



REQUEST FOR QUOTATION

Contact person/Telephone
Tara Bugg/201-395-5236

Collective# 0000031914 Bid Due Date 01/31/2013
Bids must be received no later than 11:00 AM on the above Bid Due Date.

Deliver Goods/Services To:
Howland Hook
300 Western Avenue
Staten Island NY 10303

Quantity	Description	Unit Price		Total
	<p>TRACK TURNOUTS</p> <p>MANUFACTURE AND DELIVER TWO (2) RAILROAD TURNOUTS IN ACCORDANCE WITH THE PORT AUTHORITY OF NY & NJ DRAWING #SK01, DRAWING #SK02 AND SPECIFICATION, "DIVISION 2 SECTION 02455 CONCRETE SWITCH TIES".</p> <p>**PLEASE QUOTE ONLY FULLY DELIVERED PRICES.**</p> <p>LEAD TIME: _____</p> <p>A price preference of 10 % is available for NY/NJ Minority and Women Business Enterprises (M/WBE) or 5% for NY/NJ Small Business Enterprises (SBE) certified by the Port Authority (PA) by the day before bid opening for awards not exceeding \$1,000,000. My firm was certified as a _____ on _____.</p> <p>PLEASE MAIL BIDS TO: PORT AUTHORITY OF NY AND NJ PROCUREMENT DEPT, COMMODITIES & SERVICES DIVISION 2 MONTGOMERY STREET, 3RD FLOOR JERSEY CITY, NJ 07302</p>			
		PAYMENT TERMS		
	PLEASE QUOTE FULLY DELIVERED PRICES	Total Delivered Price		

This Quotation is subject to the terms and conditions set forth on the back page hereof. Bidder is advised to read these before signing.

We have read the instructions and, if favored with an order, we agree to furnish the items enumerated herein at the prices and under the conditions indicated.

Signed _____
Firm Name _____
Telephone number _____ Date _____
Fax Number _____
Federal Taxpayer ID _____

Bidder
Must
Sign
In
Two
Places

NOTICE TO BIDDERS: Unless the following term of assurance that the above offer is irrevocable is signed, the offer submitted herein shall not be deemed to be complete.

The foregoing offer shall be irrevocable for 90 days after the date on which the Port Authority of New York and New Jersey opens this proposal.

Signed _____ Date _____
Firm Name _____



REQUEST FOR QUOTATION

Bid Due Date
01/31/2013

Quantity	Description	Unit Price	Total
	<p>This is a Formal Bid Invitation Mail Sealed Bids to:</p> <p>The Port Authority of NY & NJ Attn: Bid Custodian Procurement Department 2 Montgomery Street, 3rd Floor Jersey City, NJ 07302</p> <p>by the date and time listed above, where it will be publicly opened and read.</p> <p>Bids are only accepted Monday through Friday, excluding Port Authority holidays, between the hours of 8 A.M. & 5 P.M., via regular mail, express delivery service or hand delivery.</p> <p>If you do not use or have an envelope provided, you must clearly mark the outside envelope/package with 'BID ENCLOSED' and show the company name, address, as well as Bid number and Due date as stated on this bid document.</p> <p>A valid photo id is required to gain access into the building, to attend the bid opening or hand deliver a bid.</p>		
2 EA	<p>purchase turnouts/incd. dlrvy.</p>		
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Firm Name _____

TERMS AND CONDITIONS

1. The Port Authority (PA) reserves the right to request information relating to seller's responsibility, experience and capability to perform the work.
2. Unless otherwise provided, complete shipment of all items must be in one delivery FOB delivery point. Payment will not be made on partial deliveries unless authorized in advance by the party to be charged and the discount, if any, will be taken on the total order.
3. PA payment terms are net 30 days. Cash discounts for prompt payment of invoices may be taken but will not be considered in determining award, except in the case of tie bids.
4. Separate unit and total FOB delivered prices must be shown.
5. Sales to the PA and to PATH are currently exempt from New York and New Jersey State and local taxes and generally from federal taxation. The seller certifies that there are no federal, state, municipal or any other taxes included in the prices shown hereon.
6. The PA shall have the absolute right to reject any or all proposals or to accept any proposal in whole or part and to waive defects in proposals.
7. Unless the phrase "no substitute" is indicated, bidder may offer alternate manufacturer / brands, which shall be subject to Port Authority approval. Please indicate details of product being offered with bid.
8. Acceptance of seller's offer will be only by Purchase Order Form signed by the PA. No change shall be made in the agreement except in writing.
9. If the seller fails to perform in accordance with the terms of this purchase order, the PA may obtain the goods or services from another contractor and charge the seller the difference in price, if any, a reletting cost of \$100, plus any other damages to the PA.
10. Upon request, sellers are encouraged to extend the terms and conditions of any terms agreement with the PA to other government and quasi-government entities by separate agreement.
11. By signing this quotation or bid, the seller certifies to all statements on Form PA 3764A regarding non-collusive bidding; compliance with the PA Code of Ethics; and the existence of investigations, indictments, convictions, suspensions, terminations, debarments and other stated occurrences to assist the PA in determining whether there are integrity issues which would prevent award of the contract to the seller. The PA has adopted a policy set forth in full on PA 3764A, that it will honor a determination by an agency of the State of New York or New Jersey that a bidder is not eligible to bid on or be awarded public contracts because the bidder has been determined to have engaged in illegal or dishonest conduct or to have violated prevailing wage legislation. The Terms and Conditions of PA 3764A apply to this order. A copy can be obtained by calling (201) 395-3405 or at <http://www.panynj.gov/business-opportunities/become-vendor.html>
12. The vendor may subcontract the services or use a supplier for the furnishing of materials required hereunder to such persons or entities as the Manager, Purchasing Services may from time to time expressly approve in writing. All further subcontracting shall also be subject to such approval.
13. The successful bidder (vendor) shall not issue nor permit to be issued any press release, advertisement, or literature of any kind, which refers to the Port Authority or that goods will be, are being or have been provided to it and/or that services will be, are being or have been performed for it in connection with this Agreement, unless the vendor first obtains the written approval of the Port Authority. Such approval may be withheld if for any reason the Port Authority believes that the publication of such information would be harmful to the public interest or is in any way undesirable.

