificate of Qualification as the concrete crosstie supplier. Owner-approved manufacturers include CXT, Rocla, and KSA.

B. Rail Fastener Assembly Manufacture's Qualifications:

1. A minimum of five years experience, in one location, of the large scale manufacture of rail fastener assembly for use in pretensioned prestressed concrete crossties.

2. Has supplied the rail fastener assemblies used on concrete crossties of a Class 1 Freight or Commuter Railroad within the last 5 years.

3. Owner-approved manufacturers include Pandrol.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Handle all ties such that to prevent damage (such as chipping, spalling, cracking, etc.) during loading, shipping, unloading and stockpiling. Do not drop, bang, scrap, or skid ties. Use only lifting devices appropriate for handling ties.

B. Securely brace ties for transportation to prevent any movement that could cause damage. Stack ties in upright position, separated uniformly with wooden spacer blocks (align with the rail seat area) to clear fastener shoulder inserts. Do not load ties higher than 6 layers.

C. Package rail fastener assembly parts separately and in waterproof containers to prevent damage during shipment and to facilitate handling.

D. Store ties to prevent unnecessary additional handling until the final distribution. Store ties in separate stacks seggregated according to type of tie. Provide the necessary supports and spacers so that the ties will not contact the ground.

E. Replace concrete ties and rail fastener assemblies damaged during loading, shipping, unloading, and storage.

1.7 WARRANTY

A. Guarantee all items against defective materials, construction, or workmanship for a period of eight (8) years from the date of the ties and associated fastener assemblies have been installed on the ground and accepted, except when a longer guarantee is provided by the supplier or manufacturer.

1.8 SPARE PARTS

A. Furnish and deliver as Owner spares each of the following, separately packaged and clearly marked "SPARE PARTS"

1. For every 5000 cross ties:

   a. 100 fast clips (galvanized) including insulators
   b. 50 sidepost insulators
   c. 50 tie pads

2. For each grade crossing:

   a. 10 e clips (galvanized)

PART 2 - PRODUCTS

2.1 CONCRETE CROSSTIE DESIGN CRITERIA

A. Fabrication Dimensions and Tolerances:

1. Track Gage: The concrete tie and fasteners shall hold track gage to plus or minus 1/16 inch. The centerline of the tie shall be within 1/2 inch of the centerline of the track gage.

2. Differential Tilt of Rail Seats: The differential tilt in the direction parallel to the rail of one rail seat to the other rail seat shall not exceed 1/16 inch over the width of the tie.

3. Concrete Cover for Prestressing wires: 3/4 inch minimum cover

4. Prestressing wires shall be 5.32 mm minimum diameter, conforming to ASTM A881, Grade 260

5. Surface Finish: Heavy concentrations of surface voids or evidence of improper mixing, vibrating, or curing are not acceptable.

2.2 CONCRETE DESIGN CRITERIA

A. Concrete Mix Design, in accordance with ACI

1. Qualify concrete mix design based on tests on trial batches, which shall show that concrete mix achieves the specified strengths and properties, including shrinkage and permeability.

2. Submit a new mix design to qualify the mix if any constituents of the concrete are changed during cross tie production.

B. Cement: ASTM C150 Type III low alkali (less than 0.60 percent alkali content)

C. Flexural Strength, tested in accordance with ASTM

1. Minimum 28-Day Flexural Strength: 750 psi

3. Test one beam for every 2,000 ties for the first 6,000 ties produced

2.3 RAIL FASTENER ASSEMBLY DESIGN CRITERIA

A. General:

1. The fasteners shall be of threadless design. To ensure compatibility among all components of the rail fastener assemblies and compatibility to the ties, they shall be manufactured by a single manufacturer.

2. Note that the specified Pandrol fasteners and corresponding part numbers comply with the requirements in this Section. The specified part number may be different due to subsequent production change by Pandrol. The fasteners proposed for replacement shall meet or exceed the specified fasteners, and shall be as recommended, in writing, by the Pandrol, and submitted for the Engineer's approval.

B. Rail Tie Pads (tie pads): Tie pads shall be Pandrol 7085WB, 6.5 mm thick, Poly complying with the following requirements:

1. Minimize abrasion of the rail seat area, reduce impacts and vibration effects on the track structure and provide electrical insulation of the rail.

2. Provide a positive means of preventing movement of the pad parallel to the rail. The pad thickness shall be 6.5mm, a width to extend around the shoulder to lock it in place.

3. Manufactured from natural rubber or thermoplastics which provide the required chemical and physical properties to resist effects of temperature ranging from minus 20 degrees F to plus 160 degrees F, as

well as oxidation, water, alkali, salt, petroleum products, synthetic lubricants, and sunlight. Manufacture pads of first quality, new ingredients, processed and cured in accordance with accepted standard industry practice. Oil-extended rubber, reclaimed rubber, or rubber containing wax is not acceptable.

C. Rail Clips: The clips shall be Pandrol Fastclip 1601 (for standard crossties), galvanized and Pandrol E-clip 2055 (for grade crossing ties), galvanized complying for requirements for ease of installation and maintenance. The clips shall be adaptable to track laying machine. They shall be one-piece elastic, heat treated, alloy spring steel forced and quenched to achieve the holding power. Spring-wedged clips are not acceptable.

D. Insulators: Insulators shall be Pandrol 7695 (toe insulators) and 7692 (post insulators), covering the full widths of the shoulders, complying with the following requirements:

1. Provide electrical isolation, reduce abrasion, and transfer dynamic loading from the rail to the rail clip to prevent relative motion in any direction.

2. Two (2) insulators for each rail fastener assembly, one on each side of each rail. They shall insulate the rail clip from direct contact with the rail, and also insulate the rail from the shoulder inserts.

3. Except for surfaces in contact with the rail, the surfaces of the insulators shall be smooth, clearly finished and free of flash. Insulators shall be free of internal defects and cavities.

4. Keys shall be provided between the insulators and the fastener hardware to prevent relative motion in any direction.

5. Shall be made of materials which provide the required electrical, chemical and physical properties to resist dynamic loading, oxidation, water, alkali, salt, petroleum products, synthetic lubricants, and sunlight through a temperature range of minus 20 degrees F and plus 160 degrees F. Recycled material is not acceptable.

6. Insulator material shall be injection molded nylon conforming to ASTM D4066, Group 1, Class 2, Grade 4, ultra-violet stabilized through the heat stabilizer.

7. Insulators shall be protected against oxidative embrittlement by inclusion of a non-conductive ultraviolet stabilizer which will not diminish the electrical insulation properties of the insulators.

E. Embedded Shoulders: Embedded shoulders shall be twin-stem Pandrol 9086, not directly anchored to the pretensioned wires, complying with the following requirements:

1. Provide and maintain proper position and alignment of the rail, rail clip, insulators, tie pad and running rail base. The shoulders shall be of

ragged stem design to maximize the surface area and pull out resistance.

2. Made of ductile cast iron conforming to ASTM A536 Grades 60-40-18, or 65-45-12.

2.4 PRODUCTION

A. Prestressing Wires

1. Placement and Spacing: Place and space prestressing wires in accordance with the AREMA Manual, Chapter 30, Concrete Ties, Section 4.3 - Tie Dimensions, Configuration and Weight.

2. Supports: Accurately place and support prestressing wires before concrete is placed. Secure the prestressing wires against displacement greater than the permitted tolerances.

3. Prestressing wires: Inspect for proper surface condition. Prestressing wires shall be free of release agents or other substances.

B. Concrete Curing: Cure in accordance with the AREMA Manual for Railway Engineering, Chapter 30, Concrete Ties, Section 4.2 - Material, Article 1.2.2.5 – Curing.

2.5 SOURCE QUALITY CONTROL - GENERAL

A. Perform the testing required in this Section for the concrete crossties. Submit test results to the Engineer for review and approval.

B. Previous qualification tests performed on nearly identical concrete crossties produced for a Class I Freight or Commuter Railroad within the last 5 years may be acceptable in lieu of performing the required qualification testing.

C. Do not proceed with the production of the concrete ties until the shop drawings, concrete mix design, and qualification test result submittals have been reviewed and approved by the Engineer.

2.6 SHOP INSPECTION BY THE ENGINEER

A. Provide the Engineer written notice for inspection at least 30 days in advance of the initial in-shop inspection and 10 days in advance for subsequent in-shop inspections. Do not prepare materials for shipment before the Engineer has either inspected the materials or waived inspection.

B. After material has been delivered and unloaded, conduct an inspection and issue a report to the Engineer.

PART 3 - EXECUTION

3.01 CONCRETE TIE INSTALLATION

A. Prior to commencement of the crosstie installation, perform a final visual inspection of each tie to ensure all ties and their fastener assemblies are free of defects or damage and equipped with rail fastening assembly.

B. Install concrete ties in accordance with Section 20400, Track Construction, and related provisions.

END OF SECTION

SECTION 20150

RAIL

PART 1 - GENERAL

1.01 DESCRIPTION

A. Section includes specifications for Contractor-furnished 136 RE Continuously Welded Rail (CWR) and Owner-furnished CWR and jointed rails. Rail installation is specified in Section 20400, Track Construction.

1.02 REFERENCE STANDARDS

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

1. Manual for Railway Engineering (Manual)

2. Portfolio of Trackwork Plans (Plans)

B. American Association of Railroads (AAR):

1. Specification for Quality Assurance M-1003

1.03 SUBMITTALS

A. Rail Material Schedule: Within 30 days of receipt of Notice to Proceed, and prior to the delivery of the rail to site, submit a complete schedule of all Contractor-furnished rail materials proposed for installation, source of the rail, and product information including rail section, length, and date rolled.

B. Product Data: Submit the following product data for rail:

1. Manufacturer's Catalog Data

2. New Rail Product Analysis

3. Rail Ultrasonic Test Report

C. Submit Certificate of Compliance that the rail furnished meets all requirements set forth in this Section.

D. Storage Plan: Submit a storage plan for each storage area where Contractor-furnished rail is proposed to be stored or stockpiled. Include sufficient detail to demonstrate that efficient handling and security provisions will be provided, that supporting soils will not be overloaded, and that materials will not be overstressed due to bending or shear.

1.04 DELIVERABLES

A. Quality Control Program (QCP): Submit rail manufacturer's quality control program.

1.05 QUALITY ASSURANCE

A. Manufacturer's Quality Control Program (QCP) shall be in accordance with the AAR M-1003 or Engineer approved equivalent quality control program.

B. Comply with AREMA Portfolio of Trackwork Plans.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Manufacturer's Quality Control Program (QCP) shall be in accordance with the AAR M-1003 or Engineer approved equivalent quality control program.

B. Handle rail with roller, tongs or other methods that will not result in damage to the rail. Do not drop rail on uneven surfaces nor leave it unevenly supported.

C. Move CWR on rollers, buggies or other means to fully support it. Do not drag along the ground or across crossties.

D. Store rail in a designated site under the direction of the Engineer if not used for construction within 6 months of delivery.

PART 2 - PRODUCTS

2.01 GENERAL

A. Refer to Section 01600, Materials, for general requirements for Owner-furnished materials and for list of Owner-furnished materials, as applicable.

2.02 136 RE CONTINUOUS WELDED RAIL (CWR)

A. Furnish all rail, except as noted.

B. Contractor-furnished CWR shall be new 136 RE, intermediate strength, control cooled or vacuum treated carbon steel tee rail meeting AREMA Manual, Chapter 4, Section 2.1, Specifications for Steel Rails. Contractor-furnished CWR shall have been rolled within the year prior to shipment.

C. Deep head hardened rail in accordance with AREMA Manual, Internal Hardness of High-Strength Rail.

D. If the Contractor-furnished CWR are in sections instead of strings, CWR shall be manufactured on-site by welding rail sections in nominal 80 ft length into 1440 ft strings, or as specified in the Contract Documents.

2.03 OWNER-FURNISHED 136 RE CWR

A. If noted in the Contract Documents, the Owner will furnish strings of CWR of various lengths for installation at locations indicated in the Contract Drawings. Haul Owner-furnished rail from the storage locations. Haul back any surplus to storage area designated by the Engineer.

B. Re-lay existing CWR as indicated in the Contract Drawings.

2.04 OWNER-FURNISHED JOINTED RAIL

A. If noted in the Contract Documents, the Owner will furnish second hand jointed rail of varying sections in nominal 39 ft lengths at locations indicated on the Contract Drawings. Haul Owner-furnished jointed rail from the storage locations. Crop and weld the sections in required strings of CWR. Haul Owner-furnished surplus jointed rail back to storage area designated by the Engineer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Prior to installation, perform visual inspection for presence of any defects in rail being installed including rail furnished by the Owner. Inspect rail as it is being installed.

