

## REQUEST FOR QUOTATION

<b>Vendor:</b>      <b>Contact person/Telephone/Email</b> Jasmine Green/212-435-4654/jrgreen@panynj.gov	<b>Bid # / Bid Due Date</b> 60932 / 04/23/2020 Bids must be received no later than 11:00 AM on the above Bid Due Date.  <b>Deliver Goods/Services To:</b> PATH 120 Consolidated Maintenance Facility Academy Street Jersey City, NJ NJ 07302
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Quantity	Description	Unit Price	Total
	<p><b>Supply and Deliver 8'6" Standard Concrete Ties for 115RE Rail - PATH</b></p> <p>Please read all bid requirements, terms and conditions prior to preparing you quote. Complete this RFQ form and submit this solicitation package in its entirety. <b>Attaching your company's terms and conditions will cause your bid to be deemed non-responsive.</b></p> <p><b>In addition to signing this RFQ form, please provide:</b>                      Print name: _____                      Email address: _____                      Lead Time A.R.O.: _____</p> <p><b>Attachments:</b> "Port Authority Trans-Hudson Corporation -Specifications for Concrete Ties" and "Drawing Number CT-01" are to be made part of this Contract.</p> <p><b>Pricing must include all Pandrol Fast clip fastener components for standard gauge 4'8 1/2" (clips, pads and insulators).</b></p> <p><b>Delivery:</b> Deliveries must be made between the hours of 8:00 AM and 2:30 PM Monday through Friday.</p> <p>A price preference of 10% is available for NY/NJ Minority and Women Business Enterprises (MBE/WBE) or 5% for NY/NJ Small Business Enterprises (SBE) certified by the Port Authority of New York and New Jersey by the day before bid opening for awards not exceeding \$1,000,000.                      My firm was certified as a _____ on _____.</p>		
	<b>PLEASE QUOTE FULLY DELIVERED PRICES</b>	<b>PAYMENT TERMS</b>	<b>Total Delivered Price</b>

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

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 TRANS-HUDSON CORPORATION opens this proposal.

Signed \_\_\_\_\_ Date \_\_\_\_\_  
 Firm Name \_\_\_\_\_

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Quantity	Description	Unit Price	Total
	<p><b>BID SUBMISSION INSTRUCTIONS:</b></p> <p>The Port Authority has temporarily ceased public bid openings and will allow for the electronic submission of bids.</p> <p>Bidders are advised that their bids must be electronically submitted as a readable Adobe PDF or in the format as provided by the Port Authority. The Port Authority shall only accept bids in electronic format until 11:00 A.M. ET on the Bid Due Date.</p> <p>Electronic Bids should be submitted via email only to Bid Custodian at bidrfpsubmittal@panynj.gov. Each electronic Bid submission must include all required information. The Port Authority may request an original, signed paper submission at any time following the Bid Due Date.</p> <p>Each email submission should include the Due Date, Bid #, and solicitation title.</p> <p>If requested by the Port Authority, the paper submission must be identical to the electronic submission that was submitted by the Bid Due Date. In the event of a discrepancy, the electronic submission shall take precedence.</p> <p>THERE WILL BE NO PUBLIC BID OPENINGS AND HAND DELIVERIES WILL NOT BE ACCEPTED. Bid results will be</p>		
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Quantity	Description	Unit Price	Total
	<p>posted to the Port Authority's website as soon as they are available.</p> <p>Bidders should anticipate that some emails may take a period to be delivered, and as such, should send them as early as possible to ensure it is received no later than 11:00 A.M. ET in the designated Port Authority's designated email account.</p> <p>Bidders should note that there is a limit to the size of attachments that can be received by the Port Authority's designated email account. That limit is 100MB. Additionally, Bidders must check their files to ensure they have submitted complete documents, i.e. no missing pages.</p> <p>Bidders' internal networks may have limits on the size of emails they can send. Therefore, it is incumbent upon the Bidder to determine ahead of time that the file(s) being submitted can both be transmitted by their servers and accepted by Port Authority servers. If the files are too big, the Port Authority will accept Bid in multiple emails, provided all parts which comprise a complete submission are received by the Bid Due Date and time and all emails should include the Bid # and title. Under this circumstance, Bidders should note in the description of the email that the Bid will be arriving in multiple parts and include in the subject line the total number of components and which component, of the total, the particular transmission represents.</p>		
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<b>Vendor:</b>	<b>Bid # / Bid Due Date</b> 60932 / 04/23/2020
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Quantity	Description	Unit Price		Total
350 EA	Standard Concrete Ties 350 ea. of 8"-6" Standard Concrete Ties for 115RE Rail. Includes all Pandrol Fast Clip fastener components (clips, pads and insulators) for standard 115RE gauge of 4'-8 1/2". Manufacture as specified in the attached document entitled: "Port Authority Trans Hudson Corporation Specifications for Concrete Ties" dated 08/04/2017 and PATH Drawing No. CT-01.			
	<b>PLEASE QUOTE FULLY DELIVERED PRICES</b>	<b>PAYMENT TERMS</b>	<b>Total Delivered Price</b>	

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Signed \_\_\_\_\_ Date \_\_\_\_\_  
 Firm Name \_\_\_\_\_

PA280/9-03

## TERMS AND CONDITIONS

1. For the purposes of this Request For Quotations (RFQ), the terms "Authority," "Port Authority," or "PA" mean the Port Authority of New York and New Jersey and/or the Port Authority Trans Hudson Corporation ("PATH,") as applicable.
2. The Port Authority reserves the right to request information relating to seller's responsibility, experience and capability to perform the work.
3. Prices must be quoted in United States Dollars. All figures inserted will be interpreted as being quoted in United States Dollars. Unless otherwise specified, unit prices shall be quoted to two (2) decimal places.
4. Unless otherwise provided, complete shipment of all items must be in one delivery FOB delivery point freight included. Payment will not be made on partial deliveries unless authorized in advance by the PA and any discount, if applicable, will be taken on the total order.
5. Inspection and acceptance will be conducted at the delivery point, unless otherwise provided. Any risk of loss will be the seller's responsibility until such delivery and acceptance is made, unless loss results from negligence of the Authority.
6. PA payment terms are net 30 days. Cash discounts for prompt payment of invoices may be quoted, but will not be considered in determining award.
7. Separate unit and total FOB delivered prices must be shown. In the event of a discrepancy between unit prices and total prices, unit prices will govern.
8. 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.
9. The PA shall have the absolute right to reject any or all quotes or to accept any quote in whole or part and to waive defects in quotes.
10. Unless "no substitute" or "no approved equal" is indicated, seller may offer alternate manufacturer/brands, which shall be subject to Port Authority approval. Please indicate details of product being offered with its quote. Brand name or equal descriptions are used as a means to define the performance or other salient characteristics of procurements. In the subject RFQ, even if the phrase "or approved equal" is inadvertently omitted, it is implied after any brand name.
11. Acceptance of seller's offer will be only in writing, authorized by the PA. No changes shall be made to any agreement resulting from this RFQ, except in writing, authorized by the PA.
12. If the seller fails to perform in accordance with the terms of this RFQ, or the terms of any agreement resulting from this RFQ, 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, per order included in this RFQ, plus any other damages to the PA.
13. The PA may cancel this RFQ at any time, when it is in the PA's best interest, via an addendum. The PA may terminate any agreement resulting from this RFQ, in accordance with terms and conditions of that agreement, in which case the successful seller ("Vendor") shall be paid for items received and accepted, including shipping costs, if applicable, up to the time of termination, unless otherwise provided for in that agreement. The Vendor shall promptly submit its final invoice to the PA to be paid to the Vendor.
14. Upon request, sellers are encouraged to extend the terms and conditions of any agreement resulting from this RFQ with the PA to other government and quasi-government entities by separate agreement.

