

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 Elastometric 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 segregated 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