CHIEF TIE ENGINEER

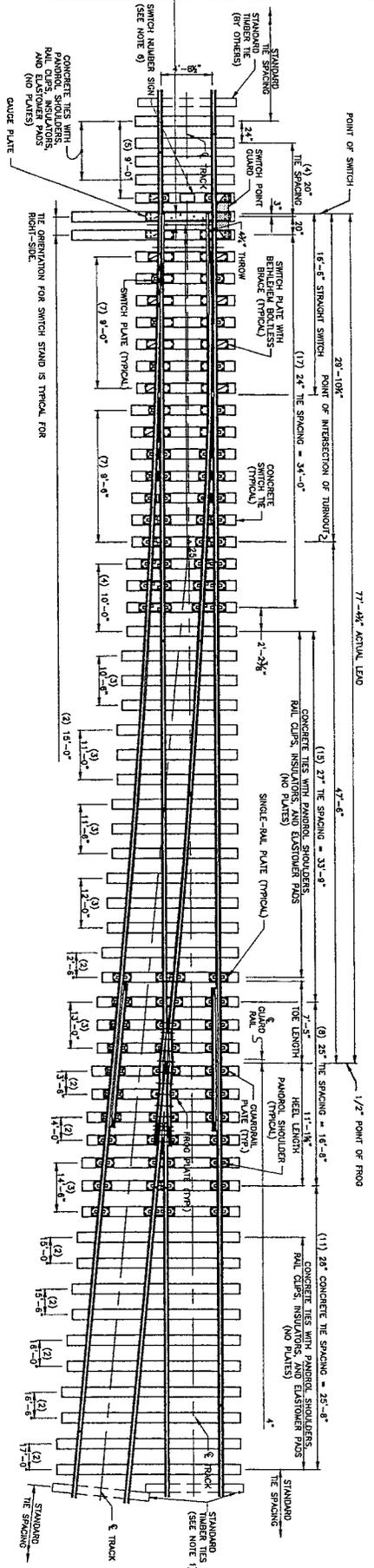
No.	Date	Revision	Approved

ENGINEERING DEPARTMENT
HOWLAND HOOK
MARINE
TERMINAL

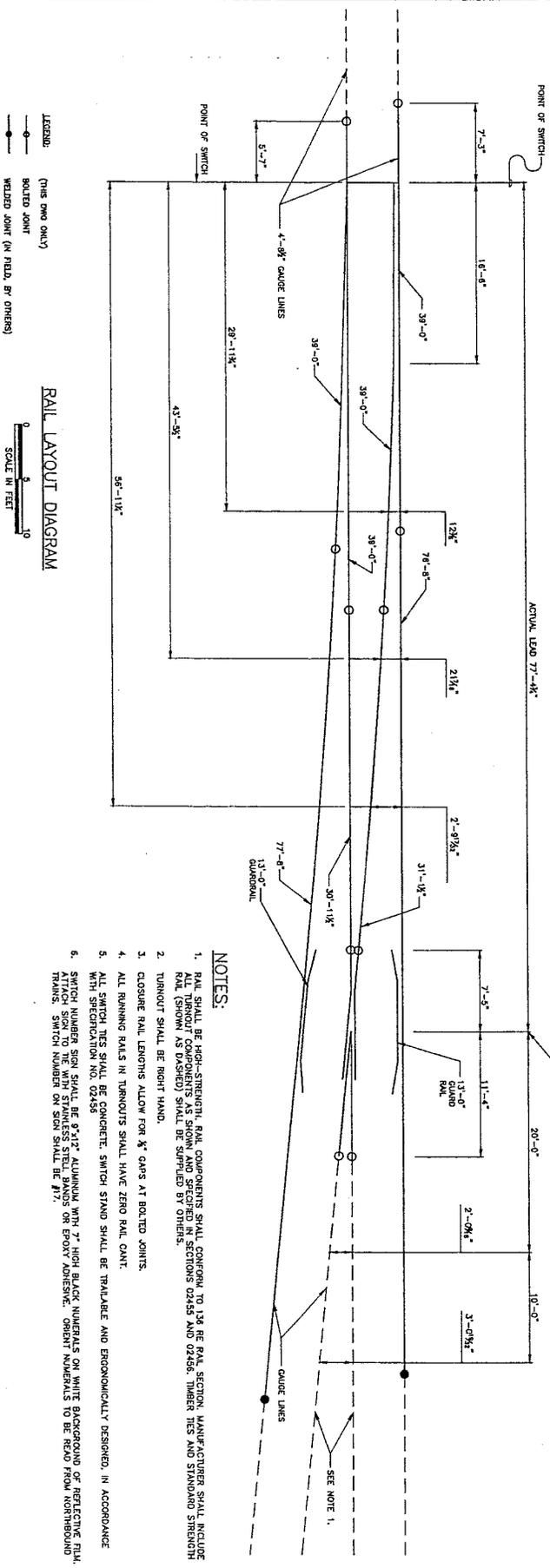
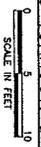
CIVIL
 TITLE
NO. 10 TURNOUT WITH
CONCRETE TIES

DESIGNED BY: **K. RUMWISSE**
 DRAWN BY: **J. GILBERT**
 CHECKED BY: **J. GILBERT**
 DATE: **10/29/2012**

PO# **SK01**
 701 12/18/2012



NO. 10 TURNOUT, BALLASTED



- NOTES:**
1. RAIL SHALL BE HIGH-STRENGTH, RAIL COMPONENTS SHALL CONFORM TO 134 RE RAIL SECTION MANUFACTURER SHALL INCLUDE RAIL TURNOUT AS DESIGNED. ALL SECTIONS 02455 AND 02456, TIMBER TIES AND STAIRWAY STRUTS SHALL BE SUPPLIED BY OTHERS.
 2. TURNOUT SHALL BE RIGHT HAND.
 3. CLOSURE RAIL LENGTHS ALLOW FOR 1/2" GAPS AT BOLTED JOINTS.
 4. ALL RUNNING RAILS IN TURNOUTS SHALL HAVE ZERO RAIL GANT.
 5. ALL SWITCH TIES SHALL BE CONCRETE. SWITCH STAND SHALL BE TRAILABLE AND ERGONOMICALLY DESIGNED, IN ACCORDANCE WITH SPECIFICATION NO. 02355.
 6. SWITCH NUMBER SIGN SHALL BE 6"x12" ALUMINUM WITH 7" HIGH BLACK NUMERALS ON WHITE BACKGROUND OR REFLECTIVE RAIL TRANS. SWITCH NUMBER ON SIGN SHALL BE #17.

LEGEND
 —●— THIS DRAWING ONLY
 —○— BOLTED JOINT
 - - - - - WELDED JOINT (ON FIELD, BY OTHERS)

RAIL LAYOUT DIAGRAM



DIVISION 2
SECTION 02455
CONCRETE SWITCH TIES

PART 1. GENERAL

1.01 DESCRIPTION:

- A. This Section includes specifications for the design, testing, manufacture, shipping, delivery and stacking of monoblock, pretensioned, prestressed concrete switch ties, including rail fasteners, rail seat pads, insulators, rail clips, plate assemblies, and related appurtenances.

1.02 REFERENCES:

- A. The following is a listing of the publications and standards referenced in this Section, of which the latest edition shall govern:
1. American Association of State Highway and Transportation Officials (AASHTO)
T26 Quality of Water to be Used in Concrete
 2. American Concrete Institute (ACI)
318 Building Code Requirements for Reinforced Concrete
22R Protection of Metals in Concrete Against Corrosion
 3. American Railway Engineering and Maintenance-of-Way Association (AREMA)
Manual for Railway Engineering
 4. American Society for Testing and Materials (ASTM)
A153 Zinc Coating (Hot-Dip) on Iron and Steel Hardware
A325 Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum
Tensile Strength
A536 Ductile Iron Castings
A881 Steel Wire, Deformed, Stress-Relieved or Low Relaxation for
Prestressed Concrete Railroad Ties
A886 Steel Strand, Indented, Seven-wire, Stress-Relieved for
Prestressed Concrete
C31 Making and Curing Concrete Test Specimens in the Field
C33 Concrete Aggregates
C39 Compressive Strength of Cylindrical Concrete Specimens
C109 Compressive Strength of Hydraulic Cement Mortar (Using 2"
Cube Specimens).
C114 Chemical Analysis of Hydraulic Cement
C143 Slump of Portland Cement Concrete

- C150 Portland Cement
- C157 Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete
- C191 Time of Setting of Hydraulic Cement by Vicat Needle
- C204 Fineness of Portland Cement by Air Permeability Apparatus
- C227 Potential Alkali Reactivity of Cement-Aggregate Combinations
- C359 Early Stiffening of Portland Cement (Mortar Method)
- C430 Fineness of Hydraulic Cement by the No. 325 Sieve.
- C260 Air-Entraining Admixtures for Concrete
- C295 Petrographic Examination of Aggregates for Concrete
- C494 Chemical Admixtures for Concrete
- C586 Potential Alkali Reactivity of Carbonate Rocks for Concrete Aggregates (Rock Cylinder Method)
- C779 Abrasion Resistance of Horizontal Concrete Surfaces
- C1260 Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
- D257 D-C Resistance of Conductance of Insulating Materials
- D395 Rubber Property – Compression Set
- D412 Vulcanized Rubber and Thermoplastic Elastomers - Tension
- D471 Rubber Property – Effect of Liquids
- D512 Chloride Ion in Water
- D573 Rubber – Deterioration in an Air Oven
- D570 Water Absorption of Plastics
- D573 Rubber-Deterioration in an Air Oven
- D638 Tensile Properties of Plastics
- D732 Shear Strength of Plastics by Punch Tool
- D785 Rockwell Hardness of Plastics and Insulating Materials
- D1229 Rubber Property – Compression Set at Low Temperatures

1.03 DESIGN CRITERIA:

- A. Design of concrete switch ties shall be in accordance with the AREMA Manual for Railway Engineering - Volume 1, Chapter 30, Part 4 – “Concrete Ties,” except as modified herein.
- B. One concrete cross-section and pre-stressing design shall be used for all concrete switch ties.
- C. Concrete switch ties shall be designed for installation under special trackwork with the following general characteristics:
 - 1. Rails: 136RE
 - 2. Uncanted rail placement.

3. Design concrete switch ties to match special trackwork design specified in Section entitled "SPECIAL TRACKWORK" and SK01 and SK02. Coordinate the design of the ties with the manufacturer of the special trackwork to ensure that the design is in accordance with the approved special trackwork shop drawings.
- D. Concrete switch tie design shall comply with AREMA Manual, Volume 1, Chapter 30, Section 4.13 – "Ties for Turnouts", except as specified herein. Tie orientation in turnouts shall be at right angles to the straight track. At the center portions of single crossovers, long ties that span under all the tracks shall be used. At Contractor's option, the spacing of switch ties shown on Sk01 and SK02 may be revised with the approval of the Engineer, upon submittal by Contractor of proposed alternate spacing and written explanation of the advantages of the alternate spacing in lieu of the indicated spacing.
- E. The factored design bending moments (M) that are used for design and testing shall be as follows:
 1. Positive moment at center of rail seat: 380 inch-kips.
 2. Negative moment at center of rail seat: 290 inch-kips.
 3. Positive moment at center of tie: 380 inch-kips
 4. Negative moment at center of tie: 290 inch-kips.
- F. Concrete switch ties shall be prestressed, pretensioned monoblock concrete ties.
- G. Concrete switch ties shall be suitable for use in areas subject to freeze/thaw cycles.
- H. Provide plate insulating pads under all special trackwork plates and provided rail seat pad at all other rail support locations.

1.04 SHIPPING AND HANDLING:

- A. Securely brace ties for shipment to prevent any movement that could cause damage. Ship ties in a horizontal position, braced with wooden spacer blocks so that the top surface of cast-in-place hardware does not contact ties loaded above. Limit the height of stacks of ties so that the lower ties and spacer blocks are not damaged. Do not drop or skid ties. Damaged ties will be rejected.