15. By signing this RFQ, the seller certifies to all relevant statements on Form PA 3764A (copy can be obtained at <http://www.panynj.gov/business-opportunities/become-vendor.html>), including but not limited to those relating to the submission of bids. As set forth on PA 3764A, the PA has adopted a policy that it will honor a determination by an agency of the State of New York or New Jersey that a seller is not eligible to bid on or be awarded public contracts because the seller 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 will apply to any agreement resulting from this RFQ.

16. The Vendor may subcontract the services or use a supplier for the furnishing of materials required hereunder to such persons or entities as the PA, may, from time to time, expressly approve in writing. All further subcontracting shall also be subject to such approval by the PA. All persons to whom the Vendor subcontracts services shall be deemed to be its agents and no subcontracting or approval thereof shall be deemed to release the Vendor from its obligations under any agreement resulting from this RFQ.

17. The Vendor may not assign any subsequent agreement resulting from this RFQ without written consent of the PA.

18. The 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 RFQ or any subsequent 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.

19. Notwithstanding anything to the contrary, the seller acknowledges that the Port Authority's obligations, if any, under this RFQ, or any agreement resulting from this RFQ, are subject to the provisions of its Public Records Access Policy, and any amendments thereto, and any disclosure made pursuant thereto is not a violation of this RFQ. The Port Authority Public Records Access Policy can be found at <http://corpinfo.panynj.gov/documents/Access-to-Port-Authority-Public-Records/>, and is incorporated herein.

20. Neither the Commissioners of the Port Authority, nor Directors of PATH, nor any of them, nor any officer, agent or employee thereof, shall be charged personally by any seller with any liability, or held personally liable to any Contractor under any term or provision of this RFQ (or any agreement resulting from this RFQ), or because of its execution or attempted execution, or because of any breach, or attempted or alleged breach, thereof.

21. MBE/WBE GOOD FAITH PARTICIPATION - The Vendor shall use every good-faith effort to provide for participation by Port Authority Certified Minority Business Enterprises (MBEs) and Port Authority Certified Women-owned Business Enterprises (WBEs) in all purchasing and subcontracting opportunities associated with any agreement resulting from this RFQ, including purchase of equipment, supplies and labor services. If this RFQ contains participation goals, the Vendor shall use good faith efforts to achieve the goals.

Good faith efforts to include and facilitate participation by MBE/WBEs shall include, but not be limited to the following:

- A. Dividing the services and materials to be procured into smaller portions, where feasible.
- B. Giving reasonable advance notice of specific contracting, subcontracting and purchasing opportunities to such MBE/WBEs as may be appropriate.
- C. Soliciting services and materials from a Port Authority certified MBE/WBE. To access the Port Authority's Directory of MBE/WBE Port Authority certified firms go to <http://www.panynj.gov/business-opportunities/sd-mwstdbe-profile.html>.
- D. Ensuring that provision is made to provide progress payments to MBE/WBEs as defined in the prompt payment provision below.
- E. Observance of reasonable commercial standards of fair dealing in the respective trade or business.

22. If this solicitation has not been set aside for the purposes of making an award based on bids solicited from Port Authority certified Minority Business, Women Business or Small Business Enterprises as indicated within this RFQ,

a price preference of 10% is available for NY/NJ Minority and Women Business Enterprises (M/WBEs) or 5% for NY/NJ Small Business Enterprises(SBEs) certified by the Port Authority (PA) by the day before bid opening for awards not exceeding one million dollars (\$1,000,000.)

23. Non-Discrimination Requirements - The Vendor shall take all necessary and reasonable steps to ensure non-discrimination in the performance and administration of all aspects of any agreement resulting from this RFQ.

A. Vendor hereby agrees that no person on the ground of race, color, national origin, creed / religion, sex, age, or handicap / disability shall be excluded from participation in, denied the benefits of, or be otherwise subjected to discrimination in the furnishing of goods or services or in the selection and retention of subcontractors and /or vendors under any agreement resulting from this RFQ. Vendor shall also ascertain and comply with all applicable federal state and local laws, ordinances, rules, regulations and orders that pertain to equal employment opportunity, affirmative action, and non-discrimination in employment.

B. Vendor agrees that these "Non-Discrimination Requirements" are a binding part of any agreement resulting from this RFQ. Without limiting the generality of any other term or provision of this RFQ or any agreement resulting from this RFQ, in the event the Authority, or a state or federal agency finds that the Vendor or any of its subcontractors or vendors has not complied with these "Non-Discrimination Requirements," the Authority may cancel, terminate or suspend this RFQ or any agreement resulting from this RFQ.

C. Vendor agrees to cooperate fully with the Authority's investigation of allegations of discrimination. Cooperation includes, but is not limited to, allowing the Authority to question employees during the investigation of allegations of discrimination, and complying with directives that the Authority or the State or Federal government deem essential to ensure compliance with these "Non-Discrimination Requirements."