B. Notify the Engineer of any suspected defects in any rail. Remove rail that is damaged or defective, including wear and corrosion, and clearly mark and place it by the rail bed. Communicate to the Engineer and Contractor's employees whichever means the Contractor uses to mark defective rail.

3.02 INSTALLATION, CUTTING AND DRILLING OF RAIL, AND REMOVAL OF DEFECTIVE RAIL

A. Install rail as specified in Section 20400, Track Construction.

B. Cut and drill rail as specified in Section 20400, Track Construction.

C. Replace rail which has been installed but which is found to be defective, including isolated defects, as specified in Section 20400, Track Construction.

END OF SECTION

SECTION 20200
TRACK REMOVAL AND SALVAGE

PART 1 – GENERAL

1.01 DESCRIPTION

A. Section includes specifications for salvage and removal of existing track, special trackwork, and other track materials (OTM).

B. The work of this Section may require signal support and testing if removal of existing track involved signal equipment and components.

1.02 REFERENCES

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

1. Manual for Railway Engineering (Manual)

1.03 SYSTEM DESCRIPTION

A. Perform work on this Section in accordance with applicable provisions of the AREMA Manual.

B. Engineer has the right to review and inspect all records and reports for track material salvage and removal at anytime between commencement and completion of the Work.

1.04 SUBMITTALS

A. Submit proposed salvage and removal methods and schedule, including personnel and equipment; schedule shall be consistent with SSWP specified in Section 01011, Work Planning.

B. Submit product data for marking paint.

C. Submit completed Track Material Inventory forms for all salvaged and removed materials except ballast. See Attachment 20010-A, found at the end of this Section.

1. Include completed inventory forms for turnout components including ties. Utilize forms similar to the attached form, as required and accepted by the Engineer.

PART 2 – PRODUCTS

2.01 DUNNAGE

A. Pallets, sills, and other materials used for packaging and stacking of unused salvaged track items shall be clean, free of decay or other defects, and sufficiently sturdy for the service intended.

2.02 MARKING PAINT

A. Marking paint shall be a good quality spray marking paint or a good quality paint marker as approved by the Engineer.

PART 3 – EXECUTION

3.01 VERIFICATION

A. Prior to commencement of removal and salvage, verify the removal and salvage quantities and storage locations.

3.02 SALVAGE AND REMOVAL OF TRACK MATERIALS

A. Salvage timber ties that Engineer determines to be in good condition, otherwise remove.

B. Salvage turnouts as indicated in the Contract Drawings.

C. Salvage joint bars, tie plates, bolts, nuts and washers (OTM), along with salvaged trackwork.

3.03 SALVAGE OF CWR TRACK

A. Salvage existing continuous welded rail (CWR) as indicated on Contract Drawings for track construction. Reuse where indicated; if reuse is not required, rail may be cut to manageable lengths and haul to storage area and stockpile as specified herein or as required by the Engineer.

B. Handle rail by roller tongs or other methods that will not result in damage to the rail. Do not drop rail on uneven surfaces nor leave them unevenly supported.

C. Move CWR on rollers. Do not drag along the ground or across crossties.

D. Do not cut salvaged CWR. Cutting of CWR is permitted only for fitting within limits of track construction. Use only rail saw or abrasive rail cutting wheel to cut CWR. Other methods for cutting rail will not be accepted. Cuts shall be square and clean.

E. A single handling hole may be drilled in the ends of CWR. Drill hole at 9 inches or 15 inches from the end of the rail to suit joint bar hole spacing. Remove hole prior to installation of CWR. Drilling and cutting rail as described in Section 20400, Track Construction, under Drilling and Cutting of Rail.

F. Remove ties, tie plates and other OTM not suitable for reuse as determined by the Engineer.

3.04 SALVAGING TRACK IN PANELS

A. In areas of existing CWR, the Contractor will be required to temporarily replace the CWR with owner-furnished 39 feet long jointed rail. The jointed rail shall be installed with squared joints in order to remove the track in panels. The removed CWR shall be handled in accordance with Caltrain Standard Specifications, so as to prevent

damage to the rail. Existing CWR will generally be reused unless otherwise indicated in the Contract Drawings or directed by Engineer. CWR shall not be cut unless authorized by Engineer.

B. In areas of existing jointed rail, which is staggered, the Contractor will be required to square up the rail joints in order to remove the track in panels. This will require cutting and moving of the rail on one side of the track.

1. Do not torch cut rail or holes. Rail sections less than 15 feet in length are not allowed.

2. Rail joints must be bolted with at least 4 bolts, 2 per rail end. Broken bolts must be replaced when found, and all bolts must be kept tight allowing no vertical rail movement in the joints.

3. All trackwork done as required to remove existing track in panels shall be performed in accordance with Caltrain Standard Specifications.

5. Do not reuse existing rail anchors. Install new rail anchors on the jointed rail based on the anchoring pattern specified in Caltrain Standard Drawings. Prior to panel removal, install two (2) anchors per tie to the shoulder and joint ties with full bearing against the side of tie. Do not overdrive, as this may fracture or spread the metal, resulting in less holding power. Replace any rail anchor that is fractured or spread.

3.05 CLEANING OF TRACK MATERIALS

A. Sufficiently clean and then inspect track materials, except ballast, designated for salvage or reuse to ensure that no damage or significant corrosion exists.

B. Clean rail and joint bars by hand or mechanical means to remove dirt, and sort and haul them to the storage area indicated on the Contract Drawings or designated by the Engineer.

3.06 STORAGE AND HANDLING OF SALVAGED TRACK MATERIALS

A. Prevent damage to salvaged materials during salvage operation, handling, and storage.

B. Properly stack or contain salvaged track materials, in a neat fashion at the storage area designated by the Engineer.

C. Where specifically required in the Contract Documents or when required by the Engineer, clean and set salvaged continuously welded rail (CWR) and OTM adjacent to track. Requirements for storage of salvaged track materials shall apply.

D. Rail: Segregate salvaged jointed rail by rail section and length. Support bottom layer of rail on crossties evenly spaced. Locate rail piles in well drained sites with base of rail separated from ground surface. Separate each layer by at least three 2 x 4 inch wood strips evenly spaced for each 39 feet of rail. Stack rail in pyramid form with each tier of rail to be offset inward by one half the width of the rail base. Stacks shall be maximum height of 4 feet and maximum width of 15 feet at the base or as

directed by the Engineer. Stack rail with the heads up and with the rail ends square and even. Locate rail stacks in areas safely accessible by forklifts, cranes with rail tongs, and other equipment.

E. Turnouts: Disassemble, clean, palletize, box, place in drums salvaged turnouts, securely to prevent loss and damage during transport and storage. Clearly mark the contents of each individual package with a securely attached, weatherproof label.

F. Joint Bars: Sort joint bars by rail section and joint bar length, and stack on pallets. Steel band each pallet for forklift handling.

G. Tie Plates: Sort by size (length and rail base width), stack, and band on pallets for forklift handling.

H. Nuts, Bolts, and Washers: Sort and store in nylon sacks and on pallets.

I. Timber Ties, General: Stack crossties neatly and securely in bundles of 12 (3 ties high, 4 ties wide), band with three 1-1/4 inch bands, and space evenly for forklift handling. Plug all spike holes with tie plugs. Stack to a maximum of 3 bundles high and stockpile at the storage area shown on the Contract Drawings or where designated by the Engineer.

J. The maximum weight of any pallet with any material shall be 1,500 pounds.

3.07 REMOVAL OF TRACK MATERIALS

A. Where track and track materials are designated on the Contract Drawings or specified in this Section to be removed, remove from the work site and dispose of in accordance with the Contract documents.

ATTACHMENT FOLLOWS

ATTACHMENT 20200

INVENTORY OF MATERIALS SALVAGED, STORED, REUSED, AND REMOVED

Item No.	Item (Description)	Location Removed	Quantity	Unit	Date Removed	Date Placed in Storage Area	Quantity Reused	Location Used	Date Used	Remarks

END OF ATTACHMENT
END OF SECTION

SECTION 20300
CROSSTIE REPLACEMENT

PART 1 - GENERAL

1.01 DESCRIPTION

A. Section includes specifications for production timber crosstie replacement and spot timber crosstie replacement.

1.02 GENERAL

A. Section 01005, Contractor's Personnel and Equipment: Includes general requirements and submittals regarding railroad construction equipment used for work of this Section.

1.03 REFERENCES

A. Caltrain Standard Drawings

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

1. Manual for Railway Engineering (Manual)

1.04 DEFINITIONS

A. Production crosstie replacement generally refers to work areas of 500 track feet or longer, where rate of tie replacement consists of replacing an average of 1000 crossties per mile of track, between the limits indicated on the Contract Drawings, and as required by the Engineer. The actual rate may vary, plus or minus 200 ties per mile of track. No tie replacement will be required through the limits of at-grade vehicular or pedestrian crossings.

B. Spot tie replacement refers to localized replacement of one or more crossties in a specific area, generally less than 500 track feet in length.

1.05 SYSTEM DESCRIPTION

A. Perform work on this Section in accordance with applicable provisions of the AREMA Manual.

1.06 SUBMITTALS

A. Submit diagrams showing location and function of each person and each piece of equipment in the tie gang.

B. Submit plan and schedule for removal of existing ties, installation of new ties, and handling of all ties. This submittal shall be consistent with plans and schedules of Sections 01011, Work Planning, and 01310, Schedules.

1.07 DELIVERABLES

A. For production crosstie replacement work, submit an as-built track alignment report with tabulation of the vertical and horizontal positions of the prework and final track alignments.

B. For spot tie replacement work, submit a summary report of work performed, numbers and locations of the ties replaced, and level of ballast renewal.

PART 2 - PRODUCTS

2.01 CONTRACTOR-FURNISHED MATERIALS

A. Furnish ties, spikes, and superelevation tags compatible to each of the existing track and as specified in the Contract Documents.

B. Refer to Section 20130, Timber Crossties and Switch Ties, for timber ties replacement work.

C. Refer to Section 20110, Ballast and Walkway Aggregate, for ballast for crosstie replacement work.

PART 3 - EXECUTION

3.01 INSPECTION

A. Prior to commencement of the crosstie replacement work, inspect and verify areas indicated on Contract Drawings, marked in the field, or as required by the Engineer for crosstie replacement.

3.02 GENERAL

A. Replace defective ties as marked in the quantities identified in the Contract Documents and within the Contract limits.

B. Perform work in such manner to best utilize time allowed under the available working time limits.

C. Perform work in accordance with applicable parts of Section 20400, Track Construction, except as modified or amended herein.

3.03 PRODUCTION CROSSTIE REPLACEMENT

A. Refer to Section 01011, Work Planning. For production ties, assign work crew and equipment capable of installing a minimum of 800 ties per 6-hour work window with four (4) trains per hour passing on the adjacent track under a Form B.

B. Remove existing crossties without excessively splintering them. Dispose of these crossties including associated debris in accordance with GP 7.16, Disposal of Material Outside of the Work Site. Do not raise or hump the track more than

one (1) inch when removing ties. Remove debris from crosstie renewal prior to surfacing operations.

C. Remove and dispose of existing cut spikes and rail anchors.

D. Reuse existing tie plates with the following exception: Worn, bent or cracked plates and plates less than 14-inch long shall be replaced with new plates. Position plates so that the batter of plate will cant rail to gauge side and be centered over the width of the tie to obtain proper bearing of rail. Ensure that outside (field side) shoulders of tie plates have full bearing against base of rail. Set spikes with a self propelled driver/setter machine.

E. Center tie plates over the width of the tie, except that the plate shall be positioned up to 1/2 inch off-center if necessary to avoid spiking into an existing tie split.

F. Use the standard spiking pattern in the Caltrain Standard Drawings. Keep respiking of new timber ties to a minimum. Replace ties that have been excessively respiked, as determined by the Engineer, or ties that have been respiked due to the Contractor's carelessness.

G. Replace 50% of existing anchors with new ones. Install anchors tight against the tie.

H. When replacing crossties with resilient fastening system, reinstall resilient fasteners in accordance with the requirements of Section 20400, Track Construction.

I. Place new crossties square to the line of rail spaced on 19 1/2 inch centers. Crosstie position at joints shall result in a "suspended joint", with new ties spaced so that center of the space between ties will coincide with center of joint bars.

J. Prior to completing work for the day, line and tamp all newly installed crossties with a production/switch tamper. Replenish ballast as necessary with new mainline ballast. This initial tamping pass shall result in ties being held securely, and provide a solid, balanced bearing on the ballast.

K. Upon completion of a continuous segment not to exceed one mile of crosstie replacement, perform a final line, stabilize, and surface and dress of the track to eliminate all localized humping or surface irregularities. Final line, stabilize, surface, and dress in accordance with Section 20400, Track Construction.