1.05 QUALITY CONTROL:

- A. Design tests specified in Paragraph 1.06 herein may be certified by test results on identical design and material from a qualified independent testing firm or individual, but will be subject to the submittal and approval of a test report including all relevant test results. The test loads may be the same as or higher than the specified loads. In cyclic loading tests, the load variation shall not be reduced.
- B. Control tests listed in Paragraph 3.02 herein must be performed and certified. Testing shall be performed at the manufacturer's plant or at an independent laboratory.
- C. Arrange for the tie manufacturer to employ an ACI Level I Field Technician to perform Quality Control concrete testing. Verify that the fabrication plant's concrete laboratory or independent testing laboratory is accredited by a recognized organization such as AASHTO, PCI or ACI. Submit a production schedule to the Authority 15 days prior to fabrication.

1.06 DESIGN TESTS:

- A. After shop drawings, structural design calculations, and concrete design mix for concrete switch ties and associated components have been approved, conduct the design tests on rail seat pads, plate insulating pads, and concrete switch ties.
- B. List of Design Tests:
 - 1. Design tests of rail seat pads.
 - 2. Design tests of plate insulating pads.
 - 3. Design tests of concrete switch ties.
- C. Do not start production of plate insulating pads and concrete switch ties until the design tests for these items have been passed to the satisfaction of the Authority.
- D. Design Tests of Rail Seat Pads:
 - 1. Specimens: Conduct the following tests on each of two pad specimens. The specimens shall be manufactured and cured in the same manner as the final product. Use a separate pair of specimens for each test, except as specified for the accelerated aging test. Prior to testing, condition all specimens for at least seven days at 23 degrees Celsius and 50 percent humidity. Failure of either of the two specimens to meet the specified requirements shall be cause for rejection.
 - 2. Tensile Strength:
 - a. Test Method: ASTM D412, Method A
 - b. Acceptance Criteria: 1500 psi, minimum.
 - 3. Ultimate Elongation:
 - a. Test Method: ASTM D412
 - b. Acceptance Criteria: 250 percent minimum.
 - 4. High Temperature Compression Set:
 - a. Test Method: ASTM D395, Method B, with a Type 2 specimen. Test for 22 hours at 100 degrees Celsius.
 - b. Acceptance Criteria: 25 percent maximum.
 - 5. Low Temperature Compression Set:
 - a. Test Method: ASTM D1229. Test for 22 hours at minus 18 degrees Celsius.
 - b. Acceptance Criteria: The compression set at 30 minutes after release (t30 reading) shall not exceed 40 percent.
 - 6. Accelerated Aging:
 - a. Test Method: ASTM D573. Age the elastomer for 48 hours at 100 degrees Celsius. Measure and record the change in tensile strength, and ultimate elongation.
 - b. Acceptance Criteria: After aging, the tensile strength shall not decrease more than 15 percent. The ultimate elongation after aging shall be at least 200 percent and shall be at least 60 percent of the result before aging.
 - 7. Water Absorption:
 - a. Test Method: ASTM D471. Test for 70 hours at 100 degrees Celsius in distilled water.
 - b. Acceptance Criteria: The volume change shall be between zero percent and plus 35 percent.

8. Volume Resistivity:
 - a. Test Method: ASTM D257. Apply 100 volts direct current for three minutes.
 - b. Acceptance Criteria: 1×10^9 ohm-centimeters, minimum
- E. Design Tests of Plate Insulating Pads:
 1. Specimens: Conduct the following tests on each of two pad specimens. The specimens shall be manufactured and cured in the same manner as the final product. Use a separate pair of specimens for each test, except as specified for the accelerated aging test. Prior to testing, condition all specimens for at least seven days at 23 degrees Celsius and 50 percent humidity. Failure of either of the two specimens to meet the specified requirements shall be cause for rejection.
 2. Tensile Strength:
 - a. Test Method: ASTM D412, Method A
 - b. Acceptance Criteria: 1500 psi, minimum.
 3. Ultimate Elongation:
 - a. Test Method: ASTM D412
 - b. Acceptance Criteria: 250 percent minimum.
 4. High Temperature Compression Set:
 - a. Test Method: ASTM D395, Method B, with a Type 2 specimen. Test for 22 hours at 70 degrees Celsius.
 - b. Acceptance Criteria: 25 percent maximum.
 5. Low Temperature Compression Set:
 - a. Test Method: ASTM D1229. Test for 22 hours at minus 18 degrees Celsius.
 - b. Acceptance Criteria: The compression set at 30 minutes after release (t_{30} reading) shall not exceed 40 percent.
 6. Accelerated Aging:
 - a. Test Method: ASTM D573. Age the elastomer for 48 hours at 100 degrees Celsius. Measure and record the change in tensile strength, and ultimate elongation.
 - b. Acceptance Criteria: After aging, the tensile strength shall not decrease more than 15 percent. The ultimate elongation after aging shall be at least 200 percent and shall be at least 60 percent of the result before aging.
 7. Water Absorption:
 - a. Test Method: ASTM D471. Test for 70 hours at 100 degrees Celsius in distilled water.
 - b. Acceptance Criteria: The volume change shall not be between zero percent and plus 35 percent.
 8. Volume Resistivity:
 - a. Test Method: ASTM D257. Apply 100 volts direct current for three minutes.
 - b. Acceptance Criteria: 1×10^9 ohm-centimeters, minimum

F. Design Tests of Concrete Switch Ties:

1. After all shop drawings are approved and rail seat pads and plate insulating pads have successfully completed design testing, produce a lot of at least 10 concrete switch ties conforming to the shop drawings and these Specifications. The Authority will select four of these ties for laboratory testing. For design testing of fasteners, furnish a section of tie or an equivalent prestressed concrete block with rail seat and rail fastener identical to the ties furnished for testing.
2. Measure and examine the tie block and each of the four ties submitted for testing to verify compliance with the size and condition requirements. Record results of measurements and analysis. Upon satisfactory completion of this examination, subject the tie block and two of the ties, which shall be known as Tie Nos. 1 and 2, to performance tests. Retain the remaining two ties, which shall be known as Tie Nos. 3 and 4, for further test use and as a control for dimensional tolerances and surface appearance of ties subsequently manufactured.
3. Sequence of design tests on Tie No. 1:
 - a. Rail seat vertical load tests, described in Paragraph 1.06.F.6. Perform test on one of the outer rail seats, hereinafter designated Rail Seat A.
 - b. Center negative bending moment test, described in Paragraph 1.06.F.8.
 - c. Center positive bending moment test, described in Paragraph 1.06.F.9.
 - d. Rail seat vertical load test, described in Paragraph 1.06.F.6. Perform tests on the other outer rail seat, hereinafter designated Rail Seat B.
 - e. Rail seat repeated load test, described in Paragraph 1.06.F.7. Perform test on Rail Seat B.
 - f. Bond development, tendon anchorage, and ultimate load test, described in Paragraph 1.06.F.10. Perform test on Rail Seat A.
4. Sequence of Design Tests on Tie No. 2:
 - a. Rail clip shoulder and special trackwork plate anchor insert tests, described in Paragraph 1.06.F.11. Perform tests on all shoulders and inserts.
 - b. Rail fastener uplift test, described in Paragraph 1.06.F.12. Perform test on one rail seat.
 - c. Electrical impedance test, described in Paragraph 1.06.F.16.
5. Sequence of Design Tests on Tie Block:
 - a. Rail seat pad spring rate test, described in Paragraph 1.06.F.17. Conduct the test on three pads. Use the two pads providing the highest and lowest spring rate values for the following seven tests.
 - b. Rail fastener uplift test, part 1, described in Paragraph 1.06.F.12.a.
 - c. Rail fastener longitudinal restraint test, described in Paragraph 1.06.F.14.
 - d. Rail fastener repeated load test, described in Paragraph 1.06.F.13.
 - e. Rail fastener longitudinal restraint test, described in Paragraph 1.06.F.14.
 - f. Rail fastener uplift test, part 2, described in Paragraph 1.06.F.12.b.
 - g. Rail fastener lateral restraint test, described in Paragraph 1.06.F.15.
 - h. Rail seat pad spring rate test, described in Paragraph 1.06.F.17.