24. To the extent permitted by law, the Vendor shall indemnify and hold harmless the Port Authority, its Commissioners, Directors, agents, servants, officers, representatives and employees from and against all claims and demands, just or unjust, of third persons (including Vendor's agents, servants, officers, representatives and employees) arising out of or in any way connected to or alleged to arise out of or alleged to be in any way connected with any subsequent agreement resulting from this RFQ and all other services and activities of the Vendor under any subsequent agreement resulting from this RFQ and for all expenses incurred by it and by them in the defense, settlement or satisfaction thereof. The Vendor assumes the following risks, whether such risks arise out of or are in any way connected to the Vendor's operations or to its performance of work under any agreement resulting from this RFQ, or arise out of acts or omissions (negligent or not) of the Vendor, the Port Authority or third persons (including agents, servants, officers, representatives, Commissioners, Directors and employees of the Port Authority and the Vendor) or from any other cause, excepting only risks occasioned solely by affirmative willful acts of the Port Authority done subsequent to the opening of bids/quotes on this RFQ, and shall to the extent permitted by law indemnify the Port Authority for all loss or damage incurred in connection with such risks: (a) the risk of any and all loss or damage to Port Authority or Vendor property, equipment, materials and possessions, and those of Vendor's agents, employees, materialmen or others performing work under any agreement resulting from this RFQ, on or off the premises, the loss or damage of which shall arise out of the Vendor's operations under any agreement resulting from this RFQ; and (b) the risk of claims, whether made against the Vendor or the Port Authority, including those, whether just or unjust, of third persons (including agents, servants, officers, representatives, Commissioners, Directors and employees of the Port Authority and the Vendor), for any and all injuries, loss or damages occurring to any property, equipment, materials and possessions of the Contractor's agents, employees, materialmen and others performing work under any agreement resulting from this RFQ.

25. Seller's attention is directed to the Port Authority's "Code of Ethics for Port Authority Vendors" (the "Code"). The Code will be made apart of any agreement resulting from this solicitation. The Code can be found at <https://www.panynj.gov/business-opportunities/become-vendor.html>.

26. The PA has transitioned to an all electronic method of paying its vendors and contractors via an Automated Clearing House (ACH) funds transfer. The Vendor must complete the Port Authority's "Authorization Agreement For Direct Deposits And Direct Payments (ACH Credits)" form, which is available at <http://www.panynj.gov/business-opportunities/become-vendor.html>, in order to receive payment. To avoid delays in payments for commodities and services provided, vendors and contractors must be enrolled in ACH. The Authorization Agreement shall remain in full force and effect until the Port Authority has received written notification from the Vendor of its termination in such time and in such manner as to afford the Port Authority and the depository financial institution(s) a reasonable opportunity to act on it. Any questions on this initiative may be directed to the ACH Enrollments contact line at 201 216-6002 or emailed to [ACHENROLLMENT@PANYNJ.GOV](mailto:ACHENROLLMENT@PANYNJ.GOV).

27. Prospective Bidders are advised that additional vendor information , including but not limited to, forms, documents and other information, including protest procedures, may be found on the Port Authority website at: <http://www.panynj.gov/business-opportunities/become-vendor.html>.

*The Port Authority of New York and New Jersey (Port Authority), in accordance with the provisions of Title VI of the Civil Rights Act of 1964 (78 Stat. 252, 42 U.S.C. §§ 2000d to 2000d-4) and the Regulations, hereby notifies all bidders that it will affirmatively ensure that any contract entered into pursuant to this advertisement, disadvantaged business enterprises will be afforded full and fair opportunity to submit bids in response to this invitation and will not be discriminated against on the grounds of race, color, or national origin in consideration for an award.*

*Additionally, all bidders (including proposers, and respondents, as applicable) are notified that the Port Authority will ensure that, with respect to any contract/agreement entered into pursuant to this advertisement, disadvantaged business enterprises, minority business enterprises and woman-owned business enterprises, as applicable, will be afforded full and fair opportunity to submit bids, proposals and responses, as applicable, in response to this invitation, and will not be discriminated against on the grounds of race, color, or national origin in consideration for an award.*

**PORT AUTHORITY TRANS-HUDSON CORPORATION  
SPECIFICATIONS FOR CONCRETE TIES**

August 4, 2017

**PART 1 – GENERAL**

**1.01 DESCRIPTION**

- A. This Section includes specifications for design, fabrication of component parts, manufacturing, qualification testing, quality control, handling, shipping, and unloading and stockpiling of monoblock prestressed concrete cross ties, together with cast rail fastening shoulders and embedded inserts.
- B. The concrete tie shall consist of:
  - 1. Standard 8 feet-6 inch cross tie with embedded rail fastening shoulders and insulated threaded inserts for attachment of the third rail extension channel.
  - 2. Rail fastening spring clips.
  - 3. Rail insulating elastomeric base pads.
  - 4. Rail spring clip insulators.
- C. Track Configuration for Concrete Tie Design: Concrete cross tie design loading using AREMA's Flexural Performance Requirements are for use in ballasted track sections with 115 RE rail and 4 feet – 8 1/2 inch gauge. For purposes of design of the concrete ties only, the design spacing shall be 30 inches.
- D. The ties shall be fabricated with multiple side and bottom indentations or projections to increase the resistance against lateral track movements in the ballast, or PATH-approved equal in form, fit and function.
- E. The ties shall be designed and fabricated for interspersal with existing wood ties. The current wood ties are in fair condition all with Pandrol plates with “e” clips and very little plate cutting, gauge is 4 feet-8 1/2 inches, generally the ballast is dry and in good condition. It is anticipated that the new concrete ties will be installed in three passes to replace all of the wood ties over the course of approximately 3 three months.

**1.02 REFERENCES**

<b>Sponsor</b>	<b>Number</b>	<b>Subject</b>
ACI	301-16	Specifications for Structural Concrete.
ACI	305.1-14	Specification for Hot Weather Concreting.
ACI	318-14	Building Code Requirements for Structural Concrete
AREMA		Volume I, Chapter 30, "Ties," Part 4, hereinafter referred to as the AREMA Manual.

<b>Sponsor</b>	<b>Number</b>	<b>Subject</b>
ASTM	A536	Standard Specification for Ductile Iron Castings.
ASTM	A881	Standard Specification for Steel Wire, Indented, Low-Relaxation for Prestressed Concrete.
ASTM	C31	Standard Practice for Making and Curing Concrete Test Specimens in the Field.
ASTM	C33	Standard Specification for Concrete Aggregates.
ASTM	C39	Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
ASTM	C78	Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading).
ASTM	C143	Standard Test Method for Slump of Hydraulic-Cement Concrete.
ASTM	C150	Standard Specification for Portland Cement.
ASTM	C172	Standard Practice for Sampling Freshly Mixed Concrete.
ASTM	C231	Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
ASTM	C289	Standard Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method).
ASTM	C359	Standard Test Method for Early Stiffening of Hydraulic Cement (Mortar Method).
ASTM	C494	Standard Specification for Chemical Admixtures for Concrete.
ASTM	C586	Standard Test Method for Potential Alkali Reactivity of Carbonate Rocks as Concrete Aggregates (Rock Cylinder Method).
ASTM	C1602	Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete.
ASTM	D257	Standard Test Methods for DC Resistance or Conductance of Insulating Materials.
ASTM	D570	Standard Test Method for Water Absorption of Plastics.
ASTM	D573	Standard Test Method for Rubber-Deterioration in an Air Oven.
ASTM	D732	Standard Test Method for Shear Strength of Plastics by Punch Tool.
ASTM	E122	Standard Practice for Calculating Sample Size to Estimate, with Specified Precision, the Average for a Characteristic of a Lot or Process.
PCI	MNL 116	Manual for Quality Control for Plants and Production of Structural Precast Concrete Products.