L. Install superelevation tags on completed ballasted track in accordance with Caltrain Standard Drawings.

3.04 SPOT CROSSTIE REPLACEMENT

A. Perform spot crosstie replacement in accordance with criteria given for production crosstie replacement

B. Excavate the tie cribs and ends so that the old ties can be removed and new ties installed without jacking the rails, or otherwise distorting or "humping" the track.

C. Repair any track that is distorted or humped, as a result of the Contractor's operation.

D. Install rail anchors in accordance with Caltrain Standard Drawings.

E. Spot tie replacement includes powered hand-machine tamping and dressing of track.

3.05 FIELD QUALITY CONTROL

A. After completion of spot tie replacement, perform inspection on post-work track condition. The crosstie replacement work is not accepted as complete until the Engineer has checked and verified the final track condition.

B. Refer to deliverables specified herein for reports required in connection with completion of tie replacement work.

END OF SECTION

SECTION 20400
TRACK CONSTRUCTION

PART 1 – GENERAL

1.01 DESCRIPTION

A. Section includes specifications for track construction, including surfacing existing track and turnout and shifting and raising or lowering existing track.

1.02 REFERENCE STANDARDS

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

1. Manual for Railway Engineering (Manual)

2. Portfolio of Trackwork Plans (Portfolio)

B. Federal Railroad Administration (FRA):

1. 49 CFR Part 213, Track Safety Standards

2. 49 CFR Part 214, Subpart D Regulations, Roadway Maintenance Machine Safety

C. Applicable General Orders of the California Public Utility Commission (CPUC)

1.03 SYSTEM DESCRIPTION

A. Trackwork shall be constructed in accordance with the Contract Documents and AREMA Manual and Portfolio.

1.04 SUBMITTALS

A. Submit plan for handling of materials and construction of tracks for Engineer's approval. Plan shall include proposed equipment used to line, surface, tamp, and compact the track structure; and regulate and sweep ballast.

B. Methods and equipment proposed for achieving required thermal stress in the CWR to the Engineer prior to fastening rail to crossties.

C. Plan for providing a signal support crew to protect and maintain the operating signal system. Refer to Section 01005, Contractor's Personnel and Equipment, for related submittals.

D. If the Contractor proposes alternate construction staging plans, submit plans for the prior approval of the Engineer.

1.05 DELIVERABLES

A. Submit rail temperature and fastening records on forms furnished by the Engineer for CWR installation.

B. Submit the following prior to starting track construction:

1. Report confirming subgrade meets Contract requirements.

2. Survey documenting facilities in the track subgrade and their condition prior to starting track construction.

C. Prior to beginning track construction, submit a report confirming the constructability of the Work based on the construction staging plans as indicated in the Contract Drawings.

D. Submit rail fastening record forms to the Engineer before the end of the shift during which CWR was installed.

E. Submit report confirming that track is ready for tamping, lining, and surfacing.

F. Submit an as-built report with tabulation of the vertical and horizontal positions of the final track alignment to the Engineer for final acceptance of the track.

1.06 QUALITY ASSURANCE

A. Qualifications: Manufacturer of track materials shall have successfully furnished track materials to Class 1 Freight, Passenger or Commuter Railroad. This does not include transit or light rail special trackwork. Track materials shall be new unless otherwise noted on in the Contract Documents to be used or second hand.

B. Regulatory Requirements: Comply with the following:

1. FRA 49 CFR Part 213 and Part 214

2. Applicable General Orders (G.Os) of the California Public Utility Commission (CPUC)

1.07 DELIVERY, STORAGE, AND HANDLING

A. Replace damaged crossties, rail, other track material (OTM), and fastener assemblies. If track is constructed with track panels, inspect track panels and rail and store in a designated area within the work site prior to installation.

PART 2 – PRODUCTS

2.01 CONTRACTOR-FURNISHED MATERIALS

A. Furnish all materials, equipment and labor required to complete all aspects of the track construction work as specified and shown in the Contract Documents

except for Owner-furnished materials, equipment and labor. Refer to Sections 01004, Owner Furnished Labor and Equipment, and 01600, Materials.

2.02 OWNER-FURNISHED MATERIALS

A. Refer to Section 01600, Materials for description of Owner Furnished Materials.

B. Salvaged track materials indicated on the Contract Drawings and specified Section 20200, Track Removal and Salvage, shall be considered as Owner-furnished materials if indicated for reuse in track construction.

PART 3 – EXECUTION

3.01 PREPARATION

A. Prior to commencement of trackwork construction, check the track subgrade as to line, grade, and cross section, and compaction. The track subgrade is the bottom of ballast. The track subgrade shall not vary from the design elevations and the line cross sections from the range of plus or minus 1/2 inch.

1. Correct subgrade settlement discovered at this time by repairing the subgrade as specified in Section 02300, Earthwork.

2. Place and compact subballast, if required, in accordance with the requirements of Section 02300, Earthwork.

3. Submit to the Engineer a report confirming that all requirements for the subgrade are met according to the plans and as specified in Section 02300, Earthwork.

3.02 INSPECTION

A. Survey and document the condition of facilities in the track subgrade, including buried conduits, conduit stub-ups, ductbanks, underdrains, and underground utilities. Incorporate the information in a report and submit to the Engineer prior to starting track construction work, operating heavy equipment, and allowing construction vehicles on the track subgrade.

3.03 GENERAL

A. Refer to Section 01011, Work Planning, for plans and procedures regarding work both within and outside the railroad operating environment.

B. Protect facilities in, under, or on the track subgrade during track construction. Repair damages to the facilities which were caused by the Contractor's operations and were not pre-existing as indicated in the Contractor's survey report.

C. Secure screw spikes at right angles to the tie surface, straight down.

3.04 TRACK CONSTRUCTION

A. Track construction shall include main line track construction, non-main line track construction, raise and shift track, and lining and surfacing track.

B. Main line track construction as indicated in the Contract Drawings shall include placing ballast, placing ties, installing continuously welded rail (CWR), installing OTM, de-stressing rail, lining track, surfacing track, regulating ballast, and stabilizing track.

C. Non-main line track construction as indicated in the Contract Drawings shall include placing ballast, placing timber ties, installing second hand CWR or jointed rail, installing OTM, lining track, surfacing track, destressing of rail, and regulating ballast.

D. Raise and shift of main line track as indicated in the Contract Drawings shall include raising and shifting track to the final alignment, placing ballast, replacing damaged or defective ties, fastening loose ties, installing OTM, lining track, surfacing track, regulating ballast, and stabilizing track.

E. Lining and surfacing track as indicated in the Contract Drawings shall include minor track raising and shifting without changing the existing ballast section, placing ballast as required for minor track raising, stabilizing track, and regulating ballast.

F. Lining and surfacing track shall include at least 200 feet of track beyond limits of track construction to ensure smooth alignment transition between new track and existing track.

3.05 SEQUENCE OF THE WORK

A. Schedule track construction work according to the requirements of Section 01040, Track Hours and Track Access.

B. Schedule work in such a manner so that the best use of time under the allowable working time limits is made. Make arrangements to ensure that the materials, equipment and labor needed are planned and in place, including signal support crew.

C. Refer to the construction staging plans, if applicable, in the Contract Drawings for the track construction work and other work that require relocating or reconstructing trackwork.

D. Prior to construction, review the construction staging plans to ensure the constructability of the construction. Refer to submittals and deliverables specified herein for requirement in regard to construction staging plans.

E. Track shall be constructed, brought to final line and grade, and fully ballasted before CWR is thermally adjusted.

3.06 INITIAL LAYER OF BALLAST

A. Place an initial layer of ballast, compact it over prepared subgrade prior to placing track or raising and shifting track.

B. Limit initial layer of ballast to a total compacted depth that will establish the track at an elevation between four (4) inches and six (6) inches below final top of rail elevations as indicated in the track profile of the Contract Drawings.

C. Each lift of initial ballast layer shall not exceed a maximum of four (4) inches in thickness and shall be uniformly spread and compacted with a minimum of four (4) passes with vibratory compactor, unless otherwise approved by the Engineer.

D. Place the initial layer of ballast for ballast deck bridges directly over the waterproofing membrane. Protect the waterproofing membrane and deck drainage pipes.

E. Level the surface of the initial ballast layer and compact uniformly prior to crosstie distribution or track installation.

3.07 CROSSTIE DISTRIBUTION

A. Distribute and place ties in their final locations. Install ties perpendicular to the track alignment based on the required tie spacing as indicated in Caltrain Standard Drawings.

B. Position cross ties at joints or welds so that a "suspended joint" arrangement results unless otherwise required by the Engineer.

C. Place ties within plus or minus 1/2 inch of required spacing. Discrepancies shall not be additive.

D. Place ties with the heart wood down and ensure the bottom of each tie fully supported on the initial ballast layer.

E. Replace damaged and defective ties.

F. Before laying rail, clean the wearing surface of the tie and tie plate of any debris.

3.08 CUTTING AND DRILLING OF RAIL

A. Use only approved rail saw and abrasive cutting wheel for cutting rail. Cuts shall be square and clean. When given the option of cutting existing rail or cutting the rail being installed, cut the existing rail. Do not use cutting torches on rail; rail cut with torches will be rejected.

B. Drill new holes with a proper template. Do not punch, slot, or burn with torch. Mark and drill each hole location at centers, size, and location shown on the Caltrain Standard Drawings. Peen drilled bolt holes or grind to remove sharp edges. Chamfer holes and rail ends in accordance with Caltrain Standard Drawings. Tolerance for the diameter of drilled bolt holes is plus or minus 1/16 inch.

C. Drill a single handling hole in the ends of CWR, at 9 inches or 15 inches from the end of the rail to suit joint bar hole spacing.

3.09 LAYING AND INSTALLING CONTINUOUSLY WELDED RAIL (CWR)

A. Laying CWR:

1. Lay CWR in-place in a manner that does not damage rail, crossties, tie plates, fasteners, or other appurtenances. Ensure that surface of tie plate or tie pad is free of ballast or other material that would prevent full bearing of the rail on the tie plate.

2. Install prefabricated insulated joint rail plugs at locations as indicated in the Contract Drawings. End post insulation shall be centered in the tie crib closest to the specified location. Cut the CWR string at the insulated joint location and pull it ahead instead of removing a piece from the middle of the CWR string.

3. Determine the rail temperature by means of an AREMA standard rail thermometer as specified in the AREMA Manual. Connect CWR strings with temporary joints that have gaps to provide for thermal adjustment from observed temperature to Desired Neutral Temperature (DNT) of 105 Degrees F.

4. Heat the rail as specified herein to the following required Desired Neutral Temperature Ranges (DNTR): CWR shall be installed within 5 degree of the Desired Neutral Temperature (DNT) of 105 degrees F.

5. If the rail temperature exceeds the maximum specified for that area, the Engineer reserves the right to suspend rail laying operations or require that the rail be cooled.

6. Distribute and position CWR for fastening in a manner to minimize handling over tie plates and to prevent buckling. Use rollers to move strings of CWR. Do not drag CWR along the ground or along crossties.

7. Place rails base down, parallel with track, avoiding excessive bending or damage, using suitable mechanical equipment. Avoid placing rails on manhole covers, electrical connections, or near other installations that could be susceptible to damage or cause damage to the rail.

8. In advance of the rail fastening, determine rail temperature. Place thermometer on web or base of rail shaded from the sun, long enough to record the rail temperature accurately. Check and record rail temperature every 30 minutes during laying.

9. Do not cut rail strings except as required for installation of turnouts, crossovers, and other special trackwork.

10. Position CWR strings so that tie-in welds are staggered by a minimum of 15 feet, unless otherwise approved by the Engineer.

11. Place welds at 25 feet minimum from the edge of grade crossing panels and stagger by a minimum of 15 feet.

12. Pieces of rail longer than 15 feet shall remain the property of the Owner. Pieces of rail shorter than 15 feet shall be removed and disposed.

B. Rail Ends:

1. Cut rail to a tolerance of 1/32 inch from square. Remove burrs and make ends smooth. Chamfer edges in accordance to Caltrain Standard Drawings.

2. Any mismatch of rails at joints may not be more than 1/16 inch on the tread and 1/16 inch on gage side.

3. Rail batter is the distance in 1/1000 inch, between the bottom of the straight edge 24 inch long, applied along the centerline of the worn surface of the top of the rail. Limit welding to joints where one rail shows a batter of 1/16 inch or more. Where rail ends are not battered to an extent requiring welding, but where measurement shows a difference in the height of the rails of 1/16 inch or more, build up the low rail to the height of the high rail. Do not make welding repairs past the end of the joint bar or end repairs over a bolt hole.