6. Rail Seat Vertical Load Tests: With the tie supported and loaded as shown in AREMA Manual, Chapter 30, Figure 30-4-7, apply a load increasing at a rate of not greater than five kips per minute until the load P required to obtain a negative rail seat moment of 290 inch-kips is obtained. Hold this load for at least three minutes. During this period, inspect to determine if structural cracking occurs. A structural crack is a crack originating in the tensile face of the tie, extending to the outermost level of prestressing tendons and which increases in size under application of increasing load. In like manner, support and load the tie as shown in AREMA Manual, Chapter 30, Figure 30-4-8 until the load P required to obtain a positive rail seat moment of 380 inch-kips is obtained. Use an illuminated 5-power magnifying glass to locate cracks. If structural cracking does not occur, the requirements of each portion of this test will have been met. Other material may be substituted for the rubber supports shown, by agreement with the Authority.
7. Rail Seat Repeated Load Test: Following the vertical load test on Rail Seat B, increase the load at a rate of at least five kips per minute until the tie is cracked from its bottom surface up to the level of the lower level of reinforcement. Remove the load and substitute one-inch thick plywood strips for all the rubber supports shown in AREMA Manual, Chapter 30, Figure 30-4-8. Each plywood strip shall be of the same width and length as the rubber support it replaces. Then subject the tie to three million cycles of repeated loading with each cycle varying uniformly from 4 kips to 1.1 P, with P as the load required to obtain a positive rail seat moment of 380 inch-kips per AREMA Manual, Chapter 30, Figure 30-4-8. Do not apply the loading faster than 600 cycles per minute. If, after the application of three million cycles, the tie can support the rail seat load (1.1 P), the requirements of this test will have been met.
8. Center Negative Bending Moment Test: With the tie supported and loaded as shown in AREMA Manual, Chapter 30, Figure 30-4-9, apply a load increasing at a rate not greater than five kips per minute until the load P required to obtain a negative moment of 290 inch-kips at the center of the tie is obtained. Hold this load for at least three minutes. During this period, inspect to determine if structural cracking occurs. Use an illuminated 5-power magnifying glass to locate cracks. If structural cracking does not occur, the requirements of this test will have been met.
9. Center Positive Bending Moment Test: With the tie supported and loaded as shown in AREMA Manual, Chapter 30, Figure 30-4-10, apply a load increasing at a rate not greater than five kips per minute until the load P required to obtain a positive moment of 380 inch-kips at the center of the tie is obtained. Hold this load for at least three minutes. During this period, inspect to determine if structural cracking occurs. Use an illuminated 5-power magnifying glass to locate cracks. If structural cracking does not occur, the requirements of this test will have been met.
10. Bond Development, Tendon Anchorage, and Ultimate Load Test: With the tie supported and loaded at rail seat A as shown in AREMA Manual, Chapter 30, Figure 30-4-8, apply a load increasing at a rate not greater than five kips per minute until a load of 1.5 P is obtained. (The load P shall be as determined in Article 1.06.F.6 "Rail Seat Vertical Load Tests" for positive moments.) If there is no more than 0.001 inch tendon slippage determined by an extensometer reading to 1/10,000 inch suitably attached to the end of the tie, the requirements of this test will have been met. The measurement shall be made on the outermost tendons of the lower layer. Then increase the load until ultimate failure of the tie occurs, and record the maximum load obtained.

11. Rail Clip Shoulder and Special Trackwork Plate Anchor Insert Tests:
 - a. Perform the following pull-out test and torque test on each shoulder and special trackwork plate anchor insert.
 - b. Pull-out test: Perform on each shoulder as shown on AREMA Manual, Chapter 30, Figure 30-4-10. Apply an axial load of 12 kips to each shoulder and anchor insert separately. Hold this load for at least three minutes. During this period, inspect to determine if there is any slippage of the shoulder or anchor insert or any cracking of the concrete. The shoulder and anchor insert shall not slip and there shall be no cracks wider than 0.003 inch. Inability of the shoulder or anchor insert itself to resist the 12 kip load without permanent deformation shall also constitute failure of this test.
 - c. Torque test: Perform on each shoulder and anchor insert. Apply a torque of 250 foot-pounds about the vertical axis of the shoulder or anchor insert by means of a calibrated torque wrench and a suitable attachment to the shoulder or anchor insert. Hold this torque for at least three minutes. Ability of the shoulder and anchor insert to resist this torque without rotation, cracking of the concrete, or permanent deformation shall constitute passage of this test.
12. Rail Fastener Uplift Test:
 - a. Secure an 18 to 20 inch piece of 136RE rail to one rail seat using a complete rail fastener assembly, including rail seat pad, rail clips, rail clip insulators, and other associated hardware. In accordance with the loading diagram in AREMA Manual, Chapter 30, Figure 30-4-12, apply an incremental load to the rail until the rail separates from the pad, the pad separates from the rail seat or a load P of 10 kips is reached, whichever occurs first. The load P shall be the measured load plus the unsupported tie weight plus the frame weight. Record the load P at which the rail separates from the pad, the pad separates from the rail seat, or 10 kips is reached, whichever occurs first. Then release the load completely.
 - b. Then apply a load of 1.5P or 10 kips, whichever is smaller. The shoulders shall not pull out or loosen in the concrete and no component of the fastener shall fracture nor shall the rail be released.
13. Rail Fastener Repeated Load Test:
 - a. Remove the loose mill scale from an 18 to 20 inch section of new 136RE rail by wiping it with a cloth. Secure the rail to the rail seat in the tie block using a complete rail fastener. Determine the load P as specified in Paragraph 1.06.F.12. This load may be determined during the fastener uplift test described in Paragraph 1.06.F.12, in which case, use a new set of rail clips for the repeated load test.
 - b. Secure the rail section to the rail seat in the tie block using a complete rail fastener assembly. In accordance with the loading diagram in AREMA Manual, Chapter 30, Figure 30-4-13, apply alternating downward and upward loads at an angle of 20 degrees to the vertical axis of the rail at a rate not to exceed 300 cycles per minute for three million cycles. The rail shall be free to rotate under the applied loads. One cycle shall consist of a downward and an upward load. The magnitude of the upward load shall be 0.6P with P as determined in Paragraph 1.06.F.13.a. If springs are used to generate the upward load, the downward load shall be 30 kips plus 0.6P. If a double-acting hydraulic ram is used to generate both the upward and downward load, the downward load shall be 30 kips.

- c. This test may generate heat in elastomeric rail seat pads. Do not allow the temperature of such pads to exceed 140 degrees F. Heat build-up can be controlled by reducing the rate of load application or by providing periods of rest to allow cooling of the pad to take place.
 - d. Rupture failure of any component of the fastener shall constitute failure of this test.
14. Rail Fastener Longitudinal Restraint Test: Both before and after the performance of the fastener repeated load test above, and without disturbing the rail fastener, subject the fastener to a longitudinal restraint test. Apply a longitudinal load as shown in AREMA Manual, Chapter 30, Figure 30-4-14 in increments of 400 pounds. Take readings of longitudinal rail displacement after each increment. Readings of rail displacement shall be the average of the readings of two dial indicators reading to 0.001 inch, one placed on each side of the rail with their plungers parallel to the longitudinal axis of the rail. Apply the load in the direction coinciding with the longitudinal axis of the rail. Increase the load incrementally until a load of 2400 pounds is reached. Hold this load for at least 15 minutes. The rail shall not move more than 0.20 inch during the initial 3-minute period, and there shall be no more than 0.01 inch movement of the rail after the initial 3 minutes. The fastener shall be capable of meeting the requirements of this test in either direction. If these criteria are met, the tie and fasteners will have passed this test.
15. Rail Fastener Lateral Restraint Test:
- a. With a suitable length of new 136 RE rail affixed to the tie block in a manner appropriate to the fastener being tested, support and load the entire assembly as shown in AREMA Manual, Chapter 30, Figure 30-4-15. Fix the loading head against translation and rotation. The wood block shall be 10 inches by 10 inches by $\frac{3}{4}$ inch thick, five ply, exterior grade plywood.
 - b. Apply a preload of 20 kips to the rail to seat the rail in the rail fastener. Upon release of the preload, take a zero reading on the dial indicators that measure rail translation. Apply the load at a rate not to exceed five kips per minute until either 41 kips have been applied or the rail base has translated $\frac{1}{8}$ inch, whichever occurs first. Inability of the fastener to carry to 41 kip load with $\frac{1}{8}$ inch or less of rail translation shall constitute failure of this test. Complete failure of any component of the tie or fastener is cause for rejection.
 - c. With all load removed from the rail, place a roller nest between the fixed loading head and the wood block on the rail head. The roller nest shall not offer resistance to lateral motion of the rail head. After taking zero readings on the dial indicators that measure gauge widening and rail translation, apply a load of 20.5 kips at a rate not to exceed five kips per minute. Rail rotation, gauge widening less rail translation, greater than $\frac{1}{4}$ inch shall constitute failure of this test.
16. Electrical Impedance Test:
- a. Two short pieces of rail shall be affixed to Tie 2 using tie pads, insulators and fastenings in a manner appropriate to the fastener system to be used
 - b. The complete assembly shall be immersed in water for a minimum of 6 hours.
 - c. Within one hour after removal from water, an A-C 10-volt 60-Hertz potential shall be applied across the two rails for a period of 15 minutes. If the rails are rusty or contain mill scale, the contact points must be cleaned.

- d. The current in amperes is read using an A-C ammeter and the impedance determined by dividing the voltage (10) by the current in amperes.
 - e. If the impedance exceeds 20,000 ohms, the tie will have passed the test.
17. Rail Seat Pad Spring Rate Test:
- a. Load the rail seat pad vertically using a rail section secured to the tie block by a complete rail fastener.
 - b. Apply a cyclic load varying from 4 to 30 kips continuously at a rate of four to six cycles per second for a total of 1,000 cycles.
 - c. Apply a static load, at a rate between three and six kips per minute, in increments of one kip up to a maximum of 50 kips. For each load increment, measure and record the vertical pad deflection to the nearest 0.0001 inch. Plot the recorded values for vertical load versus deflection on a graph. Calculate the spring rate, as determined by the slope of the line connecting the points representing pad deflections at 24 and 44 kips.
 - d. Release the load and record the pad deflection 10 seconds after removal of load.
 - e. Acceptance Criteria:
 - (1) Each pad shall return to within 0.002 inch of its original position 10 seconds after removal of load.
 - (2) The final spring rate value for each pad when determined by the Tie Block Test Sequence specified by Paragraph 1.06.F.5.h shall not vary more than 25 percent from the initial value for that pad determined by the Tie Block Test Sequence specified by Paragraph 1.06.F.5.a.
 - (3) The spring rate values determined from the initial tests conducted on the three pads specified in the Tie Block Test Sequence specified by Paragraph 1.06.F.5.a shall not vary more than 25 percent from each other.
 - (4) The spring rate values determined from the final tests conducted on the three pads specified in the Tie Block Test Sequence specified by Paragraph 1.06.F.5.h shall not vary more than 25 percent from each other.