### **1.03 DESIGN CRITERIA AND REQUIREMENTS**

- A. Design: Prepare the final design of each of the types of concrete cross ties and appurtenances required:
  - 1. Monoblock concrete ties with Pandrol shoulders, fast clip running rail fasteners and insulated threaded inserts for attachment of the third rail extension plate bracket for use in ballasted track.

- B. Track Configuration: Prestressed concrete switch ties shall be designed for use in ballasted track sections with 115 RE continuously welded rail. The track gauge shall be 4 feet – 8 1/2 inches and the tie spacing shall be based on 30 inches. The tie support foundation shall be based on a minimum 12-inch layer of crushed quarry rock ballast stone and 8-inch layer of subballast. The allowable bearing pressure at the tie/ballast interface shall be limited to 65 psi.
- C. Installation and Track Maintenance: The compaction of ballast under and around the concrete tie will be done by using hydraulic or electric activated tamping tools on a production ballast tamper. The tie must resist these tamping forces without spalling of concrete on the sides and bottom corners.
- D. Design Parameters and Operating Conditions
  - 1. Maximum spacing is 30 inches.
  - 2. Multiple unit electrically propelled trains up to 10 cars operating at speeds of up to 60 mph on mainline track.
  - 3. The annual tonnage is 30 million gross tons.
  - 4. Design moments and test loads for the concrete ties are as follows:

<b>Tie End to Rail Centerline</b>	<b>Rail Seat Positive</b>		<b>Rail Seat Negative</b>		<b>Center Positive</b>		<b>Center Negative</b>	
	M	P	M	P	M	P	M	P
Length 21"	248.4 in-k	42.3 k	131.7 in-k	23.9 k	116.7 in-k	8.6 k	166.4 in-k	12.3 k

- E. Tie Design, Components, and Dimensions:
  - 1. Concrete ties shall be of a prestressed monoblock design, provided with steel prestressing tendons and rail fastenings consisting of embedded cast iron shoulders, Pandrol standard drive on spring clips, plastic insulators, and pads. Threaded fastener inserts shall be provided for attachment of the switch, heel plates, frog plates, and third rail extension bracket.
    - a. Concrete ties with designs which have already passed tests equivalent to those specified herein may be accepted without additional testing as determined by the PATH.
    - b. For such acceptance to be given, certified laboratory test reports shall be submitted in sufficient detail as required by the PATH to make the determination as to its equivalency.
    - c. The concrete ties shall be suitable for use as the transverse components of a 115RE crossover or turnout with straight switch points.
  - 2. The tie design and fabrication shall be subjected to the acceptance tests specified in Section 3.07. Failure of the concrete ties to pass the prescribed tests will be cause for rejection.

3. Location and tolerances of rail fastener shoulders shall be in accordance with the fastener manufacturer's drawings and specifications.
- F. Rail Fastener Assembly:
1. Cross ties and turnout ties shall include cast shoulders for the Pandrol Type "fast clip" Series rail clips.
  2. Ties shall be designed so that the rail clips can be easily installed or replaced in the field by one man using standard, readily available track tools. Clips shall also be capable of being installed by commercially available automated equipment. Clip installation and removal shall not damage the tie, shoulder, clip, or rail. The rail clip shall not notch nor otherwise damage the rail base during installation or removal.
  3. Configuration:
    - a. Recesses in the fastener shall be free draining of water and debris in all positions of lateral adjustment, and at all values of track superelevation from 0 inch to 6 inches. Fastener surfaces shall be resistant to conductive oil and dirt buildup and facilitate effective periodic cleaning by track maintenance equipment and personnel.
    - b. Rail seat shall be sloped at 40:1 toward the gauge side of the rail.
  4. Rail fastener assembly shall be subjected to the acceptance tests specified under Section 3.08. Failure of the fastening system to pass the prescribed tests will be cause for rejection.
    - a. Existing fastener designs which have already passed tests equivalent to those specified herein may be accepted without additional testing as determined by the PATH.
    - b. For such acceptance to be given, certified laboratory test reports shall be submitted in sufficient detail as required by the PATH to make the determination as to its equivalency.
- G. Cap plugs: Shall be furnished for each insert to prevent entry of moisture and debris.

#### 1.04 SUBMITTALS

A. General

Submit the following to the PATH for review and approval at least 30 days before fabrication:

B. **Submittals:**

	<u>Title</u>	<u>Reference</u>
1.	Shop Drawings	1.04.C and 1.04.H
2.	Samples	1.04.J

3.	Material Certificates	1.04.G
4.	Plant Certification	1.06
5.	Concrete Mix Design	3.01
6.	False Set Penetration Test	2.01.A
7.	Uniformity of Cement	2.01.A
8.	Aggregate Tests (ASTM C33)	2.01.B
9.	Alkali-Carbonate Reaction	2.01.B
10.	Water Soluble Chlorides	2.01.C
11.	Admixtures Tests	2.01.D
12.	Compressive Strength Test	3.02.A
13.	Flexural Strength Test	3.02.A
14.	Acceptance Tests	
	a.	Design Criteria and Requirements 1.03
	b.	Rail Seat Vertical Load Test 3.07.C
	c.	Rail Seat Repeated Load Test 3.07.D
	d.	Center Negative Bending Moment Test 3.07.E
	e.	Center Positive Bending Moment Test 3.07.F
	f.	Bond Development, Tension Anchorage and Ultimate Load Test 3.07.G
	g.	Fastening Insert Test 3.07.H
	h.	Fastener Uplift Test 3.07.I
	i.	Electrical Impedance Test 3.07.J
	j.	Fastening Repeated Load Test 3.08.C
	k.	Fastening Longitudinal Restraint Test 3.08.D
	l.	Fastening Lateral Load Restraint Test 3.08.E
	m.	Tie Pad Test 3.08.F
	n.	Tie Pad Attenuation Test 3.08.G