C. Fastening CWR:

1. Install resilient fasteners, only after the rail has achieved a temperature within the specified range and has been de-stressed to relieve internal stresses.

2. Fasten rail only when its temperature is within 5 degrees F of the opposite rail's fastening temperature.

3. Prior to de-stressing rail, remove any joint bars or compromise joints installed at the Contractor's convenience and replace by thermite weld.

4. At the time of joining CWR strings by welding, ensure that the rail has been adjusted to zero thermal stress.

D. Adjustment by Heating:

1. Heat rail with an approved rail heater when installing rail with a rail temperature lower than the specified minimum for that area. Rail lengths of 200 feet or less may be adjusted by a rail puller. For rail lengths over 200 feet, use a rail heater.

2. Adjust rail temperature after it has been laid but before it is fastened or anchored, as applicable. Rail shall not be thermally adjusted before the track is constructed to final line and grade with a full ballast section.

3. At the time of welding, provide a gap at the end of each continuous welded rail equal to the amount of the expansion that is required for that rail plus the required gap for the weld.

4. Begin heating at the end of the rail and steadily apply moving forward without reversing direction until the required temperature range (Desired Neutral Temperature) has been achieved for that rail. Control uniformity of expansion by marking each quarter of the string and introducing expansion as follows:

1/4 Point	1/4 of total required expansion
1/2 Point	1/2 of total required expansion
3/4 Point	3/4 of total required expansion

   a. Mark quarter points with a continuous line from the base of rail to the tie plate or shoulder of concrete tie so that the amount of expansion can be accurately determined. The reference shall be one that will not move as the rail expands.

5. Vibrate the rail along its entire length during heating or after it has achieved zero stress temperature to facilitate the relieving of internal rail stresses (destressing). Use only appropriate vibrators as approved by the Engineer. Do not strike the rail with objects which might damage the rail.

6. The fastening operation shall immediately follow destressing. Fastening of the rail shall occur within the temperature range as specified in this Section.

E. Gaps for Rail Distribution Adjustment:

1. During rail laying below the indicated zero thermal stress or desired temperature, determine the gap between CWR strings by using the following equation:

$$G = (t - T)LK + Q$$

G	=	Required rail gap (inches)
t	=	Desired Neutral Temperature (DNT) in degrees F
T	=	Actual rail temperature at time of laying in degrees F (before heating)
L	=	Length of rail in feet (total length of unrestrained rail)
K	=	Coefficient of thermal expansion for rail steel (0.000078 inch per foot per degree F)
Q	=	Rail gap as required by manufacturer of field weld

kit in inches

2. The Desired Neutral Temperature used in the formula above shall be 105 degrees F.

F. Rail Fastening Record:

1. Provide in an acceptable, reproducible, and separate form during installation the following data for each end of a CWR or at each 500 foot interval for rails longer than 1,500 feet:

a. Date and time

b. Track number (i.e. MT1) and rail (left or right looking up-station or milepost)

c. Railroad stationing

d. Weather, air, and base of rail temperature; the base of rail temperature shall be recorded every 30 minutes.

e. Type of fastener used

f. Length of rail being anchored or fastened

3.10 LAYING AND INSTALLING TRACK PANELS OR JOINTED RAIL

A. Installation and placement of track panels or jointed rail:

1. Place track panels on initial layer of ballast according to the final horizontal alignment as indicated in the Contract Drawings.

2. Place each sequential track panel close enough to install joint bars with minimal sliding or handling of track panels.

3. Place tie plates under rails on all crossties. Clean tie plates and center them on the tie so that the rail will have full bearing on the plate and the plate will have full bearing on the tie. Set tie plates at right angles to the rail with the outside shoulder having full bearing against the base of the rail.

4. Lay rail with staggered joints. The joints in each line of rail shall be not more than 30 inches from the center of the opposite rail on tangents and curves up to 6 degrees, or more than 4 feet on curves over 6 degrees. Rails of less than standard length shall be used to space the joints on curves.

5. Adjust rail with squared joints in track panels so rail joints will be staggered as required above.

6. Drill new holes. Remove chips and burrs from rail drilling before installing joints. Rail end drilling shall match joint bar.

7. Gap rails at time of laying, before joint bars and bolts are installed, in accordance with the following table for 39-foot rail:

Rail Temperature (degrees F)	Expansion (inches)
Below 6	5/16
6 to 25	1/4
26 to 45	3/16
46 to 65	1/8
66 to 85	1/16
Over 85	0

8. Completely bolt joint bars with all bolts torqued. Use expansion shims to provide proper rail gap. Use an AREMA standard rail thermometer to determine the thickness of shims in accordance with the recommendations in "Temperature Expansion for Laying Rails" Chapter 5 Part 5 of the AREMA Manual.

B. Properly apply joint bars with full number and correct size of bolts, nuts and spring washers. Properly tighten joint bolts before spiking rail; tighten the two center bolts in advance of the end bolts. Except insulated joint bars, coat all joint bars on the rail fishing areas with approved track grease prior to assemblage. Similarly, clean all rail ends with a wire brush and apply grease in the areas of joint bar contact.

C. Place bolts with the nuts alternately on the inside and outside of the rail. Place nuts with the flat side toward the rail. Lubricate track bolts. Check rail ends for mismatch. Rail end mismatch exceeding 1/16 inch on the head and 1/16 inch on the gage face of the rail shall be welded and ground prior to placing track in service.

3.11 TRACK TAMPING, LINING, AND SURFACING

A. Tamp, line, and surface track as follows:

1. Completely construct, gage, spike, or fasten and weld or bolt track in conformance with the requirements specified in this Section prior to tamping, lining and surfacing. Align track with a full ballast section to the final horizontal alignment as indicated in the Contract Drawings.

2. Check the track on the initial ballast layer to ensure all track components including ballast, tie, rail, and OTM meet the requirements specified in this Section and as indicated in the Contract Drawings. Refer to deliverables specified herein for required report confirming that the track is ready for tamping, lining and surfacing.

3. Perform tamping of track including lifting, lining, and surfacing. The tamper shall meet the following requirements:

a. The tamper shall be capable of external control of both line and grade and shall be capable of external control of alignment utilizing a laser guidance system.

b. The tamper shall be an automatic, vibratory, squeeze-type power tamper equipped with fully functional laser liner and 16 tamping heads, capable of raising both rails simultaneously and maintaining cross-level.

c. The tamper shall be a production type tamper-liner capable of lifting, lining, and surfacing track and turnouts within the specified track tolerances and with the specified ballast.

d. The tamper and equipment to be used for tamping operations will be subject to approval by the Engineer.

4. Every tie in the track shall receive two (2) or more full insertions of the tamping heads and shall be tamped from a point 15 inches inside each rail on both sides of the ties to the end of the ties. Tamping will not be permitted in the center of the tie between the above stated limits. Where raising the track has resulted in a void under the center of the tie, lightly fill the center space. Tamp both ends of a tie, inside and outside of the rail, simultaneously.

5. Accomplish track surfacing by a method that will not cause undue bending of rail, straining of joints, and damaged rail fastenings. Raise both rails at one time and as nearly uniform as possible. Limit each track lift to an amount that will not endanger the horizontal, vertical, and longitudinal stability of the track. The maximum lift shall not exceed 4 inches. Raise the track so that a final lift of not less than one inch or more than 2-1/2 inches is necessary to bring the track to proper final grade.

6. Lift all ties that are pulled loose during surfacing operations. Clean plate surface of dirt and ballast, plug, spike, and re-tamp to provide full bearing against the rail.

7. Surface and align track to the tolerances specified in this Section. The number of surfacing passes shall be as necessary to obtain the Engineer's acceptance of the alignment.

8. The runoff at the end of raise shall not exceed 1/4 inch in 31 feet of track unless otherwise approved by the Engineer.

9. Tamp ties to provide solid bearing against the base of the rail after the track is raised to grade at final surfacing. Just prior to final dressing, stabilize track with a dynamic track stabilizer. Bring up all down ties to the base of rail and machine tamp. The resultant track surface and alignment shall be uniform and smooth.

10. Stabilize all track with a dynamic track stabilizer or work train as specified in the Contract Documents or required by the Engineer. The dynamic track stabilizer shall meet the following requirements:

    a. The Dynamic Track Stabilizer shall be a well proven machine widely use by the railroad industry and capable of applying controlled, accurate stabilizing forces into the track structure at continuous speeds of up to 1mph.

    b. The track may be stabilized with a work train. Refer to Contract Documents for the requirements for using a work train to stabilize the track.

11. During track tamping and stabilizing, add, re-tamp, and re-compact ballast to maintain the depth of ballast indicated on the Contract Drawings.

12. Upon completion of tamping, surfacing and lining operations, the track shall have been fully ballasted, tamped, surfaced, lined, stabilized, and dressed as shown on the Contract Drawings and specified in this Section.

13. Remove excess ballast from the track. After completion, no ballast shall remain on the tops of the ties, tie plates, or fastening systems.

14. Remove and replace overworked and excessively tamped or compacted ballast as determined by the Engineer.

B. Maintain horizontal alignment during the raising operation. Use automated controls on tampers to satisfy this requirement.

C. Apply rail bonding across any bolted joints in accordance with the requirements in Section 18400, Rail Bonding, and obtain approval of the bonding from the Engineer.

D. Perform tests to ensure the operating signal system has been restored. Obtain approval of signal test results from the Engineer prior to opening the track to service.

3.12 TRACK CRITERIA AND TOLERANCES

A. Construct track to the alignment and grade shown on the Contract Drawings. Gage shall be 4 feet 8-1/2 inches. Completed track shall conform to the following tolerances:

1. Deviation from correct gage timber ties: 1/8 inch

2. Deviation from correct gage concrete ties: 1/16 inch

3. Track Surface

a.	Runoff in any 31 feet of track at the end of a raise may not be more than:	1/4 inch
b.	Change in cross level or super-elevation over any 31 feet of track may not be more than:	1/8 inch
c.	Deviation from uniform profile on either rail at the mid-ordinate of a 62-foot chord may not be more than:	1/8 inch
d.	Deviation from zero cross-level at point on tangent may not be more than:	1/8 inch
e.	Deviation from design super-elevation may not be more than:	1/8 inch
f.	Difference in cross-level between 2 points less than 62 feet apart on tangents may not be more than:	1/4 inch
g.	Deviation from specified top of rail to top of platform:	+0, -1/4 inch
h.	Location of crosstie placement:	1/2 inch

4. Alignment: Maximum deviations for horizontal alignment shall not exceed:

   a. Tangent Track: 1/4 inch at mid offset on a 62-foot chord.

   b. Curved Track: 1/4 inch from correct mid-ordinate on a 62-foot chord.

5. Track shall be constructed to within 1/2 inch of correct horizontal and vertical position as indicated in the Contract Drawings and within the allowable tolerances specified above.

6. Constructed track shall conform to all required minimum tolerances; + (plus) as specified above and – (minus) zero.

3.13 RAISING AND SHIFTING TRACK

A. Perform raising and shifting of existing track and turnouts to permanent new alignments at locations indicated in the Contract Drawings and in accordance with the requirements of these Specifications. Do not shift tracks more than two (2) feet in any single pass.

B. Prior to raising and shifting track or turnout, widen the existing trackbed in conformance with Section 02300, Earthwork, as required to provide a full track subgrade in accordance with the typical section indicated in the Contract Drawings.

C After track has been raised and shifted, reposition skewed ties and other track components to their proper spacing and alignment. Re-gage track not less than every fifth tie as necessary. When re-gaging track, remove spikes from ties. Destress rails in accordance with these Specifications.

D. Destress rails if track shift is 500 feet or longer on tangent track, or if track shift reduces the curvature of the track.

E. Add to accommodate increase in alignment due to track shift. Adding rail shall be performed as follows:

1. Remove existing rail anchors

2. Cut and remove a minimum of 15 feet of existing rail

3. Install a new section of rail and weld joints

4. Re-install existing rail anchors

5. Destress rails in accordance with these specifications

F. Track raise and shift work shall include resurfacing of existing track adjacent to the track shift area as required to maintain the consistent track profile grade.

3.14 REPLACEMENT OF DEFECTIVE RAIL AND DAMAGED RAIL FASTENER ASSEMBLIES

A. Remove and replace rail that has been found to be defective during construction as follows:

1. In tangent track: with 15 foot minimum length of defect-free rail.

2. In curved track: with 30 foot minimum length of defect-free rail.

B. Weld defect-free rail into the rail in accordance with Section 20720, Thermite Rail Welding.

C. Replace rail fastener assemblies damaged during tamping, regulating or other track construction operation.

3.15 FIELD QUALITY CONTROL

A. After completion of trackwork construction, check the track alignment as to line, grade, and cross section.

1. Track alignment and profile with errors exceeding construction tolerances specified in this Section shall be corrected by shifting, raising, or lowering the track.