PART 2. PRODUCTS

2.01 CONCRETE:

- A. Conform to AREMA Manual, Volume 1, Chapter 30, Article 4.2.2, with the following additions and exceptions:
- B. Cement:
 - 1. Portland cement in conformance with ASTM C150, low alkali. The false set penetration, when tested in accordance with ASTM C359, shall be not less than 50mm initially, 35mm at intermediate times and 40mm after remix.
 - 2. Cement alkali content: Na_2O equivalent ($\text{Na}_2\text{O} + 0.658 \text{K}_2\text{O}$) shall not be greater than 0.6 percent.
 - 3. Cement mill certificates shall be obtained and available for review for all cement used during tie production in order to ensure consistency in chemical ingredients. Under no circumstances, shall substitution of cement be permitted unless it has been pre-qualified through testing.
- C. Fine and Course Aggregates:
 - 1. Aggregates shall be natural aggregates complying with ASTM C33, Class 4S.

2. Provide evidence that concrete containing aggregate from the proposed source with cement content and alkali burden similar to the job mix has a satisfactory service history of at least 5 years. This evidence shall include structures requiring a Class 4S aggregate.
 3. The gradations of the fine and coarse aggregates shall conform to ASTM C33. The size number of the coarse aggregate gradation shall have a maximum size of coarse aggregate that does not exceed three-fourths of the clear spacing between prestressing tendons or between prestressing tendons and forms, whichever is less. If the coarse or fine aggregate is supplied in more than one size, each size shall be stored separately.
 4. Washed aggregate shall be allowed to drain, in stockpiles, before being used. All aggregates shall be free from ice when used.
- D. Mixing Water:
1. Mixing water shall be potable and free of any injurious amounts of oils, acids, alkalis, salts, sugars, vegetable matter, or other substances that may be deleterious to concrete or reinforcement. Mixing water shall conform to the test requirements and recommendations of AASHTO T26.
 2. In addition, mixing water shall have a chloride ion content of less than 100 parts per million. Test mixing water in accordance with ASTM D512, Test Method B.
 3. Water-cement ratio in concrete: 0.40 maximum
- E. Entrained Air: Use air-entrained concrete. Air entraining agents used shall comply with ASTM C494 and ASTM C260. Air content in the hardened concrete shall be a minimum of 4.0 percent. Minimum air content in the wet concrete shall be included in the mix proportion data submitted 35 days prior to production for approval.
- F. Chloride Ion Content by Weight of Cementitious Material in Concrete: The acid soluble chloride ions by weight of cementitious material in the concrete mix shall be less than or equal to 0.10% for reinforced concrete and 0.08% for prestressed concrete, as per ACI 222R. The water soluble chloride ions by weight of cementitious material in the concrete mix shall be less than or equal to 0.08% for reinforced concrete and 0.06% for prestressed concrete, as per ACI 222R.

2.02 PRESTRESSING TENDONS:

- A. Use pretensioned prestressing tendons conforming to AREMA Manual, Volume 1, Chapter 30, Article 4.2.4, and as specified herein.
- B. For prestressing tendons, use either steel wire conforming to ASTM A881, or steel strand conforming to ASTM A886. If wire is used, do not use strands larger than 3/8 inch diameter.

2.03 RAIL CLIP SHOULDER INSERTS AND ANCHOR INSERTS

- A. Rail Clip Shoulder Inserts (for locations without special trackwork plates):
 1. Rail clip shoulder shall be a one-piece cast ductile iron casting. Ductile iron shall conform to ASTM A536 Grade 60-40-18 or 65-45-12.
 2. The lower portion of the shoulder shall include a concrete embedment which conforms to the pullout and torque resisting tests specified in Paragraph 1.06.F.11 herein. The exposed portion of the shoulder shall be designed to accommodate the placement of rail seat pad, rail clip insulators and rail spring clips specified herein.

3. The shoulder insert shall not be directly anchored, or come in contact with, the prestressing tendons.
- B. Anchor Inserts for Special Trackwork Plates:
1. Anchor inserts for running rail support plates in the switch and frog areas shall be embedded in the concrete switch tie during the casting operation. The inserts shall be designed to provide pull-out and torque resistance specified in Paragraph 1.06.F.11 herein.
 2. Inserts shall be threaded for anchor bolts specified below. Length to be determined by manufacturer in conformance with special trackwork design and pull-out requirements.
 3. Material: Glass fiber reinforced nylon with ductile iron or steel shell:
 - a. Glass fiber reinforced nylon:
 - (1) Tensile Strength: 27,000 psi, when tested in accordance with ASTM D638.
 - (2) Elongation at Break: 4 percent, when tested in accordance with ASTM D638.
 - (3) Volume Resistivity: 10^{12} ohm-centimeters, when tested in accordance with ASTM D257.
 - b. Ductile Iron or Steel Shell: Material type and dimensions designed by the manufacturer to meet the pull-out and torque resistance specifications herein as well as prevent cracking in the concrete surrounding the inserts caused by uncontained thermal expansion of the nylon in the insert.
 4. Prevention of Ice in Bottoms of Inserts: To prevent damage caused by expansion of water as it freezes into ice, provide drain holes through the bottoms of the inserts and through the tie to the bottom of the tie.
 5. Bolts: High strength heavy-hex structural bolt, 7/8-inch diameter. Chemical, mechanical and other properties in accordance with ASTM A325. Bolts, including threads, shall be hot-dip galvanized in accordance with ASTM A153. Provide a spring washer and a flat washer under each bolt head.
 6. Insulating Bushings:
 - a. Material: Glass-reinforced nylon.
 - b. Tensile strength: 11,000 psi, minimum, when tested in accordance with ASTM D638 at 23 degrees C and 50 percent relative humidity
 - c. Volume resistivity: 10^9 ohm-centimeters, minimum, when tested in accordance with ASTM D257 at 50 percent relative humidity.

2.04 FASTENER COMPONENTS:

- A. Rail Seat Pads:
1. Rail seat pads shall be used on all switch ties that do not have special trackwork plates. They shall be single-durometer, single-piece molded pads.
 2. Dimensions: Thickness shall be 9 to 10 mm (0.35 to 0.40 inches). Width shall equal the spacing between the rail clip shoulders (tolerance plus zero inch, minus 1/16 inch). Pads shall have ears on both sides of the shoulder to keep the pad in place.
 3. Material: Conform to the testing requirements of Paragraph 1.06.D.
- B. Rail Clip Insulators:

1. Rail clip insulators shall be placed on all switch ties that do not have special trackwork plates. They shall be designed to electrically insulate the rail clip and rail clip shoulder from the rail.
2. Configuration and Dimensions: Design shape shall provide a key between the insulator and the rail clip shoulder to prevent relative motion in any direction. Length (in the direction of the rail) shall be long enough to cover the full width of the rail clip shoulder and provide the aforementioned key. Insulator shall deep enough in the installed position such that its bottom edge is in contact with the rail seat pad over the entire length of the insulator after installation of the rail clip.
3. Material: Nylon reinforced with 33 percent glass fibers. Do not use recycled material.
4. Volume Resistivity: 10^{12} ohm-centimeters, minimum, when measured in accordance with ASTM D257.
5. Water Absorption at Saturation: Three percent, maximum, when measured in accordance with ASTM D570.
6. Rockwell Hardness: R-95, when measured in accordance with ASTM D785.
7. Dry Shear Strength: 6,500 psi, minimum, when measured in accordance with ASTM D732.
8. Heat Aging: Age for 10 days at 70 degrees Celsius using ASTM D573. Compare properties before and after aging at 20 degrees Celsius. The tensile strength shall not decrease more than 10 percent. The Rockwell hardness shall not change more than five points. There shall be no warping, cracking, discoloration, or exudation of plasticizer.
9. Weatherometer test: After 1000 hours with cycled spray, the tensile strength shall be a minimum of 6000 psi when tested in accordance with ASTM D638.
10. Insulators shall be capable of withstanding temperatures of -20° Fahrenheit to $+140^{\circ}$ Fahrenheit without having detrimental effect on the performance of the insulator.
11. The insulator shall be capable of withstanding the degradation from oxidation, water, alkali, petroleum oils, synthetic lubricants, and sunlight without having a detrimental effect on the performance of the insulator.
12. The insulator shall be designed to withstand the rigors of application and reapplication of the rail clips and other components without breaking, cracking, or any other detrimental effect on the performance of the insulator.