- o. Wear/Abrasion Test 3.08.H
  - p. Single Tie Lateral Push Test 3.08.I
- C. **Shop Drawings:** Submit one reproducible and six legible copies of all Shop Drawings for concrete ties for approval. These drawings are to be complete and detailed. Shop Drawings shall consist of fabrication diagrams, all dimensions, including a layout of the steel prestressing tendons, rail fastening components, inserts, and any other pertinent information.
- D. **On Site Review and Acceptance:** Submit a quality control plan for the manufacture of ties and components, and a fabrication plan describing the tie manufacturing process. Submit the method of handling, shipping, unloading, and stacking of concrete cross ties for review and approval at least four weeks before shipping of the concrete cross ties.
- E. **Concrete Tie Marking Scheme:** Provide a concrete tie marking scheme for identification of ties and submit to the PATH.
- F. **Test Records and Documentation:** Provide test records and all other required test documentation, for informal review during the in-plant inspection and formally submit for approval prior to shipping of the ties.
- G. **Certified Test Reports:** Submit test reports and/or certificates of compliance for the tests identified in Section 1.04.B, 3.07 and 3.08 of this specification and that the test reports and other specified documents comply with these specifications.
- H. Shop Drawings and Data requirements:
  - 1. Shop Drawings show the general arrangement and such details as are necessary to provide a comprehensive description of the work to be performed.
  - 2. As indicated below, prepare Shop Drawings including design calculations and other data as may be required by the Specifications as are necessary to adequately perform the work.
  - 3. Furnish Contractor's Shop Drawings on sheets measuring 22 inches by 34 inches. On each drawing, provide a blank area 5 square inches, located adjacent to the title block. The title block shall display the following:
    - a. Contract Number and Name.
    - b. Number and Title of the Drawing.
    - c. Date of Drawing or Revision Date and Number.
    - d. Name of Contractor Submitting Drawing.

- I. Furnish tie-design calculations prepared in accordance with AREMA Chapter 30, Part 4 including bending moments and loads for specified tests, and other required data on standard 8-1/2 by 11 inch sheets, printed on one side only. Each sheet shall bear the information required by paragraph H.3 above, except that the 5 inch square blank space will not be required. Report shall be sent to Leong Chan, 7<sup>th</sup> Floor, One PATH Plaza, Jersey City, NJ, 07306 prior to the manufacture of any tie.
  
- J. Samples:
  - 1. Unless otherwise indicated, submit not less than two identical samples of each type of component to be used in the fabrication prior to supply of concrete tie.
  
  - 2. Label each sample indicating:
    - a. Contract Name and Number.
    - b. Name of Contractor and Subcontractor.
    - c. Material or equipment represented.
    - d. Source.
    - e. Name of producer and brand.
    - f. Reference Specifications Section and Article Number.

## **1.05 QUALITY ASSURANCE AND CONTROL**

- A. Qualifications of Fabricator:
  - 1. Concrete ties shall be produced in a plant or production facility by a fabricator who has been regularly and continuously engaged in the manufacture of precast, prestressed concrete products for a minimum of five years. In addition, the fabricator shall have had experience in the fabrication of precast, prestressed concrete cross ties similar to the ties indicated.
  
  - 2. The fabricator shall have sufficient production capacity to produce the required number of ties in accordance with the quality requirements and without causing any delay in the work.
  
  - 3. The fabricator shall furnish certification that all aspects of the yard operation, including materials testing, storage, and handling conform to the quality control requirements herein, and current industry standards as defined in PCI MNL 116 – Manual for Quality Control for Plants and Production of Structural Precast Concrete Products.
  
  - 4. Current certification by PCI throughout the fabrication period will be accepted as evidence of conformance with this requirement.
  
  - 5. Certification by a qualified, independent consultant or laboratory will also be accepted as evidence of conformance with this requirement. Initial certification shall be based on a plant inspection of yard operations and quality control procedures. The PATH shall be notified prior to the inspection and may attend. At least two follow-up inspections

shall be performed during the production run, and after each certificate of conformance submitted to the PATH.

- B. Tolerances: Fabricate concrete ties within the tolerances indicated and specified. When not indicated or specified, conform to tolerances specified in the AREMA Manual.

## **PART 2 – PRODUCTS**

### **2.01 CONCRETE**

- A. The concrete used for concrete ties shall have a minimum 28-day compressive strength of 7,000 pounds per square inch as determined by ASTM Designation: C39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens. The test cylinders shall be made and stored in accordance with ASTM Designation: C31, Standard Practice for Making and Curing Concrete Test Specimens in the Field. The Portland Cement used shall be low alkali cement with a maximum alkali content of 0.6 percent conforming to ASTM Designation: C150, Standard Specification for Portland Cement, Type III low alkali. Conduct false set penetration tests per ASTM Designation: C359, Standard Test Method for Early Stiffening of Hydraulic Cement (Mortar Method). False set penetration values shall not be less than 50 mm initially, 35 mm at intermediate times, and 40 mm after remix.
- B. Concrete Aggregates: Fine and coarse aggregates shall be clean, hard, strong, durable, and free of deleterious material.
  - 1. Aggregates shall be natural aggregates conforming to ASTM Designation: C33, Standard Specification for Concrete Aggregates, Class 4S.
  - 2. Soluble sulfates and chlorides shall not exceed the values given in Table 19.3.1.1 of ACI 318-14, for prestressed sections.
  - 3. The manufacturer shall submit evidence that concrete containing aggregate from the proposed source, with a cement content and alkali burden similar to the job mix, has a satisfactory service history of at least 10 years. This evidence shall include concrete with ASTM Designation: C33, Standard Specification for Concrete Aggregates, Class 4S aggregate.
  - 4. The manufacturer shall submit evidence that the fine and coarse aggregates do not react with alkalis in the cement, to the extent that excessive expansion in the concrete may result. The results shall be interpreted as outlined in ASTM Designation: C33, Standard Specification for Concrete Aggregates.
    - a. Evaluation of potential alkali-silica reactivity shall be made according to:  
  
ASTM Designation: C289, Standard Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method)
    - b. Evaluation of potential alkali-carbonate reactivity for aggregates containing dolomites/limestones shall be made according to:

ASTM Designation: C586, Standard Test Method for Potential Alkali Reactivity of Carbonate Rocks as Concrete Aggregates (Rock Cylinder Method)

5. The maximum size of aggregate shall be 3/4 inch (size number 67) for coarse aggregate gradation. If the coarse or fine aggregate is supplied in more than one size, each size shall be stored separately.
  6. Washed aggregate shall be allowed to drain in stockpiles before use. All aggregates shall be free from ice when used.
- C. Water: Mixing water shall be fresh water complying with the requirements of ASTM Designation: C1602, Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete and the following additional requirements:
1. pH shall be between 6.0 and 8.0.
  2. Chloride content shall not exceed 500 ppm.
  3. Sulfate content shall not exceed 3,000 ppm.
  4. Alkalies content shall not exceed 600 ppm.
  5. Total solids content shall not exceed 50,000 ppm.
- D. Concrete Admixtures: Accelerating, Retarding, and Water-Reducing Admixtures: Water-reducing admixtures, retarding admixtures, and accelerating admixtures, if used, shall conform to ASTM Designation: C494, Standard Specification for Chemical Admixtures for Concrete. In no case shall admixtures containing chlorides be used.