2. Submit to the Engineer a report with tabulation of the vertical and horizontal positions of the final track alignment.

3. The track construction is not accepted as complete until the Engineer has checked and verified the final track alignment data submitted by the Contractor.

3.16 TRACK BACK IN SERVICE

A. Refer to Section 01011, Work Planning, for track back in service requirements. Complete the Return to Service Report attached at the end of this Section prior to returning track to service.

B. Perform a visual inspection after installation, but prior to returning track to service to ensure ties and rails are properly fastened, lined, and free of defects that might be caused during installation.

ATTACHMENT FOLLOWS

RETURN TO SERVICE REPORT

Inspection is required to restore track to service following any significant work/outage. All involved parties (Contractor, JPB, Rail Operator) shall inspect and verify conditions. Inspectors shall be trained and qualified under JPB SPTM&C rules as well as the applicable regulations, and shall be familiar with the scope and progress of the work involved.

Reason for Outage			
Description of Work			
Date/Time		**Weather/Temperature**	
Location (Station & Milepost)	Track Number/Name	Timetable Speed	Current Speed
Condition/Remarks		Corrective Action Taken	

Track is acceptable for return to service	Yes	No	N/A	Print Name & Date	Signature
Responsible Party	☐	☐	☐		
Contractor Track	☐	☐	☐		
JPB Track	☐	☐	☐		
Operator Track	☐	☐	☐		
Contractor Signal	☐	☐	☐		
JPB Signal	☐	☐	☐		
Operator Signal	☐	☐	☐		

Track Conditions						**Corridor Conditions**				**Stations**		**Bridges**	
Rail	☐	Ties	☐	Fasteners	☐	Excavation	☐	Signals	☐	Crossings	☐	Piles/Caps	☐
Alignment	☐	Gage	☐	Turnouts	☐	Shoring	☐	Crossings	☐	Platforms	☐	Substructure	☐
Surface	☐	Anchors	☐	Crossings	☐	Footing	☐	Clearances	☐	Walkways	☐	Superstructure	☐
Joints	☐	Spikes	☐	Bolts	☐	Falsework	☐	Drainage	☐	Clearances	☐	Ballast Retainers	☐

END OF ATTACHMENT

END OF SECTION

SECTION 20500
SPECIAL TRACKWORK

PART 1 - GENERAL

1.01 DESCRIPTION

A. Section includes specifications for Contractor-furnished and Owner-furnished special trackwork.

1.02 REFERENCE STANDARDS

A. Caltrain Standard Drawings

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

1. Manual for Railway Engineering (Manual)

2. Portfolio of Trackwork Plans (Portfolio)

1.03 DEFINITIONS

A. Special Trackwork: A generic term referring to turnouts, crossovers, track crossings, derails, and similar track items.

1.04 SYSTEM DESCRIPTION

A. Special trackwork shall be configured, fabricated, and installed in accordance with the Contract Documents and AREMA Manual and Portfolio, where applicable.

B. Special trackwork shall be coordinated with signal work. Include coordination of specific signal equipment or components required for special trackwork construction. Refer to Division 18, Signals.

1.05 SUBMITTALS

A. Submit shop drawings prepared using the latest release of AutoCAD at least 30 days before fabrication is scheduled to begin, unless otherwise specified. Submit files in a CD in both Pdf and AutoCAD format. Submit hard copies of shop drawings as specified in Section 01300, Submittals and Deliverables.

B. Submit material data for Contractor-furnished new material.

C. Submit special trackwork packaging method.

D. Qualifications: Submit data documenting each manufacturer's past performance and projects within the last ten (10) years furnishing special trackwork material to Class 1 Freight, Passenger or Commuter Railroad.

E. Staging Plans: Submit plans include assembly locations, transport methods, and equipment used for prefabricating special trackwork outside of the working track.

1.06 DELIVERABLES

A. Manufacturer of special trackwork (for either Owner-furnished or Contractor-furnished) shall provide to the Engineer the following:

1. 2 copies of conformed design in latest AutoCAD

2. 2 copies of as-builts in latest AutoCAD

B. Installation of special trackwork:

1. Submit Manufacturer's certificates of compliance for special trackwork.

2. Certification of Installation: Submit affidavit by the manufacturer's field representative certifying that the installation of the special trackwork meets Manufacturer and Contract requirements.

3. Submit an as-built report with tabulation of the vertical and horizontal positions of the final track alignment.

4. Submit final shop drawings revised to show any variations from the tolerances, dimensions, lengths, or angles shown on the approved shop drawings.

1.07 QUALITY ASSURANCE

A. Qualifications: Manufacturer of special track shall have successfully furnished special trackwork to Class 1 Freight, Passenger or Commuter Railroad. This does not include transit or light rail special trackwork.

B. All special trackwork, assemble turnouts, crossovers, and derails shall be inspected in the manufacturer's fabrication shop.

1. Coordinate the details and scheduling of the inspection with the Engineer at least six (6) weeks before the shop assembly inspection. Provide the Engineer with a safe access to the lay down area and assist with the inspection activities as required.

2. Note on the final shop drawings any variations from the tolerances, dimensions, lengths, or angles shown on the approved shop drawings.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Limit the amount of "bundles" for each unit to the absolute minimum possible and indicate in the packaging plan how the materials will be stacked and marked to allow for easy identification of all the components that are part of the same unit.

B. Pack as complete units in secured bundles all turnouts, crossovers, and derails.

C. Mark units, bundles, and boxes clearly with the following information: identification of item contained, Manufacturer's name, shipping date, unit designation (right or left), number of pieces, destination, and gross weight.

D. Handle special trackwork materials in a manner that will prevent breaking, bending, or other damage during packaging, loading, transporting, and unloading. Do not drop or throw materials from cars, but lift or skid to the ground or other surface. Do not sharply strike special trackwork.

E. Transport and handle insulated joints in a manner that will protect them from damage.

PART 2 - PRODUCTS

2.01 CONTRACTOR-FURNISHED TURNOUTS, CROSSOVERS, AND DERAILS

A. Fabricate turnouts, crossovers, and double point split switch derails, including frogs and guardrails, from new materials. Fabricate special trackwork entirely insulated with the proper number of gage plates ahead and behind the extended switchpoints and stockrails and with all other components necessary.

B. Design for turnouts, crossovers, and derails shall conform to Caltrain Standard Drawings. All rail shall be 136 RE rail section.

C. Special trackwork shall be manufactured from head hardened (HH) rail.

D. Spring frogs shall conform to Caltrain Standard Drawings or Engineer approved equal. Castings shall be 3-shot explosion-hardened. Rail shall be deep head hardened rail. Furnish frogs without plates for turnouts and crossovers on concrete ties. Bolts shall be 1-3/8 inch Grade 8 square head with 1/4 inch hardened flat washers and hexagon security locknuts. Lubricate frog bolts and torque to 2,500 foot pounds.

E. Railbound Manganese (RBM) frogs with elastic fastening system shall conform to Caltrain Standard Drawings or Engineer approved equal. Manganese castings shall be 3-shot explosion-hardened in accordance with AREMA Specifications. Heel of the frog shall incorporate a 30-degree cut. Furnish frog plates with one inch round holes except as otherwise indicated on the Caltrain Standard Drawings. Bolts shall be 1-3/8 inch Grade 8 square head with 1/4 inch hardened flat washers and hexagon security locknuts. Lubricate frog bolts and torque to 2,500 foot pounds.

F. Turnouts and crossovers shall be fully insulated and welded from the ends of the stock rails through the switchpoints, insulated joints, closure rails and frog area, including all trim rail and beyond the long switch ties where it shall be welded into the existing track or newly constructed track. This includes the welding of the insulated frog gage plates to the guardrail plates.

G. Switchpoints, stockrails, frogs, and trim rail shall have the two (2) outside bolt holes drilled to facilitate temporary connections during constructing panelized

turnouts and crossovers. Refer to Part 3 of this Section for welding of temporary connections after installation.

H. All switchpoints are extended; the turnout switchpoint shall have a replaceable manganese tip, samson undercut, furnished with rollers and have the two outside bolt holes drilled in accordance with Caltrain Standard Drawings.

J. Switch pack with Hollow Steel Ties (HST) shall be used for new #10, #14, and #20 turnouts on mainline tracks. Switch pack shall include, but not limited to, rails, ties, hollow steel ties, blue rods, and all related components to complete the entire switch pack assembly.

K. All stock rails are extended, samson undercut and have the two (2) outside bolt holes drilled in accordance with Caltrain Standard Drawings.

L. Boltless adjustable guardrails shall have one inch riser furnished with U69 Guard Bar, complete with four (4) shims per guard-rail plate and fastened with Pandrol "E" clips. Determine the length of guardrail and quantity of guardrail plates in accordance with the switch layout. Furnish guardrail plates with one (1) inch round holes and a 1:40 cant.

M. Provide insulated vertical switch rods with AAR bracket for GRS 5F switch machine for the No. 1 and No. 6 positions, where applicable. Furnish all other vertical switch rod locations without AAR brackets.

N. Insulated Joints:

1. Conform to the requirements in Section 20120, Track Appurtenances and Other Track Material.

2. Incorporate insulated joints into closure rails in order to eliminate additional welds in turnouts and short pieces of rail.

3. Furnish insulated joints in lengths of 19 feet 6 inches minimum, and install them with a minimum stagger of 4 feet 8 inches and a maximum stagger of 10 feet 0 inches.

4. Paint manufacturer's lift locations or center point on the rail head.

5. Provide sufficient clearance on insulated joints for the insulated bar rail and Pandrol E2063B clip to properly fit together.

6. Elastically fastened using Pandrol Fastclip, modified "E" clip, or Engineer approved equal.

O. Ties:

1. Nominal tie spacing: 19-1/2 inches (wood) and 24 inches (concrete).

2. Refer to Section 20130, Timber Crossties and Switch Ties, for timber ties for special trackwork.

3. Refer to Section 20140, Concrete Crossties and Rail Fastener Assemblies, for concrete ties for special trackwork

P. Furnish all other track material (OTM) required for construction of turnouts, crossovers, and derails.

Q. Furnish signal bonding equipment as part of the complete special trackwork items.

2.02 SWITCH STANDS

A. Hand throw switch stands shall be Racor 36-EH switch stand or approved equal. Furnish a 14-inch red target with reflective material such as Scotchlite or equal on both sides.

B. Hand throw switch stand for crossovers shall be Racor 36-E switch stand, or Engineer approved equal, furnished with a 40 1/2 inch straight handle providing maximum clearance between tracks. Furnish an 8-inch red target with reflective material such as Scotchlite or equal on both sides.

C. Hand throw switch stand for double point split switch derail shall be Racor 36-EH switch stand, or Engineer approved equal, in accordance with Caltrain Standard Drawings. Furnish a 14-inch round "D" target with yellow reflective material such as Scotchlite or equal on both sides.

D. Derail sign and posts will be Owner-furnished. Refer to Section 01600, Materials, for related requirements.

2.03 POWER SWITCH MACHINES

A. See Division 18, Signals, for type and installation requirements.

2.04 LUBRICANTS

A. Provide the following types of lubricant or Engineer approved equal:

	Switch Components	Type of Lubricant	Brand/Manufacturer
1	Spring Frogs Wing Rail & Base Plates	Graphite	Slip Plate No. 1 – Superior Graphite Co
2	Switchpoint & Slide Plates	Soy Oil Base	Ultra Green Sprayable – Trac Lubricants & Coatings, LLC
3	Switch Rods & Hand Throw Switch Stands	Grease	
4	M23 Power Switch Machine	Soy Oil Base	Ultra Green Sprayable – Trac Lubricants & Coatings, LLC
5	5F Power Switch Machine	Soy Oil Base	Ultra Green Sprayable – Trac Lubricants & Coatings, LLC
6	A-5 Pneumatic Power Switch	Soy Oil Base	Ultra Green Sprayable – Trac Lubricants & Coatings, LLC
7	M23 Power Switch Machine – Gear Box	Petroleum Lubricating Grease	Lubriplate No. 5555 – Fiske Brothers Refining Co

PART 3 - EXECUTION

3.01 INSPECTION

A. Prior to commencement of special trackwork installation, perform inspection of the following items:

1. Inspect the 8-inch HMAC track underlay and verify its line, grade, cross section, and compaction as specified in Section 02720, Asphalt Paving.

2. In locations where HMAC underlayment is not required, inspect the track subgrade and verify its line, grade, cross section, and compaction as specified in Section 20400, Track Construction.