C. Rail Clips: Use Pandrol's e2055 rail clip.

2.05 TIE DIMENSIONS AND TOLERANCES:

- A. Protrusions: Do not use sharp angles or protrusions, which are easily damaged by handling or tamping.
- B. Length: Varies with location in special trackwork. Minimum length: 9 feet - 0 inches. Maximum length 22 feet - 0 inches.
- C. Width: 9 inches minimum, 12 inches maximum, measured at the bottom. The width at the bottom shall be equal to or greater than the width at the top. Allow room for switch rods between the ties.
- D. Depth: Uniform depth across the top. Minimum depth: 8-1/2 inches. Maximum depth: 10 inches.

- E. Ensure that the Manufacturer's drawings show location and tolerances of rail fastening shoulders and inserts.
- F. Tolerances:
1. Length: Plus or minus 1/4 inch.
 2. Width: Plus or minus 1/8 inch.
 3. Depth: Plus ¼ inch, minus 1/8 inch.
 4. Embedded rail clip shoulders and plate anchor inserts shall be placed to maintain track gauge to a tolerance of plus or minus 1/16 inch. Spacing of shoulders and inserts for each rail shall be to a tolerance of plus or minus 0.04 inch.
 5. Rail seat plane: Flat smooth surface within plus or minus 1/32 inch.
 6. Differential Tilt of Rail Seats: Not to exceed 1/16 inch over a width of six inches, in the direction parallel to the rail on one rail seat to the other.
 7. Concrete cover for prestressing tendons
 - a. ¾ inch minimum concrete cover.
 - b. Manufacturing tolerances for concrete cover and depth of prestressing tendons: plus of minus 1/16 inch.
 8. Tolerances for locations of tendons: plus or minus 1/8 inch vertical and plus or minus ¼ inch horizontal. Greater tolerances will be allowed if the manufacturer can show that the tie has adequate flexural strength, minimum cover is not compromised, and there are no electrical shorts.
 9. Projection of tendons beyond the ends of the ties: 1/4 inch maximum.
 10. Surface finish of concrete:
 - a. The top and side surfaces shall present a smooth, uniform appearance. Except at the rail seat, a random scattering of surface voids will not be cause for rejection. Heavy concentrations of surface voids or evidence of improper mixing, vibrating, or curing will be cause for rejection.
 - b. The ends of the ties need not be flat planes or surfaces, but there shall be no evidence of tearing of the concrete where the prestressing tendons emerge or of any void in contact with a tendon.
 - c. The bottom of the tie shall have a rough finish such as may be obtained with a broom.
 11. Rail fastening pieces: The tolerances of the ties, shoulders, rail clips, rail clip insulators, and rail seat pads shall be small enough to prevent excessive variations in the rail clip toe loads. Ensure that the rail clip manufacturer approves tolerances that affect the rail clip toe loads.

PART 3. EXECUTION

3.01 FABRICATION:

- A. Forms:
1. Forms shall be rigid and shall be constructed of material that will result in finished ties conforming to the shape, lines and dimensions called for on the approved shop drawings.
 2. Tie Marking: A method of marking each tie shall be incorporated into the forms so that a permanent impression is left in the top of the finished tie, away from running rail support surfaces. The marking shall include the following information:

- a. Manufacturer
 - b. Tie design type or model number
 - c. Date of manufacture (date cast)
 - d. Form cavity identification
 - e. Other information as needed to identify each tie with concrete certifications and test reports and the quality control program requirements.
 - f. Identification of the Port Authority as the owner
- B. Placement Of Prestressing Tendons:
1. Place and space pretensioning tendons in accordance with AREMA Manual, Volume 1, Chapter 30, Articles 4.2.4 and 4.3.2, except that tolerances for placement shall meet the requirements of Paragraph 2.06 herein.
 2. Pre-stress all tendons simultaneously in order to ensure equal stresses in each.
 3. The pretensioning load shall be applied in two increments. An initial load of approximately 1,000 pounds shall be applied to the individual strands to straighten them, eliminate slack, and provide a starting or reference point for measuring elongation.
- C. Curing: In accordance with AREMA Manual, Volume 1, Chapter 30, Article 4.2.2.5.

3.02 PRODUCTION QUALITY CONTROL TESTS:

- A. Tie Materials Tests:
1. Concrete:
 - a. Slump: Conduct at least two slump tests on separate batches of concrete for each bed cast or each 50 cubic yards of concrete, whichever is less volume, in accordance with ASTM C31 and C143.
 - b. Air Content: Conduct a minimum of two tests of air content on the plastic concrete for each bed of ties cast or each 50 cubic yards of concrete, whichever is less volume of concrete.
 - c. Compressive Strength:
 - (1) Make at least six cylinders per bed cast or per day, whichever is the lower volume. Make 6 inch by 12 inch or 4 inch by 8 inch cylinders, in accordance with ASTM C31. Cure cylinders with the ties being cast and entirely under production conditions.
 - (2) On two of the cylinders, conduct 28-day compressive strength tests on the cylinders in accordance with ASTM C39. Minimum 28-day compressive strength shall be 7000 psi.
 - (3) On another two of the cylinders, conduct tests for strength at the time the prestress is transferred to the concrete – minimum strength shall be 4500 psi.
 - (4) After curing, document and tag the third set of cylinders as to project, date, time and place, and store them as spares.
 - d. Absolute drying shrinkage at 28 days shall not exceed 0.04% in accordance with ASTM C157, Air Drying Method.
 2. Cement:

- a. Separate random samples of cement shall be taken each day to represent the cement used on each bed. Each sample shall be not less than two pounds and shall be clearly identified with the date and bed number. Each sample shall be kept in air-tight containers until the corresponding 28 day cylinder tests have been carried out and results accepted by the Authority.
 - b. Cement mill certificates shall be provided weekly by each supplier and shall include the results of the following tests on cement delivered during that week.
 - (1) Fineness by air permeability, in accordance with ASTM C204.
 - (2) False Set, in accordance with ASTM C359. Penetration at 3, 5, 8, 11 minutes and after mix.
 - (3) Setting Time, in accordance with ASTM C191.
 - (4) Compressive Strength in accordance with ASTM C109 at 1 day, 3 days, and 7 days.
 - (5) Chemical Analysis in accordance with ASTM C114, including SiO₂, Al₂O₃, Fe₂O₃, CaO, MgO, SO₃, K₂O, Na₂O and calculated alkalis as Na₂O equivalent, C₃S, C₂S, C₃A, C₄AF.
 - (6) Residue on 325 mesh sieve, in accordance with ASTM C430.
 - c. At least once during every three months, analyze a randomly chosen sample of cement from each source used, for alkali content in accordance with ASTM C114 by an outside testing laboratory.
3. Aggregates: In addition to the requirements of ASTM C33, an outside testing laboratory shall conduct the following tests:
- a. Petrographic examination in accordance with ASTM C295. This shall be conducted on each new source.
 - b. Evaluation of potential alkali reactivity, in accordance with ASTM C227.
 - (1) A separate test shall be conducted with each job cement and the results shall conform to ASTM C33 at three and six months.
 - (2) This shall be repeated every 6 months for each source.
 - (3) When there is insufficient time for testing in accordance with ASTM C227, potential alkali reactivity may be evaluated by ASTM C1260.
 - c. Evaluation of potential alkali carbonate reactivity. Test aggregates containing carbonate in accordance with ASTM C586.
 - d. Abrasion resistance, in accordance with ASTM C779, Procedure A. Conduct the test on the molded concrete surface of test pieces cut from a tie made with the job concrete. The depth of wear shall be measured at 60 minutes.
 - (1) The depth of wear shall be not more than 5% greater than the depth of wear on similar test pieces cut from ties made from concrete that has been used for concrete ties to the satisfaction of a Class 1 Railroad.
 - (2) The age at test and curing procedure used for each of the test pieces shall be similar and shall be stated in the test certificate.
 - (3) Conduct this test using aggregate from each source.
- B. Rail Seat Pads

1. During the production of rail seat pads, conduct production quality control tests on each batch used in the production of pads. A batch is defined as the rubber mixed, processed and cured together, not exceeding one day's production. Keep the pads segregated by batch. Perform the following tests on two samples chosen from each batch at random. Use two different specimens for each test. If either of the two samples fails a test, the entire batch shall be either rejected or subjected to the test that the sample failed. Prior to testing, condition all specimens for at least seven days at 23 degrees Celsius and 50 percent relative humidity.
 2. Tensile Strength, Ultimate Elongation, High Temperature Compression Set, Volume Resistivity, and Water Absorption: Conduct in accordance with Paragraph 1.06.D. Acceptance Criteria shall be as specified in Paragraph 1.06.D.
- C. Concrete Ties:
1. Perform the following production quality-control tests prior to delivery on one tie selected at random from every 200 ties or fraction thereof, produced each day. Test each tie with different rail clips, insulators, and rail seat pads. Individually select all fastener parts tested at random and from each production lot in proportion to the number of parts in that lot.
 - a. Verify the rail seat configuration and shoulder location for compliance with Paragraph 2.06.
 - b. Perform the rail seat vertical load test with positive moment specified in Paragraph 1.06.E.6. Apply the load at a rate of at least five kips per minute and hold it for at least one minute.
 - c. If the instant de-molding process is used, perform the shoulder tests specified in Paragraph 1.06.E.11 on all the shoulders on the tie.
 2. Retesting: Should any test tie fail the tests required by Paragraph 3.02.C.1, test two additional ties from that same 200 tie lot. In the event either of these ties fails, test or reject 100 percent of the remainder of the 200 tie lot.
 3. Disposition of Test Ties: Ties that pass the testing requirements, have no cracks or only non-structural cracks, and are otherwise undamaged after testing, will be considered acceptable for delivery.
 4. Bond Development or Tendon Anchorage Test: Subject one tie selected at random from every 2000 ties or fraction thereof, to the bond development or tendon anchorage test specified in Paragraph 1.06.E.10. A load rate exceeding five kips per minute may be applied. If the tie does not pass the test, test three additional ties selected at random. If any of the three additional ties do not meet the requirements of Paragraph 1.06.E.10, the entire lot may be rejected at the option of the Authority.
 5. Notify the Authority in writing at least 14 days in advance of dates scheduled for quality control tests. Upon request, arrange for testing to be observed by the Authority.