## **2.02 PRESTRESSING WIRE**

- A. The wire shall be 0.2094 inch diameter, indented low-relaxation steel wire complying with ASTM Designation: A881, Standard Specification for Steel Wire, Indented, Low-Relaxation for Prestressed Concrete.
1. The wire (Stress relieved or mill coil (non-stress relieved)) shall be from an approved source of supply. Acceptance of the wire shall be dependent on the tie manufacturer showing that the wire meets the following strength requirements as specified in Section 2.02.A.2 and that the ties meeting all specified requirements can be produced using the wire. It is also the responsibility of the tie manufacturer to monitor the wire used in production to ensure consistent quality.
  2. The prestressing wire used shall be an indented wire 0.2094 inch in nominal diameter with a minimum breaking load of 39.1kN or 9,000 lbf.

## **2.03 IRON SHOULDERS**

- A. Ductile iron shoulders shall be obtained by the concrete tie manufacturer and shall conform with ASTM Designation: A536, Standard Specification for Ductile Iron Castings, Grades 60-

40-18 or 65-45-12; Pandrol part No's 4714 and 7250 insulated. The shoulders shall be marked, on non-bearing surfaces above the concrete level, with the part number, supplier's identification, and pattern number.

1. The shoulders shall be free from burned-on sand, cracks, cavities, injurious blow holes, and other defects. All fins shall be removed from the vertical faces of the head of each shoulder. Fins across the top of the head shall not exceed 1/32 inch and below the head, fins shall not exceed 1/16 inch. At gates, there shall be no cavity in the shoulder more than 1/8 inch below the general surface level.
  2. Go and No Go inspection gages shall be used to check that tolerances conform with the iron shoulder drawings. A sampling plan for Acceptable Quality Levels of 1 percent for major dimensions and 4 percent for minor dimensions shall be used in accordance with ASTM Designation: E122, Standard Practice for Calculating Sample Size to Estimate, with Specified Precision, the Average for a Characteristic of a Lot or Process. The manufacturer shall decide which are major and minor dimensions. These shall be indicated on the shop drawings.
- B. Iron shoulders shall be free of mud, oil, loose rust, and other contamination when cast into ties. They shall be rigidly secured in the forms during casting and shall not move within the concrete when the securing device is released. Location within the ties shall comply with the Drawings.
1. The shoulder shall not be directly anchored to the pretensioned steel. The shoulder shall not come in contact with pretensioned steel.

## **2.04 EMBEDDED ANCHOR INSERTS**

- A. Third Rail Extension Channel Inserts
1. 3/4 inch UNC stainless steel insert, Press-Seal Corporation Insulguard NSS-34, 2-3/4" long.

## **2.05 RAIL FASTENING COMPONENTS**

- A. The rail fastening system shall include pads, clips, insulators, and threaded inserts for the third rail extension bracket.
- B. Rail fastening shall be resilient, threadless and detachable. Component part shapes shall be such that they are easily recognizable and are difficult to install incorrectly.
1. Fastening shall be comprised of as few components as economically and technically feasible for ease of assembly, disassembly, and maintenance. The rail clips, railseat pads, and insulators shall be furnished by the rail clip manufacturer.
  2. Construct fastenings so that the rail clips can be installed or replaced in the field by one man using hand tools.
  3. Construct fastenings so that when the rail clips are removed, the rail may be lifted vertically until it is completely free of the fastening shoulder without disturbing the horizontal or vertical alignment of the shoulder, or the adjacent restraining rail bracket.

4. Fastenings shall have, on both sides of the rail base, a positive means of preventing more than 1/8 inch total lateral movement of the rail base relative to the shoulders in case of failure, or loosening of one or both rail clips. The positive means of restraint shall extend at least 3/8 inch, but not higher than 1-3/4 inches above the base of rail in the installed position.
- C. Rail Fastening Spring Clips:
1. Rail clips shall not be dependent on elastomeric components in torsion.
  2. One identical clip design shall be used on the field and gauge side of the rail at the railseat. Pandrol Type "fast clip" Series rail clips shall be used.
  3. The clips shall be reusable after removal through repeated applications without any effect on the operating performance of the system.
  4. No part of the clip shall protrude below the tie surface or into the tie.
  5. The clip shall not have point contact. The clip shall be such that lateral rail movements, within the confines of the shoulders, will not produce transverse denting, carving, or scoring of the rail base. The clip shall be such that longitudinal rail slippage will not produce overstressing, ending, twisting, or other damage to the clips, and will not damage the rail.
  6. Rail clips and insulators used on rail insulated joint bars need not to be identical in design to those used on a standard rail. The clips shall clear the joint bar, shall have similar performance characteristics, shall be made by the same manufacturer, and shall be installed into identical shoulders as the standard rail clip.
- D. Insulators between fastening shoulder and rails:
1. Configuration:
    - a. Provide keys between the insulators and the fastening shoulder to prevent relative motion in any direction.
    - b. The insulators shall cover the full widths of the shoulders.
    - c. 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.
  2. Volume Resistivity:  $10^{12}$  ohm-cm, minimum. Measure in accordance with ASTM Designation: D257, Standard Test Methods for DC Resistance or Conductance of Insulating Materials.
  3. Water Absorption at Saturation: Three percent, maximum. Measure in accordance with ASTM Designation: D570, Standard Test Method for Water Absorption of Plastics.
  4. Dry Shear Strength: 6500 psi, minimum. Measure in accordance with ASTM Designation: D732, Standard Test Method for Shear Strength of Plastics by Punch Tool.

5. The insulator shall be capable of withstanding degradation from oxidation, water, alkali, petroleum oils, synthetic lubricants, and sunlight without having detrimental effect on the performance of the insulator. 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 of the performance of the insulator.
  6. Heat Aging: Age for 10 days at 70°C using ASTM Designation: D573, Standard Test Method for Rubber-Deterioration in an Air Oven as a guide. Compare properties before and after aging at 70°C. 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.
- E. Rail Seat Pads:
1. Provide rail seat pads compatible with the rail fastening system, that have a shape which provides positive means of preventing movement of the pad parallel to the rail. Pad thickness shall be at least 3/16 inch and not more than 1/2 inch, with a width identical to the distance between the shoulder faces on the railseat (+0, -1/16 inch) and a length one inch longer than the railseat bearing area (plus or minus 1/16 inch). Mark pads in a permanent manner to identify manufacturer, month and year manufactured, and pad designation.
  2. Use first quality new ingredients processed and cured in accordance with accepted good practice.
  3. Rail pads shall not be of a material and design; e.g., flat EVA rail pads that have proven to contribute to concrete tie or rail base abrasion, either by testing or railway experience.