3. Verify track alignment as to line, grade, and cross section:

   a. Track center distance at crossover locations shall be in conformance with track center distance designed for the crossover. Maximum deviation shall not exceed 1/2 inch of the design distance or alignment.

   b. Track shall be on tangent at locations of the straight side of the special trackwork.

3.02 TURNOUT, CROSSOVER, AND DOUBLE POINT SPLIT SWITCH DERAIL CONSTRUCTION AND INSTALLATION

A. Fully weld turnouts, crossovers and double point split switch derails at joint locations, including both the toe and heel of the frog. Bolt and properly bond

temporary joint locations. Drill only two (2) outside holes on each side at all temporary joint locations. Weld out all temporary joints within 14 days of installation.

B. Dimensions, details and configuration of the turnout, crossover or double point split switch derail shall be as shown on the Caltrain Standard Drawings and the Contract Drawings. Shop drawings of Owner-furnished materials will be provided to the Contractor when they become available.

C. In no case shall a spike or screw spike be within 14 inches of the end of a switch tie.

D. Shift connecting tracks to their new alignments as shown on the Contract Drawings and connect all tracks to the replacement turnout.

E. Tracks shall be within 1/2-inch of the designed alignment prior to placing ballast.

F. Switchpoints/stockrails, rail joints, frogs, and other parts of the turnout, crossover or double point split switch derail shall fit together properly and be of the proper match. Allow two (2) inches of clearance between moving parts of the switch and the top of the ballast.

G. Place ballast as required in the turnout, crossover, or double point split switch derail and raise to proper grade in a minimum of two (2) lifts. The initial lift shall not exceed four (4) inches. The final lift shall not exceed two (2) inches and all tracks shall be brought into final alignment at that time. In addition, stabilize with a dynamic track stabilizer. Surfacing (tamping), ballast dressing requirements, alignment tolerances, and de-stressing shall be in accordance with Section 20400, Track Construction.

1. Use care not to surface through frog utilizing the tampers switch hooks only. Wing rail or frog base plates can be bent or torn and rendered inoperable. Use helper jacks on opposite guard rail and frog itself to lift track and achieve proper surface.

2. Use care when surfacing through switch point section so that rail remains properly seated in slide plates be careful not to allow tamping tools to strike or damage turnout component.

H. After the turnout, crossover, and double point split switch derail and associated track has been completely surfaced, lined, stabilized, and dressed with ballast, place walkway aggregate around the turnout and associated track to the dimensions governed by CPUC General Order 118 and as shown on the Contract Drawings and specified in Section 20110, Ballast and Walkway Aggregate, and Section 20400, Track Construction.

I. Install switch stands and adjust the switch operating mechanisms so that the switch operates smoothly and without requiring excessive forces. Force at end of handle must be verified with a torque wrench designed for testing switch stand resistance. The measured force at end of handle shall not exceed 30 pounds for the lift-up handle position, 50 pounds for the middle handle position, or 75 pounds for the push-down position. Hand throw switch stands shall have

a proper target. Lubricate switch plates and connection points in the switch rod with the lubricants specified herein.

J. Install switch to hold the switch point tightly against the stock rail when stand is in normal position. Adjust switch rods to hold the opposite point tightly against the rail when stand is in reverse position. Secure switch stands with spikes and fasteners to the headblock. Square headblocks with the track prior to tamping.

K. Install and adjust as required all required rods and plates, including switch point rods, switch point rollers, switch stand rods, basket rods, gauge plates, and U5 box and connections.

L. Install signal bonding as required in accordance with Section 18400, Rail Bonding. Coordinate special trackwork installation with signal work.

M. After installation of special trackwork, perform necessary tests to ensure the operating signal system has been restored. Complete all signal testing in accordance with Section 18600, Signal Systems Testing, prior to placing the turnout in service. Obtain approval of signal test results from the Engineer prior to opening the track to service.

N. Refer to Section 01011, Work Planning, for track back in service requirements. Complete the Return to Service Report in Section 20400, Track Construction, prior to restoring track to service.

3.03 PANELIZED TURNOUT, CROSSOVER AND DOUBLE POINT SPLIT SWITCH DERAIL CONSTRUCTION

A. As an option, construct panelized turnout, crossover, and double point split switch derail as a unit or in multiple panels for installation into the track.

B. Provide all equipment, tools and materials necessary to safely move the panelized turnout, crossover or double point split switch derail as a unit or in multiple panels, providing sufficient bearing to avoid excessive stress to the turnout, crossover or double point split switch derail during handling. Repair any damage caused to turnout, crossover, or double point split switch derail during handling and installation to a condition in accordance with this Section and Section 20400, Track Construction.

C. Panelized turnout construction tolerances shall conform to the track criteria and tolerances in Section 20400, Track Construction.

3.04 DERAIL SIGNS

A. Install derail sign and post in conformance with Caltrain Standard Drawings.

3.05 FIELD QUALITY CONTROL

A. After completion of special trackwork installation, perform inspection of the track alignment as to line, grade, and cross section.

1. Correct track alignment and profile with errors exceeding construction tolerances specified in this Section.

2. Prepare an as-built report with tabulation of the vertical and horizontal positions of the final track alignment.

3. Final acceptance will not be granted until work, punch list and as-built data of final alignment are submitted and verified.

END OF SECTION

SECTION 20600
CONCRETE GRADE CROSSINGS

PART 1 – GENERAL

1.01 DESCRIPTION

A. Section includes specification for furnishing and installing concrete grade crossing panels.

1.02 REFERENCE STANDARDS

A. Caltrain Standard Drawings

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

1. Manual for Railway Engineering (Manual)

C. American Society for Testing and Materials (ASTM International)

1.03 SUBMITTALS

A. Submit crossing panel system shop drawings.

B. Submit list of all crossing panel system materials.

C. Submit installation instructions.

D. Qualifications: Submit documentation for Engineer's approval that manufacturer has satisfactorily furnished grade crossing panels and complies with qualification requirements specified herein.

1.04 QUALITY ASSURANCE

A. Qualifications of the Crossing Panel Manufacturer: Manufacturer shall have furnished concrete grade crossing panels to Class 1 Freight or Commuter Railroads for use on 10 feet long concrete ties within the past two years.

PART 2 – PRODUCTS

2.01 CONCRETE GRADE CROSSING SYSTEM

A. Grade crossing system shall be designed for 136 RE rail. System shall be complete with all components, including 10 foot long precast concrete crossing panels, rubber seat pads for gage and field panels, assemblies, rubber flangeway inserts, fasteners, metal panel end deflectors and end restraints in accordance with Caltrain Standard Drawings.

B. The panels shall be shunt resistant.

C. Furnish panels with permanent mark on each panel top, imprinted in the concrete during fabrication, indicating the size of rail, weight of panel, manufacturer's name, and month/day/year of manufacture. Additionally, mark ends of panels with paint indicating size of rail and weight of panel.

D. Materials:

1. Rebar: ASTM Grade 60

2. Steel Angle: ASTM Grade 36

E. Concrete compressive strength shall be minimum 6000 psi.

2.02 CONCRETE CROSSTIES

A. The grade crossing panels shall be compatible with the 10 feet long grade crossing concrete ties. The concrete crossties shall be new 10 feet long flat-top crossties conforming to the requirements in Section 20140, Concrete Crossties and Rail Fastener Assemblies. The concrete crossties and concrete panels shall fit properly together and the ties shall provide a stable load bearing surface.

B. See Caltrain Standard Drawing SD-2212 for rail fastener requirements.

2.03 TIMBER CROSSTIES

A. Timber crossties for concrete grade crossings shall be new 7 by 9 inch by 10 feet 0 inch long. Timber ties shall conform to the requirements in Section 20130, Timber Crossties and Switch Ties.

B. Fasteners for timber ties under the concrete grade crossings: Two 16-inch Pandrol plates, four (4) galvanized Pandrol E-2055 clips, and eight 15/16 inch by 6 1/2 inch long screw spikes.

2.04 OTHER TRACK MATERIALS

A. Except where otherwise required by panel manufacturer, other track materials used in connection with installation of grade crossings shall be as specified in Section 20120, Track Appurtenances and Other Track Material.

B. Ultimate tensile strength of screw spikes shall be 75,000 psi minimum.

C. Rubber inserts or fillers for the grade crossing panels shall be manufactured from 100 percent extruded virgin rubber (virgin SBR – Styrene Butadiene Rubber) and shall meet the following requirements:

1. Rubber filler shall fit both 132# and 136# rail sections. See Caltrain Standard Drawings for dimensions.

2. Rubber filler shall have connector pins at the joints to prevent gaps and maintaining continuity throughout the railroad crossing.

3. Rubber filler shall fit snugly against the top of rail without gaps.

4. Material properties:

   i. Tensile: 2,000 psi

   ii. Elongation: 400%

   iii. Hardness: 65 ± 5 Durometer Shore A

2.05 SOURCE QUALITY CONTROL

A. If the crossing panel manufacturer is different from the tie manufacturer, panel manufacturer shall assemble one complete 10 foot grade crossing panel prototype along with six crossties at the panel manufacturer's plant to demonstrate the compatibility of the two products. Both the panels and the crossties shall fit together properly and provide a stable load bearing surface.

   1. Notify the Engineer sufficiently in advance of prototype assembly to give the Engineer the opportunity to observe the demonstration.

PART 3 – EXECUTION

3.01 DEMOLITION

A. Remove any existing pavement, track structure, ballast, natural ground and other materials down to the elevations shown in the Contract Drawings and as specified in Sections 02100, Demolition, and 02300, Earthwork.

3.02 TRACKBED PREPARATION

A. Excavate existing ballast and other existing base in accordance with Caltrain Standard Drawings and the Contract Drawings.

B. Construct the trackbed, including aggregate base and HMAC underlayment in accordance with Caltrain Standard Drawings and the Contract Drawings.

C. Install surface ditches and other drainage facilities, including track subdrains, as shown on the Contract Drawings. Clean all existing drainage ditches and channels adjacent to the grade crossing and slope to provide drainage away from the grade crossing.

3.03 TRACK CONSTRUCTION

A. Construct track at grade crossings as specified in Section 20400, Track Construction, and related sections, as modified and appended in this Section. No field welds of rail is allowed within the limits of the new grade crossing.

B. Within the limits of the crossing, the gage of the track shall be 56-1/2 inches, plus or minus 1/16 inch.

C. Within the limits of crossing on concrete crossties, place ties at 24-inch spacing. Place transition ties on each end of the crossing as shown on the Caltrain Standard Drawings.

D. Within the limits of crossings on timber crossties, place ties at 20-inch spacing. Place the transition ties on each end of the crossing as shown on the Caltrain Standard Drawings.

E. Outside the limits of the grade crossing and beyond the transition ties, fully box anchor all timber ties for 195 feet on each side of the grade crossing.

F. Final align and surface the track in accordance with the requirements in Section 20400, Track Construction, prior to placement of crossing panels.

3.04 EXAMINATION AND APPROVAL

A. Prior to installation of crossing panels, perform inspection on track final profile, all fastenings of the rail to the ties, and grading.

B. Notify the Engineer prior to installing panels for inspection and approval of the track surface and alignment. Obtain Engineer's approval prior to installation.

3.05 INSTALLATION OF THE CROSSING

A. Be familiar with the type of installation to be performed, and install the grade crossing system in accordance with panel manufacturer's installation instructions.

B. Do not to drop or strike the panels.

C. Remove deleterious materials from the top of the ties prior to installation of the concrete panels, and ensure that the panels are seated with good bearing on the ties. Crossing panels shall not "rock" on the crossties once in final position.

D. Install rubber flangeway inserts to fit snugly to the web and (if applicable) head of the rail in accordance with Caltrain Standard Drawings.

E. The crossing components shall fit snugly and have a uniform surface without sharp edges resulting from elevation change between adjacent panels, the panels and the rail, the panels and flangeway inserts, the rail and flangeway inserts, or any other combination of crossing surface components. Crossing surface that has significant elevation breaks greater than 1/4 inch between adjoining components is not acceptable.

F. Weld crossing panels together with a minimum of six 8-inch to 10-inch beads at time of installation, in accordance with Caltrain Standard Drawings. Finished grade crossings shall match grade crossing approach pavement.

G. Install end restraints and metal deflectors on each end of the crossing in accordance with Caltrain Standard Drawings. Tack-weld deflectors and end restraints to the ends of the panels. Fasten end restraints to concrete ties with tack welds. Fasten end restraints to timber ties with screw spikes.

H. Refer to Section 02720, Asphalt Paving. Place asphalt pavement at the ends of crossing panels as indicated on Caltrain Standard Drawings and the Contract Drawings.

I. Fill eye hooks for lifting panels with manufacturer's recommended epoxy. Final surface shall be smooth and flush with the panels.

J. Provide the necessary signal support. All associated signal tests shall be completed and the results accepted by the Engineer prior to placing the grade crossing in service.