END OF SECTION

SECTION 02455
CONCRETE SWITCH TIES

SUBMITTALS

APPENDIX A

The following shall be submitted to the Engineer:

- A. If the Manufacturer proposed to revise the tie spacing, submit proposed alternate tie spacing and explanation of advantages as required by 1.03D.
- B. Manufacturer: Prior to manufacture, the name and location of the concrete tie supplier shall be submitted to the Authority for approval.
- C. Shop drawings for the concrete switch ties, including all dimensions, and the size and layout of the steel prestressing tendons, embedded clip shoulders and plate anchor inserts, and other supplied parts that are signed and sealed by a Professional Engineer licensed in the state of New York.
- D. Structural calculations from the manufacturer including bending moment analysis and other criteria of ACI Standard 318, Chapter 18. The design calculations shall include verification that the concrete switch ties are capable of passing the test requirements specified herein, and that the design and material are adequate for their intended use.
- E. Concrete mix proportion, including description and chemical composition of all materials and admixtures 35 days prior to production. Provide sources and gradations of aggregates.
- F. Fabrication plan describing the tie manufacturing process.
- G. Tie-labeling scheme for identification of switch ties.
- H. Quality Control Program for monitoring the production, including manufacturing control test procedures and tests specified herein.
- I. Letter stating that the concrete tie manufacturer is currently certified in Precast/Prestressed Concrete Institute's Plant Certification Program or will be certified within six (6) months of NTP.
- J. Schedule of the work, including design, shop drawing submittals, design testing, manufacturing of each component, in-plant inspections, and shipment. Submit the notification requirements as specified in Paragraph 1.06 C and 3.02 C.5.
- K. Test reports for all specified design tests.
- L. Within 30 days after completion of tests, submit test reports of all control tests conducted during manufacturing and all other required test documentation.
- M. If the Manufacturer proposes greater tolerances for tendon locations, submit justification per 2.05 F.8.

END OF APPENDIX A

DIVISION 2
SECTION 02456
SPECIAL TRACKWORK

PART 1. GENERAL

1.01 SUMMARY

- A. This Section specifies requirements for furnishing and delivery of special trackwork, including switch machines.

1.02 REFERENCES

- A. The following is a listing of the publications referenced in this Section:
 - 1. American Railway Engineering and Maintenance-of-Way Association (AREMA)
 - a. Manual for Railway Engineering
 - b. Portfolio of Trackwork Plans, including Specifications for Special Trackwork
- B. In AREMA publications, the words "railway", "railroad", "railway company", or words of like import shall be understood to mean the Port Authority of New York and New Jersey.

1.03 QUALITY ASSURANCE

- A. All of the above Work shall be performed in accordance with all applicable recommended practices in the AREMA Manual for Railway Engineering, and as modified in this Section and by the Contract Drawings.

1.04 DRAWING REQUIREMENTS

- A. Drawings, details and sketches for shop drawings and catalog cuts shall be dimensioned in the Imperial System and angles shall be dimensioned in degrees, minutes and seconds of arc.

1.05 MANUFACTURER'S CERTIFICATIONS

- A. Obtain manufacturers' certifications for each product to be installed in the Work and submit to the Authority.
- B. Annotated shop drawings, annotated catalog cuts, letters of certification, or a combination of them will be acceptable formats for manufacturer's certifications.

1.06 DELIVERY

- A. Turnouts and all other products shall be delivered to a location at Port Ivory Marine Terminal in Staten Island, New York. Provide directions for unloading materials.

1.07 SUBMITTALS

- A. See Appendix "A" for submittals requirements.

PART 2. PRODUCTS

2.01 SPECIAL TRACKWORK

A. General

1. Whenever the words "Special Trackwork" are used in this Section, they shall mean all of the frogs, switches, crossings, rails, and fittings as shown on SK01 and SK02 and as specified herein.
2. Special Trackwork shall be furnished as shown on SK01 and SK02 and shall be manufactured in accordance with AREMA Portfolio of Trackwork Plans, including AREMA Portfolio Plan Nos. 100, 1021 and 1020, and as modified by the requirements of this section.
3. Rail weight and section of Special Trackwork shall be 136 RE. Rail shall be high strength.
4. Prepare ends of rails and frogs for welded joints or bolted joints conforming to SK01 and SK02 and the requirements of this Section. Bolted Joints for Special Trackwork shall have six bolts except where otherwise required by AREMA plans.
5. The words "hand identity" in this Section shall mean "right-hand" or "left-hand" according to the requirements shown on SK01 and SK02.

B. Shop Drawings and Manufacturer

1. Special Trackwork, such as switches and frogs, shall be fabricated by one of the following trackwork manufacturers, or approved equal:
 - a. Cleveland Track Material Inc., Cleveland, OH
 - b. Pohl Corporation, Reading, PA
 - c. UniTrac Railroad Materials Inc., Knoxville, TN
2. All component parts of a single item of Special Trackwork shall be fabricated by a single manufacturing entity.
3. Prior to fabrication of Special Trackwork, submit the name(s) and location(s) of the Special Trackwork manufacturer's shop(s) to the Authority for approval.
4. Prior to fabrication of Special Trackwork, submit shop drawings of each item of Special Trackwork to the Authority for approval. Shop drawings shall include a bill of materials.
5. Do no fabrication of Special Trackwork until shop drawings are approved, or until notification to proceed is received in writing, from the Authority.
6. Bring any apparent discrepancies in SK01 and SK02 to the attention of the Authority by means of written notice.
7. Furnish to the Authority one set of reproducible mylar tracings duplicated from the approved shop drawings.

C. Parts Fabricated from Rails

1. Frogs, switches, crossings, stock rails, guard rails and all other articles of Special Trackwork which are to be made of rails shall be manufactured only of new rails as specified in 2.02 Steel Rail of this Section. The use of "A" rails and No. 2 rails will not be permitted for Special Trackwork.
2. All rails used for Special Trackwork shall be AREMA high strength rail.
3. Rail ends at bolted joints shall be beveled in accordance with AREMA Portfolio Plan No. 1005.

D. Frogs

1. The frog numbers and type of frog construction shall conform to SK01 and SK02.
2. Rail bound manganese frogs for 136-RE trackwork shall be of medium wall design and conform to AREMA Portfolio Plan No. 621.
3. All frogs shall have wing wheel risers deleted and shall have depressed points.
4. All frog body castings and fully assembled frogs shall be explosion hardened according to M2.7 of AREMA Portfolio Plan No. 100. After items are explosion hardened, dye-check for defects. Submit written reports of this inspection to the Authority.
5. Radiographic testing of castings and frogs according to M2.5.4 through M2.5.4.3 of AREMA Portfolio Plan No. 100 will not be required.

E. Split Switches

1. Verify that length and hand identity of split switches conform to SK01 and SK02.
2. All switch points shall conform to AREMA Portfolio Plan No. 221 with double reinforcing bars with floating heel blocks for each point. All switch points shall be "Samson style" machined with AREMA Portfolio Plan No. 221, Detail 5100.
3. Each switch point shall be furnished with a stock rail. All stock rails shall be undercut for AREMA Portfolio Plan No. 221, Detail 5100 and undercutting shall only be in the area of switch point "fit up". Stock rails must not be undercut throughout their entire length. Stock rail extensions shall be 5'-7" and 7'3" as in AREMA Portfolio Plan No. 911.
4. Switch rods for switches shall be Racor-style Type "MJ" vertical switch rods.
5. Switches shall be furnished with ergonomic, parallel-throw, trailable switch stands and the required connecting rods. Switch stand shall be Racor Tri-Glide Model 22-E, as manufactured by Nortrak – Decatur, IL, or approved equal. Switch stands shall be located on whichever side of the switch layout is shown on SK01 or SK02.

F. Switch Point Guard

1. Split switch shall be furnished with a fabricated switch point guard, Western-Cullen-Hayes' Model FM switch point guard, or approved equal.
2. Switch point guard shall be suitable for 21" tie centers and for the rail weight and section of stock rail and without the need for bolting through the rail.

G. Double-Tongue Switches

1. Hand identity of switch layouts shall conform to SK01 and SK02.
2. Double tongue switches shall conform to AREMA Portfolio Plan No. 988 and be suitable for diesel locomotives with three-axle driving trucks.
3. All tongue switches shall be furnished with manually-operated embedded switch machines.