## **PART 3 – EXECUTION**

### **3.01 CONCRETE MIX DESIGN**

- A. Trial mixtures using aggregates, water, cement, and admixtures proposed for the manufacture of the concrete ties shall be made using at least three different water-cement ratios which will produce a range of strengths. For each water-cement ratio, at least three specimens for each age shall be made, cured, and tested as described in Section 3.02. Each batch of concrete shall be mixed separately in a pan mixer.
- B. Design compressive strength at the time proposed for transfer of prestress forces to the concrete shall be no less than 4,500 psi, or higher if so required by the tie design or manufacturing method. Design compressive strength at 28 days shall be not less than 7,000 psi. Design flexural strength at 28 days shall be not less than 600 psi.
- C. Aggregates and cement shall be measured by weight. The weight of aggregate shall be based on the saturated surface dry condition corrected for free moisture. Water shall be measured by weight or volume and admixtures shall be measured by volume, unless otherwise directed by the admixture manufacturer.
- D. Mix proportions shall be developed in accordance with ACI 301, Chapter 4-Concrete Mixtures.
- E. Restriction on design mix proportions:
  - 1. The water-cement ratio shall not exceed 0.40 by weight. Water content shall be kept to the minimum consistent with strength requirements and placement needs.
  - 2. Air content in the plastic concrete shall ensure a minimum 4.0 percent air entrainment in the hardened concrete.
- F. The proportions of aggregate to cement shall be such to produce a mixture that will work readily into corners and angles of the form and around the prestressing elements with the assistance of specified vibration, but without permitting the materials to segregate or excess of free water to collect on the surface.
- G. The strength tests shall be made at 28 days. A curve shall be developed for each design mix showing the relationship between water-cement ratio and compressive strength.
- H. Acceptance of trial mix: Substantiate attainment of all specified properties by designated ASTM test methods. Provide concrete that has 56-day compressive strengths that exceed the specified design strength ( $f'_c$ ) in accordance with ACI 301-16 Chapter 4, Table 4.2.3.1 – “Required average compressive strength  $f_{cr}$ , when data are not available to establish standard deviation”.

### **3.02 STRENGTH TESTS OF CONCRETE**

- A. Compressive and Flexural Strength tests shall be made to check the adequacy of the mix proportions and as a basis for acceptance. Samples for compressive test specimens shall be secured in accordance with ASTM Designation: C172, Standard Practice for Sampling Freshly Mixed Concrete. Samples for flexural tests specimens shall be secured and all

specimens shall be made and laboratory cured in accordance with ASTM Designation: C31, Standard Practice for Making and Curing Concrete Test Specimens in the Field. Specimens made to check the adequacy of curing and protection of concrete shall be cured entirely under production conditions.

1. Compressive Strength tests shall be made on 4 inch by 8 inch cylinders in accordance with ASTM Designation: C39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens. For each day of production at least nine cylinders shall be prepared; three for 28 day testing, and three for checking strength at transfer, and three spares.
  2. Flexural Strength tests shall be made on 6 by 6 by 20 inch beams in accordance with ASTM Designation: C78, Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading). Minimum flexural strength (modulus of rupture) at 28 days shall be 600 psi.
- B. Durability of Concrete shall be in accordance with AREMA Chapter 30, Part 4, Article 4.2.2.6. Testing for excessive sulfate content in the cement or excessive temperatures during the curing process shall be testing in accordance with Duggan Concrete Expansion Test as detailed in AREMA Chapter 30, Part 4, Section 4.2.3.

### **3.03 FABRICATION AND FORMS**

- A. Dimensions and Tolerances: The tie design shall be within the following dimensional limits set forth in this section. The finished tie shall not deviate in any dimension from that shown in the Contract Drawing CT-01 for the approved tie design by more than the tolerance associated with that dimension.
1. Nominal Length: Cross ties: end of tie to rail centerline 21 inches. Turnout ties: as per design.
  2. Width of Bottom: 10-3/8 inches plus or minus 1/8 inch.
  3. Width of Top: center of rail seat 9-1/8 inches plus or minus 1/8 inch.
  4. Depth of tie: 6-3/4 inches minimum at any location and 8-1/2 inches at the rail seat, plus 3/16 inch or minus 1/8 inch.
  5. Track Gauge: 4 feet – 8 1/2 inches, plus or minus 1/16 inch, exclusive of rail dimensional tolerances.
  6. Rail Cant: zero cant within the turnout and 1 in 40, plus or minus 5, towards the center line of the tie, for cross ties.
  7. Differential Tilt of Rail Seats: Differential tilt in the direction of the rail of one rail seat to the other shall not exceed 1/16 inch in a width of 6 inches.
  8. The center line of the tie shall be within 1/2 inch of the center line of track gauge.
  9. Chamfer: 1 inch at 45 degrees nominal plus or minus 1/2 inch

10. Rail Seat Plane: The rail seat shall be a smooth, flat surface, plus or minus 1/32 inch.
  11. Surface finish on top and sides shall be smooth except at the rail seat. A random scattering of surface voids will not be cause for rejection.
  12. Identification Marking: submit the identification system for approval. Markings must be such that they will remain legible for the design life of the ties. Permanently label ties by indented or raised numerals or letters on the top surface to identify the following:
    - a. Manufacturer's I.D.
    - b. Form Number
    - c. Tie number
    - d. Year of manufacture
    - e. Date code traceable to day of manufacture
- B. Method of Production: Monoblock ties shall be manufactured in accordance with AREMA Chapter 30, Part 4, Section 4.9.2.
- C. Forms:
1. Forms shall be rigid and constructed of material that will result in finished ties conforming to the shape, lines, dimensions, and tolerances called for on the Contract Drawings.
  2. Forms shall be constructed to permit movement of the tie without damage during release of the prestressing force.
  3. Forms shall provide proper marking with indented or raised letters or numerals to identify the manufacturer and year of production. Marking shall be placed on top of tie surface.

### 3.04 PLACEMENT OF PRESTRESSING STEEL

- A. Prestressing force in each of the strands shall be 16,750 pound +/- 500 pounds.
- B. The 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. Prestressing force shall be determined by (1) measuring strand elongation and also (2) by either checking jack pressure on a calibrated gauge or by the use of a calibrated dynamometer. The cause of discrepancy that exceeds 5 percent shall be ascertained and corrected. Elongation requirements shall be taken from average load elongation curves for the steel used.
- D. Strands shall be stretched either individually or simultaneously. If strands are stretched simultaneously, provision for taking up slack and equalizing stress shall be made individually as required to induce approximately equal stress in each strand.
- E. Transfer of force from bulkheads of the pretensioning bed to the concrete shall be accomplished by gradual and simultaneous detensioning of all strands. Exposed strands shall be cut near the tie end. The projection of strands beyond the ends of the ties shall be no more than 1/4 inch.