K. Complete paving work at crossing approaches and related drainage, sidewalk, and other work as indicated on the Contract Documents.

3.06 REPAIR OR REPLACEMENT

A. Repair or replace any damage to the concrete panels, flangeway inserts, or other components resulting from handling and installation.

3.07 FIELD QUALITY CONTROL

A. At completion of work, prior to returning grade crossing to service, perform a road test with cars and trucks passing newly installed grade crossing panels at the speed limit to demonstrate the quality of smooth ride on the road and that concrete panels are free of "rocking" action on the crossties.

B. Perform any other tests required by the jurisdictional authority of the roadway.

END OF SECTION

SECTION 20710
FLASH BUTT RAIL WELDING

PART 1 – GENERAL

1.01 DESCRIPTION

A. Section includes specification for welding rails together to Continuous Welded Rail (CWR) strings by the electric flash butt weld process. Rail within turnouts or elsewhere as approved by the Engineer may be thermite field welds in accordance with Section 20720, Thermite Rail Welding.

B. Refer to Sections 20400, Track Construction; 20150, Rail, and 20720, Thermite Rail Welding, for additional requirements.

1.02 REFERENCE STANDARDS

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

1. Manual for Railway Engineering, Volume 1, Chapter 4, Rail

B. American Society for Testing and Materials (ASTM International):

1. E10 Test Method for Brinell Hardness of Metallic Materials
2. E94 Guide for Radiographic Examination
3. E164 Practice for Ultrasonic Contact Examination of Weldments
4. E709 Guide for Magnetic Particle Examination

C. Federal Railroad Administration (FRA):

1. CFR 49 Part 213 Track Safety Standards
2. CFR 49 Part 214, Subpart D Regulations, Roadway Maintenance Machine Safety

1.03 SUBMITTALS

A. Submit the following welding equipment and procedures to the Engineer for approval:

1. Work program and schedules for electric flash butt rail welding.
2. Working and laying out drawings, manufacturer's catalog, performance data and detailed specifications of the equipment to be used for rail welding and handling. Include lists and details of equipment or welding plant for the electric flash butt welds.
3. Welding procedure qualification.

4. Written description of welding ability, including facilities, personnel qualifications and a list of completed projects similar in scope.

5. Procedures for pulling and aligning the rail, allowances for destressing, and procedures for bolt holes.

6. Details of proposed equipment and procedure proposed for straightening welds, if required, including reference data of successful use on previous projects.

7. Proposed facility for storing CWR.

B. Submit detailed description of testing program and procedures to be performed by Inspection and Testing Agency (ITA). Submit a copy of the agreement between the Contractor and ITA at least 30 days before initiating welding operations. Refer to Section 01400, Quality Control and Assurance, for submittal of proposed ITA.

C. Submit the following reports:

1. Brush recorder charts for each electric-flash butt weld.

3. Daily summary reports of production rail welding inspection and testing.

3. Summary CWR strings.

4. Record on each CWR string installed.

1.04 QUALITY ASSURANCE

A. The agreement between Contractor and ITA shall specify the following:

1. ITA shall submit all original test results directly to the Engineer.

2. ITA shall promptly provide copies of all correspondence between ITA and the Contractor to the Engineer.

3. The agreement shall run for the duration of the Contract, except as otherwise agreed to by the Engineer.

4. Test reports to the Engineer to allow for 7 days review and appropriate action by the Engineer prior to being eligible for payment.

B. Regulatory Requirements: Perform work in accordance with CFR 49 Part 213.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Weld Owner-furnished or Contractor-furnished rail strings into CWR in accordance with this Section.

B. Provide all incidental materials required to complete the work of this Section.

PART 3 – EXECUTION

3.01 RAIL STORAGE AND HANDLING

A. Equipment and methods to handle and store CWR strings shall conform to the requirements of AREMA Manual, Chapter 5, Section 5.2.3, "Handling and Transporting Continuous Welded Rail (CWR)."

B. Do not use any methods that are likely to cause scratching, notching, rubbing, scoring, or striking of the rails.

C. Support CWR strings off the ground and space them such that the load on the supporting ground will not exceed 1,500 pounds per square foot.

D. Store CWR at locations shown on the Contract Drawings or where designated by the Engineer.

3.02 RAIL WELDING

A. Weld rail by the electric-flash butt welding process. Welding shall conform to AREMA Manual, Chapter 4, Section 3.11, Specifications for Fabrication of Continuous Welded Rail, as applicable, except as modified or appended in this Section. All production welding shall use procedures specified in this Section.

B. Each welding machine shall be equipped with a brush recorder to produce charts showing traces of electrical impulses and movable platen travel. Submit chart to the Engineer for each weld. If the chart indicates performance which is not in conformance with the approved standards, the weld will be rejected.

C. Refer to Section 01590, Temporary Facilities. Furnish all mobile electric power and utilities required.

D. CWR Strings:

1. String lengths of CWR shall be in lengths as required to install a single piece of rail meeting the length of the stage of construction or other lengths approved by the Engineer.

2. Paint string number and length with an aluminum paint on both sides of the web of the rail at each end of each string.

3. Weld rails so that Heat Number appears on the same side in each string.

4. Do not weld within 8 inches from a bolt hole.

E. Rail Straightening and Cutting Back:

1. Field align or cut back rail ends not meeting the requirements of AREMA: Chapter 4, Section 3.11, Specifications for Fabrication of CWR.

2. When rail ends cannot be straightened or cut back to achieve the required rail end tolerance, rail will be rejected.

3. Mark rejected rail and stockpile in an on-site area designated by the Engineer.

F. Cutting and Cropping of Rail:

1. Cut clean and square all rails cut prior to welding by means of rail saws or abrasive cutting disks in accordance with AREMA Manual, Chapter 4, Section 2.1, Specifications for Steel Rails. Do not torch cut rail.

2. Crop or cut rails with bolt holes or thermite welds within 2 feet of a weld at least 8 inches behind the bolt hole or thermite weld. If the rail is bent, cut back the rail an additional amount to remove the bend.

3. The small, scrap sections of cropped rail shall become the property of the Contractor and shall be disposed of off-site.

4. After cutting back the rail, slide back the next rail to make ready for the next weld or joint.

5. Close gaps generated during sliding back the next rail by installing a plug of owner-furnished rail.

6. Plugs used to fill the gaps shall be at least 15 feet in length on tangent and 30 feet in length on curved track. Similarly, no rail left in track shall deviate from this requirement.

7. Prior to placing track back into service at the end of each shift, fully spike, bolt, and anchor the rail according to the requirements in FRA Class 4 track.

G. Rail End Preparation:

1. Clean the rails free of grease, oil, dirt, scale and moisture to a minimum of 6 inches back from the rail ends, including the rail end surfaces.

2. Grind rail areas in contact with electrodes to remove mill scale and raised lettering.

3. Align the faces of the rail ends. Divide any difference in the width of the rail heads equally on both sides of the head.

4. Align vertically for a flat running surface. Any difference of height of the rail shall be made in the base.

5. Align horizontally so that any variance in width of the 2 rail heads is split equally between gauge and field side, providing the misalignment along the gauge line does not exceed 0.040 inch. Additional variance shall be apportioned to the field side of the weld.

6. Rail ends shall be square and smooth, and shall show no steel defects, dents or porosity before welding.

H. If more than 300 LF of rail is welded into CWR, destress the length so fabricated and 300 feet of rail in both directions beyond.

I. Conform to the requirements of Section 20400, Track Construction for adjusting and destressing rail in track when rail is pulled.

3.03 WELD QUALITY

A. Each weld shall have full penetration and complete fusion and shall be free of cracks.

B. Small porosity and slag inclusion which show on radiographic film will be accepted if the total area of internal defects does not exceed 0.09 square inch and the largest single defect does not exceed 0.180 inch in diameter.

3.04 WELDING PROCEDURE QUALIFICATIONS

A. Prior to beginning of production welding, make three (3) test welds on each welding machine using the same welding procedure that will be used in production welding. Each test weld shall join two (2) pieces of rail 18 inches in length.

B. Inspection of welding procedures and testing of welds shall be performed by the ITA employed by the Contractor.

C. Test each test weld radiographically with a minimum of 4 exposures: One through the head, one through the web, and one through each of the 2 flanges. Perform radiography in accordance with ASTM E142. Radiographic film shall be Type 1 or Type 2. Exposed film density shall be within the range of 1.5 to 3.8.

D. Magnetic particle test each test weld by the coil method (longitudinal magnetization) using the dry powder method in accordance with ASTM E709.

E. Ultrasonically test each test weld in accordance with ASTM E164. Use equipment capable of detecting a 3/64-inch discontinuity, 6-1/2 inches below top of rail.

F. Test each test weld for hardness in accordance with ASTM E10. Perform this test on the head of the rail in the center of the weld. The hardness of the weld shall be equal to the average Brinell hardness of the two (2) parent rails joined with a permissible variance of 20 Brinell points.

G. Acceptance will be based on the weld quality requirements stated above.

3.05 WELD NUMBERING

A. Mark a sequential weld number on the rail immediately adjacent to the weld using a quality aluminum paint marker at the time the weld is made.

B. Number welds sequentially in the order in which they are made.

C. Obtain the initial weld number from the Engineer.

D. When defective welds are replaced, assign a new sequential number to the new weld by adding a letter to the defective weld number. (e.g. defective weld 109 will be replaced by 109A)

3.06 FINISHING THE WELDS

A. Finish weld with a rail mounted profile grinder specifically designed for the work. Finishing shall conform to the following tolerances:

1. Top of rail head: Plus 0.010 inch to minus 0 inch of the parent rail section.

2. Sides of rail head: Plus or minus 0.010 inch of parent rail section.

B. Finish the balance of the rail section with a hand-held grinder as required to remove notches, protrusions, gouges, visible cracks and other defects. All grinding shall blend to the parent rail section and shall not overheat the steel. Complete heavy grinding while the steel is still hot from welding.

3.07 INSPECTION AND TESTING OF PLANT WELDING

A. The ITA shall perform and report all inspection and testing of production welding as specified herein within 24 hours of making the welds. Keep the Engineer informed regarding testing of production welds so that the Engineer may observe inspection and testing.

B. Visually and dimensionally inspect each weld to determine conformance with the alignment and finishing tolerances in AREMA Manual, Chapter 4, Section 3.11, Specifications for Fabrication of Continuous Welded Rail. Cut out and re-weld out-of-tolerance welds in accordance with this Section.

C. ITA shall magnetic particle test each weld by the coil method (longitudinal magnetization) using the dry powder method in accordance with ASTM E709. Cut out and re-weld welds giving fault indications in accordance with this Section.

D. Ultrasonically test each weld for defects in accordance with ASTM E164. Use testing equipment capable of detecting a 3/64-inch discontinuity, 6-1/2 inches below top of rail. Perform ultrasonic testing after rail has been destressed.

E. Inspect each weld using a 3-foot straightedge along the centerline of the rail and 0.625 inch below top of rail on the gauge side of the rail head. Center the straightedge over the weld; the gap between the straightedge and the rail shall comply with the requirements of AREMA Manual, Chapter 4.

F. Submit to the Engineer a daily summary of results of all testing for each weld on a form containing the following information:

1. Date and shift

2. Inspector's and welding foreman's name

3. Weld number

4. Result of magnetic particle test

5. Result of ultrasonic test

6. Note of any dimensional tolerance or other rejections

7. Certification of acceptance or rejection of weld

G. Submit a summary of CWR strings produced, including the following information:

1. String number

2. Lead Rail heat, ingot and letter

3. End Rail heat, ingot and letter

4. String length

5. String temperature at the time of measurement of length

H. For every rail string installed, record on a form provided in this Section the unique string number assigned to the string, the rail manufacturer of each individual segment of rail that makes up the string, the month and year date that each individual segment of rail was rolled, the length of each individual segment of rail that makes up the string, and the location of each numbered weld that connects each individual segment of rail in the entire string (i.e. Begin String 145, CF&I 04/96 33', Weld 1, PST 10/91 30', Weld 2 etc….End String 145). The form shall also indicate the stationing where the "Begin String" portion of the string is installed and the stationing of where the "End String" portion of the string is installed, the track number, east/west rail it was intalled on (i.e. Being String 145 Sta 1000+10, End String 1010+00, MT-1, east rail).

3.08 REPAIR OF DEFECTIVE WELDS

A. Cut out and re-weld all welds rejected during inspection or testing.

B. Crop rails 6 inches from the center of the defective weld prior to rewelding.

3.09 FIELD QUALITY CONTROL

A. The Engineer may randomly select any welds and request to be retested at any time within the period of the Contract. Replace any defective welds.