H. Guard Rails

1. Furnish two guard rails for each turnout frog.
2. Guard rails shall conform to AREMA Portfolio Plan No. 504. Guard rails shall be 13'-0" long, and equipped with plates with welded Pandrol shoulders.

I. Manual Embedded Switch Machines

1. Manual embedded switch machine (switch machine) shall be Model HW(E) 61 as manufactured by Hanning and Kahl – Bridgeport, PA, and comply with the specifications of this section. No substitutions will be permitted. Provide shop drawings, detailed installation instruction and bill of materials to the Authority.
2. The manufacturer shall demonstrate that the casing for the box for the switch machine can accommodate the components required for power operation at a future date.
3. Switch machine must be designed with simple one step movement for manual switch operation (lever box).
4. Switch machine operation shall be capable of trailable moves without damage to switch machine, operating rods, switch tongues and/or rolling stock.
5. Switch machine must be designed for cold weather operation.
6. Switch machine shall be supported by and fastened to concrete switch ties.
7. Switch machine vehicle loading shall be designed to support the live load of a fully loaded 10-wheel tractor trailer, or a fully loaded reach stacker, whichever is greater (minimum 135 pounds per square inch).
8. The manufacturer shall test the switch machine prior to shipment and provide certified factory test reports to the Authority.
9. Warranty:
 - a. Provide for the Authority's benefit a warranty that the switch machine is free from defects in material and workmanship. All materials and workmanship shall contain a five-year warranty covering the cost for parts and labor in keeping with industry accepted terms and conditions.
 - b. Any defective part or equipment returned within the warranty period must be repaired/replaced and reinstalled by the equipment manufacturer within 48 hours of receipt at no additional cost to the Authority.

J. Geometry of Turnouts

1. Geometry of tongue switch turnouts shall comply with AREMA Portfolio Plan No. 980.
2. Turnouts with double-tongue switches shall be installed with tangents adjacent to the switch body castings, in accordance with this section. Tolerance of actual lead shall be one inch, plus or minus.
3. Track gage of all switches and turnouts shall be 4 feet - 8 1/2 inches. Flangeways shall be 1 7/8 inches. Guard face gages shall be 4 feet - 4 3/4 inches.
4. Install switch points with zero stagger at the point of switch. Tolerance of switch point stagger shall be 1/2 inch, plus or minus.
5. Throw of switch shall conform to AREMA Portfolio Plans.

K. Pandrolized Special Trackwork

Substitute Pandrol-compatible plates for AREMA type plates in Special Trackwork.

1. "Surefit" boltless adjustable brace shall replace the one-bolt security rail brace. Surefit braces shall be suitable for use at switch stock rails and at guard rails.
2. Boltless adjustable frog clamps shall replace hook twin tie plates at frogs.

3. At split switch and guard rail plate locations and at heels of split switches use plates with Pandrol's weld-on shoulders, without braces. At plates with insufficient clearance for one or two of the adjacent weld-on shoulders, substitute a welded stop for each deleted weld-on shoulder. Where clearances allow for one weld-on shoulder, locate that shoulder on the field side of a rail.
4. Punch ends of Pandrol-compatible plates with a two-hole pattern on each end consisting of two 1" diameter round holes at the corners.
5. Use Pandrol's e2055 rail clip in Pandrol-compatible plates.
6. No substitutes will be permitted for the above requirements.

L. Shop Layout

1. Arrange for Special Trackwork to be laid out at the manufacturer's shop for inspections by the manufacturer and the Authority.
 - a. Give the Authority's representative fifteen days notice of the time when he may conduct his inspection. The Authority's representative may waive his inspection but the manufacturer's inspection shall be required in all cases.
 - b. Transmit a copy of the manufacturer's inspection report of Special Trackwork to the Authority.
2. Lay out Special Trackwork with the required plates upon a true horizontal floor of the shop. Install rail joints and switch rods, as applicable, as part of the shop layout procedure.
3. Lay all plates upon the switch tie layout. Install Pandrol rail fasteners. Completely attach plates to ties at the shop.
4. Fill all holes in Pandrol-compatible Special Trackwork plates with anchor bolts in round holes.
5. Switch points and frogs shall bear evenly on all plates supporting these parts. Stock rails shall seat properly at the switch plates and rail braces. Split switches with heel block assemblies and switch rods installed, shall be capable of being thrown freely with use of a lining bar. Check Special Trackwork for fit, geometry and alignment, and for conformance with SK01 and SK02.
6. Correct at the shop all Special Trackwork items, components and parts not in conformance with the requirements of this Section in accordance with the requirements of AREMA Portfolio Plan No. 100 or replace with items, components and parts that are in conformance.

M. Packaging and Shipping

1. Special Trackwork, including switch ties, shall be panelized, or secured to pallets, or banded, or packaged by other means. Any packaging and shipping methods utilized shall be such as to avoid damage or loss during shipment and handling.

2.02 STEEL RAIL

- A. General: Steel rails for use in the fabrication of Special Trackwork items and for use as running rail in other trackwork shall be new and shall meet all applicable requirements of AREMA Manual, Chapter 4, Parts 1 and 2.
- B. Manufacturer: Prior to procurement of rails, submit the name(s) and the location(s) of the rail rolling mill(s) to the Authority for approval.

- C. Inspection: Complete records of all inspections and testing performed shall be made available to the Authority when requested. Arrange to have available at the mill all instruments and gauges required to measure all thresholds as specified in the AREMA specifications.
- D. Rail Weight and Section: Rails shall be 136 RE with 10" head radius, high strength, meeting the requirements of AREMA Manual, Chapter 4.
- E. Design
 - 1. 136 RE with 10" head radius rails shall be in accordance with the AREMA Recommended Rail Section.
 - 2. Where standard rail drilling is specified, rails shall be drilled for 6-hole bars and in accordance with AREMA Rail Drillings, Bar Punchings and Bolts.
 - 3. Prior to rail procurement, shop drawings of rail section and of drilling pattern shall be submitted to the Authority for approval.

F. Physical Requirements

Rails shall meet all applicable requirements of AREMA Specifications for Steel Rails, and as modified herein.

- 1. Rails intended for fabrication of Special Trackwork shall meet the requirements of 2.01 Special Trackwork of this Section.
- 2. Rails intended for welded rail trackwork shall be AREMA high strength.
 - a. Standard length of rails shall be 82 feet, 80 feet, or 78 feet, at the mill's option.
 - b. Short length rails according to AREMA Specifications for Steel Rails, Article 2.1.11.b, will be acceptable.
 - c. Rails shall be undrilled (blank).

2.03 BOLTED RAIL JOINTS

- A. General: Bolted rail joints shall meet all applicable requirements of AREMA Manual, Chapter 4, Parts 1 and 2.
- B. Design
 - 1. Design of component parts shall correspond to AREMA recommendations according to the specified rail weight and section.
 - 2. All joints shall be of the 6-bolt type.
 - 3. Joint bar designs and punchings, and track bolt size, shall be in accordance with AREMA Rail Drillings, Bar Punchings and Bolts and with AREMA Joint Bar and Assembly Figure No. 4-1-9.
- C. Track Bolts and Nuts
 - 1. Track bolts shall be of the oval neck type.
 - 2. Install each nut with AREMA standard spring washer.
 - 3. Track bolts and nuts shall conform to the dimensions and recommended sizes of AREMA Design for Track Bolts and Nuts.
- D. Physical Requirements
 - 1. Joint bars shall conform to AREMA Specifications for Quenched Carbon-Steel Joint Bars, Microalloyed Joint Bars and Forged Compromise Joint Bars.

2. Track bolts and nuts shall conform to AREMA Specifications for Heat-Treated Carbon-Steel Track Bolts and Carbon Steel Nuts.
3. Spring washers shall conform to AREMA Specifications for Spring Washers.

END OF SECTION

SECTION 02454
RAILROAD TRACKWORK
SUBMITTALS
APPENDIX "A"

- A. Where the title "Manager, Materials, Engineering Division" is used, it shall be understood to mean Manager, Materials Engineering Division, Port Authority Technical Center, 241 Erie Street, Jersey City, New Jersey 07310-1397.
- B. Submit manufacturer's certifications for each product to be used in the Work, as required by 1.05.
- C. Submit to the Manager, Materials Engineering Division all certified test reports for chemical, physical, and electrical tests required by Part 2 of this Section.
- D. Submit for approval the name and location of the Special Trackwork manufacturer's shop as required by 2.01 B.3.
- E. Submit for approval shop drawings with bill of materials for each item of Special Trackwork, as required by 2.01 B.4.
- F. Submit reproducible mylar tracings as required by 2.01 B.7.
- G. Submit written reports of casting inspections, as required by 2.01 D.4.
- H. Submit a 15-day notice of the availability of Special Trackwork shop layout for the Authority's inspection, as required by 2.01 L.1.a.
- I. Submit manufacturer's inspection report of Special Trackwork as required by 2.01 L.1.b.
- J. Submit for approval the name(s) and the locations(s) of the rail rolling mill(s) as required by 2.02 B.
- K. Submit for approval shop drawings of rail section and of drilling pattern as required by 2.02 E.3.
- L. Submit shop drawings, installation instructions and bill of materials of manual embedded switch as required by 2.01.I.1
- M. Submit certified factory test report as required by 2.01.I.8.

END OF APPENDIX "A"