B. Prior to completion of welding operation, visually inspect all welds to verify the base riser break off area has been smoothed. Smooth areas which have not been smoothed.

3.10 CLEAN UP

A. Inspect areas where welding operation performed. Collect and dispose any remaining scrap sections of cropped rail daily after completion of welding operation.

ATTACHMENT FOLLOWS

ATTACHMENT 20710
RECORD OF WELD

INSTALLATION _____ WELDER'S NAME _____ WELD NUMBER _____

FINAL INSTALLED LOCATION _____ TRACK _____ RAIL WEIGHT _____ RAILROAD STATIONING _____ RAIL L. R. (Circle) FACING UPSTATION

DATE _____ TIME _____ AM PM (Circle) COMPLETE WELD (YES/NO) circle one

AIR TEMPERATURE _____ ^{O}F. WEATHER _____

RAIL TEMPERATURE _____ ^{O}F.

WELD KIT MANUFACTURER _____ WELD INGOT #

RAIL GAP (NEAREST 1/16 INCH) _____ RAIL CUT REQUIRED? YES NO (Circle)

BACK RAIL

MANUFACTURER _____ RELAY RAIL? YES NO (Circle)

YEAR/MONTH ROLLED _____ HEAT NUMBER

AHEAD RAIL

MANUFACTURER _____ RELAY RAIL? YES NO (Circle)

YEAR/MONTH ROLLED _____ HEAT NUMBER _____

REMARKS _____

_____

_____

ULTRASONIC TEST DATE AND RESULTS

KIT MFG. REPRESENTATIVE PRESENT _____ (Initial) WELDING FOREMAN _____ (Signed)

PCJPB'S

REPRESENTATIVE PRESENT _____ (Initial) RECORDER _____ (Signed)

END OF SECTION

SECTION 20720

THERMITE RAIL WELDING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Section includes specifications for welding rails together by the Thermite process at the project site for the purpose of joining rail strings and for other in-track welds.

B. Refer to Section 20400, Track Construction; Section 20150, Rail, and Section 20710, Flash Butt Rail Welding, for additional requirements for thermite welds.

1.02 REFERENCE STANDARDS

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

1. Manual for Railway Engineering (Manual), Volume 1, Chapter 4, Rail

B. American Society for Testing and Materials (ASTM International):

1. E164 Standard Practice for Ultrasonic Contact Examination of Weldments

2. E709 Standard Guide for Magnetic Particle Examination

C. Federal Railroad Administration (FRA):

1. CFR 49 Part 213 - Track Safety Standards

1.03 SUBMITTALS

A. Submit detailed procedure specification of the step-by-step methods to be employed in making the welds for Engineer's approval. Include complete description of each of the following items, as applicable:

1. Manufacturer's trade name for the welding process.

2. Method used for cutting and cleaning the rail ends. Refer to Section 20400, Track Construction, for allowable means of cutting rail.

3. Minimum and maximum allowable gap between rail ends prior to welding.

4. Methods used for cleaning multiple-use crucibles and removing moisture, and the procedures for tracking the number of welds made. If single-use crucibles are used, the above mentioned procedure will not be required.

5. Method used for preheating, including time and temperature.

6. Method used for removing the upset metal and finishing the weld to the final contour, including a description of special tools and equipment.

7. Quality control procedures to be followed.

B. Submit welder qualifications and certification from weld-kit manufacturer for Engineer's approval.

1.04 DELIVERABLES

A. Prepare welding testing record in a form acceptable to the Engineer. Submit signed original form to the Engineer within 14 days of completion of the weld testing.

B. Submit a weld record for each weld indicating weld number, location, rail temperature, date and time of weld, and name of welder within 72 hours of completing the weld.

1.05 QUALITY ASSURANCE

A. Perform welding under the direct supervision of an experienced welding supervisor or foreman. Welding supervisors and foremen shall be familiar with FRA parts 213.119, 213.305, 213.341 and 213.343.

B. Welders shall be certified by weld kit manufacturer

C. Verify that weld kits have not expired.

D. Test weld prior to allowing revenue train traffic over.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Handle weld kits with care from receipt to installation to ensure high quality welds.

B. Identify weld kits by brand name in the original Manufacturer's container. Store weld kits in a moisture-proof container.

C. Use weld kits prior to the expiration date. Remove expired weld kits from Owner's property.

PART 2 - PRODUCTS

2.01 RAIL WELDING KITS

A. The following rail welding kits are approved.

1. Calorite, limited or standard preheat, by Calorite Inc.

2. Boutet, distributed by Esco.

3. Orgo-Thermit, by Orgo-Thermit, Inc.

PART 3 - EXECUTION

3.01 GENERAL

A. Perform welding in accordance with the requirements of the AREMA Manual, Chapter 4, Section 3.13, Specification for the Quality Assurance of Thermite Welding of Rail and Section 3.11, Specifications for Fabrication of Continuous Welded Rail, except as modified or amended by this Section.

B. Weld second hand rail according to the requirements of the AREMA Manual, Chapter 4, Section 3.12, Inspection and Classification of Secondhand Rail for Welding, for Class 1 Rail.

C. Position weld in the crib between two ties. Do not place weld on a tie. Field welds are not permitted in road crossings.

D. Weld compromise joints using in track thermite welds for compromise joints.

E. Do not weld in rain, or other inclement weather without adequate protection from the elements.

3.02 END PREPARATION

A. Clean the rails to be welded of grease, oil, dirt, loose scale, and moisture to a minimum of 6 inches back from the rail ends, including the railhead surface. Use a wire brush to completely remove dirt and loose oxide, and use oxygen-acetylene torch to remove grease, oil and moisture.

B. Align the rail ends using a rail beam specifically designed for this purpose or a 36-inch straight edge.

C. Use a power grinder with an abrasive wheel to remove scale, rust, burrs, lipped metal and mill brands which would interfere with the fit of the mold for two (2) inches on each side of the ends. Rail ends shall show no steel defects, dents, or porosity before welding.

D. Cut rail square using approved rail saws.

E. Field welds shall be no closer than 8 inches from any existing bolt hole.

3.03 GAP

A. The minimum and maximum spacing between rail ends shall be as specified by the rail welding kit manufacturer and the approved procedure specification. Wide gap welds will not be permitted unless approved by the Engineer.

3.04 ALIGNMENT

A. Properly gap and align the ends of the rails to be welded to produce a weld which shall conform to the alignment tolerances below. Hold the rail gap and alignment without change during the complete welding cycle.

1. Alignment of rail shall be done on the head, web, and base 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 side.

4. Maximum horizontal offsets: 1/25 inches in the head and/or 1/8 inches in the base.

5. Surface Misalignment Tolerances:

   a. Maximum combined vertical offset and crown camber: 1/25 inches per foot at 600 degrees F.

   b. Maximum combined vertical offset and dip camber: 1/10 inches per foot at 600 degrees F.

6. Gage Misalignment Tolerance: Maximum combined horizontal offset and horizontal kink camber is 1/25 inches per foot at 600 degrees F.

3.05 THERMITE WELD PREHEATING

A. Preheat the rail ends prior to welding to the temperature and for the time specified in the approved welding procedure specification to ensure full fusion of the weld metal to the rail ends without cracking of the rail or weld. Engineer will reject welds that were made without the rail first properly preheated in accordance with the manufacturer's recommendations.

3.06 THERMITE WELD COOLING

A. Leave the molds in place, after tapping for a sufficient time to permit complete solidification of the molten metal, in order to allow proper slow cooling in order to prevent cracking and to provide a complete weld with proper hardness and ductility.

3.07 WELD FINISHING AND TOLERANCES

A. Bring welded joints in the finished track to a true surface and align by means of an approved grinding or planning machine (shear). Use a hand grinder for the final smoothing and for areas not accessible to a track grinder. Perform finish grinding with an approved grinder operated by a skilled workman. Take care to grind evenly and leave the joints in a satisfactory condition. Finishing shall eliminate all cracks. Complete the completed weld by mechanically controlled grinding in conformance with the following requirements:

1. Tolerances: A finishing deviation of not more than plus or minus 1/100 inches of parent section of the rail will be allowed.

2. Welds produced by welding kits which are specially designed to produce reinforced welds need not be ground in the fishing area except as necessary to remove fins, burrs, cracks, etc.

3.08 WELD QUALITY

A. Each completed weld shall have full penetration and complete fusion and be entirely free of cracks or fissures.

3.09 WELD NUMBERING

A. Semi-permanently mark a sequential weld number, rail temperature, and date on the rail immediately adjacent to the weld using a quality paint marker at the time the weld is made.

B. Number the welds sequentially in the order in which they are made.

C. Obtain the initial weld number from the Engineer.

D. When defective welds are replaced, assign a new sequential number by adding a letter to the defective weld number (e.g. defective weld 109 would be replaced by 109A).

3.10 FIELD QUALITY CONTROL AND TESTING

A. Visually inspect all welds at the time of welding and during the grinding operation.

B. Prior to completion of welding operation, visually inspect all welds to verify the base riser break off area has been smoothed.

C. Visually inspect and check welds in accordance with approved procedures to ensure there are no surface defects such as cracks and to verify that the welds conform to the alignment and finishing tolerances specified in this Section.

D. Each completed field weld shall be marked with the date, name of welder, air temperature, and rail temperature or with date, name, and "free weld" for welds not used to control CWR thermal adjustment.

E. Verify that each completed weld has full penetration and complete fusion and is entirely free of cracks or fissures.

F. Perform the following tests on all welds. All testing shall be performed by a qualified Independent Testing Agency (ITA) hired by the Contractor. Refer to Section 01400, Quality Control and Assurance. The testing agency shall provide test results directly to the Engineer.

1. Ultrasonic testing shall be performed after the weld has been ground and finished to specified tolerances. Ultrasonic testing shall be

performed in accordance with ASTM E164. Equipment used shall be capable of detecting a 3/64-inch discontinuity, 6-1/2 inches below the top of rail.

G. The weld quality, finishing and alignment requirements specified in this Section shall also apply as requirements of acceptance.

H. Perform testing of welds in active tracks within 96 hours after placing the track back in service. Perform testing of welds in other tracks prior to placing the track in service. Replace unacceptable welds in accordance the requirements of this Section.

I. The Engineer may randomly select any welds to be retested at any time within the period of the Contract. Such testing shall be performed by Contractor-hired ITA.

3.11 REPLACEMENT OF DEFECTIVE WELDS

A. Welds made outside of the track which the Engineer determines to be unacceptable prior to rail installation shall be cut out, rails pulled together to the indicated rail gap, and re-welded.

B. Cut unacceptable welds and replace with a section of rail and 2 new welds. The minimum length of the new rail used shall be 15 feet.

C. Saw cuts shall be made at least 6 inches from the centerline of the faulty weld. In-track welds shall be made in accordance with the requirements specified in this Section.

D. Ultrasonically test the replacement welds as specified in this Section.

E. Install joint bars on defective welds in active track immediately upon completion of testing, and under no circumstances later than 8 hours after testing in accordance with Section 20120, Track Appurtenances and Other Track Material, and comply with FRA Standards Part 213.

3.12 CLEAN UP

A. Inspect areas where welding operation performed. Collect and dispose any remaining scrap sections of cropped rail daily after completion of welding operation.

ATTACHMENT FOLLOWS

ATTACHMENT 20720
RECORD OF FIELD WELD

INSTALLATION _____ WELDER'S NAME _____ WELD NUMBER_____

FINAL INSTALLED LOCATION _____TRACK _____RAIL WEIGHT_____ RAILROAD STATIONING_____ RAIL L. R. (Circle) FACING UPSTATION

DATE _____ TIME _____ AM PM (Circle) COMPLETE WELD (YES/NO) circle one

AIR TEMPERATURE _____ ^{O}F. WEATHER _____

RAIL TEMPERATURE _____ ^{O}F. PRE-HEAT TIME _____

WELD KIT MANUFACTURER _____ WELD INGOT #

RAIL GAP (NEAREST 1/16 INCH) _____ RAIL CUT REQUIRED? YES NO (Circle)

BACK RAIL

MANUFACTURER _____ RELAY RAIL? YES NO (Circle)

YEAR/MONTH ROLLED _____ HEAT NUMBER

AHEAD RAIL

MANUFACTURER _____ RELAY RAIL? YES NO (Circle)

YEAR/MONTH ROLLED _____ HEAT NUMBER _____

REMARKS _____

_____

_____

ULTRASONIC TEST DATE AND RESULTS

KIT MFG. REPRESENTATIVE PRESENT _____ WELDING FOREMAN _____

(Initial) (Signed)

PCJPB'S

REPRESENTATIVE PRESENT _____ RECORDER _____

(Initial) (Signed)

END OF ATTACHMENT

END OF SECTION