### 3.05 MIXING, PLACING, AND CURING OF CONCRETE

- A. Preparation for Placing Concrete:
  - 1. Prior to the placing of concrete, all equipment for mixing the concrete shall be clean, all debris shall be removed from spaces to be occupied by the concrete, the forms shall be thoroughly coated with a bond-breaker, and the reinforcement shall be thoroughly cleaned of deleterious coatings. The iron shoulder and prestressing wire shall not be contaminated with bond-breaker or any other substance which would interfere with bond development. The forms shall be inspected for alignment, tightness of joints, and dimensional accuracy of the position of bulkheads, prestressing steel, inserts, etc., shall be verified.
  - 2. Proportioning of Component Materials:
    - a. Fine and coarse aggregates and cement shall be measured by weight. Weights of aggregates shall be based on a saturated surface dry condition corrected for free moisture.
    - b. Water and liquid admixtures may be measured by either weight or volume.
  - 3. The accuracy of measurement of the various components of concrete shall be within the following limits:

Cement	1%
Water	1%

Fine aggregate	2%
Coarse aggregate	2%
Cumulative aggregate	2%
Admixtures	3%

B. Mixing of Concrete:

1. Mixing equipment shall be capable of combining all specified materials within the time specified by the equipment manufacturer into a thoroughly mixed and homogeneous mass, and discharging the mixture without segregation.
2. All concrete shall be mixed until there is a uniform distribution of the materials and shall be discharged completely before the mixer is recharged.
3. Optimum mixing time shall be established by the equipment manufacturer's recommendations. Generally, minimum mixing time shall be one minute for batches of one cubic yard or less. This mixing time shall be increased by at least 15 seconds for each cubic yard, or fraction thereof, of capacity in excess of one cubic yard. Mixing time shall not exceed three times the specified time.

C. Conveying:

1. Concrete shall be conveyed from the mixer to the place of final deposit in the shortest possible time by methods that will prevent segregation or loss of materials.
2. Equipment for chuting, pumping, and pneumatic conveying of concrete shall be of such size and design as to assure flow of concrete at the delivery location without segregation of materials.

D. Depositing:

1. Concrete shall be deposited as nearly as practical in its final position to avoid segregation due to rehandling or flowing. No concrete that has partially hardened or has been contaminated by foreign materials shall be used.
2. Concrete shall not be placed when the ambient air temperature of the casting room is below 40°F. Concrete shall have a minimum temperature of 50°F, and a maximum temperature of 90°F. When concrete is placed at an ambient temperature of 90°F or greater, ACI 305.1-14 "Specification for Hot Weather Concreting" shall be followed to prevent rapid drying and other detrimental effects of elevated temperature on fresh concrete.

E. Consolidating:

1. All concrete shall be thoroughly consolidated by vibration during placement, and shall be thoroughly worked around the prestressing elements and embedded fixtures, and into corners of the forms. Consolidation at the ends of ties is paramount to comply with the void tolerance specified in Section 3.06.B.1.

2. External form vibration, supplemented if necessary, by internal vibration shall be used to obtain uniform mix, and shall be sufficient to yield concrete with a density not less than 148 pounds per cubic foot.
  3. Care shall be taken to assure that forms are not damaged during consolidation.
- F. Surface Finishing-Bottom of Tie:
1. The bottom surface of the tie shall have a rough screeded finish. Indentations as shown on the Contract Drawings shall be pressed into the bottom of the tie prior to setting of the concrete. Two ties, which in the opinion of the Inspector show the required bottom surface condition, shall be set aside from an early batch as a comparison standard for the acceptance of later ties.
- G. Testing Fresh Concrete:
1. The first batch on any bed shall be tested and if this requires no adjustment to the mix, a further test shall be made after approximately 25 cubic yards has been poured. If the first batch requires adjustment to the mix, each subsequent batch shall be tested until no further adjustment is necessary and then a further batch shall be tested after approximately 25 cubic yards has been poured.
  2. Slump: When measured in accordance with ASTM Designation: C143, Standard Test Method for Slump of Hydraulic-Cement Concrete, the slump shall not exceed 2 inches when concrete is placed in the forms.
  3. Air Content: When measured in accordance with ASTM Designation: C231, Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method, the range of air content in the plastic concrete shall ensure a minimum 3.5 percent air void content in the hardened concrete.
  4. Temperature: The temperature of freshly mixed concrete shall not exceed 90 degrees F.
- H. Curing:
1. Immediately after placing and consolidating the concrete, the exposed surface shall be covered with impermeable sheeting.
  2. Concrete shall not be placed in forms whose temperature is less than 40 degrees F. and the concrete temperature shall not be allowed to fall below 50 degrees F. between casting and transfer of prestress.
  3. The rate of temperature rise in the concrete shall not exceed 35 degrees F. per hour and the maximum concrete temperature shall not exceed 150 degrees F. Transfer of prestress shall not be carried out at a concrete temperature above 135 degrees F. The heating method used shall be such that all ties in a bed are at a similar temperature.
  4. Curing shall be done in accordance with established procedures to produce concrete strength as specified.

- I. Detensioning. Stress transfer shall be performed in a controlled manner with hydraulic jacks. The forms shall be free to move and the stress in all wires shall be transferred at the same time and same rate. No wire shall be cut until it is completely detensioned.

### **3.06 REMOVAL OF TIES FROM FORMS AND FINISHING**

- A. Ties shall be removed from forms in a manner such as to avoid damage.
- B. Surface Finishing:
  1. All formed surfaces of the finished tie shall have a uniformly dense surface. The surface of the railseat shall have a smooth finish and be free from honeycomb, surface irregularities, and air holes in excess of 1/8 inch diameter. Other surfaces shall have a smooth finish that may contain honeycomb not to exceed 2 percent of the surface and a maximum void diameter of 1/4 inch.
  2. Two ties which, in the opinion of the Inspector, show the required surface finish and two ties, also in the opinion of the Inspector, show the maximum allowable rail seat defects shall be set aside as comparison standards for acceptance of ties. These four ties are in addition to those for bottom finish comparison.
- C. Inspection and Repair of Surface Defects:
  1. Every tie produced shall be visually inspected.
  2. The surface of the rail seat shall have a smooth, formed finish not inferior to the comparison standards. No rubbing, brushing, or other treatment shall be used on the rail seat.
  3. Surface conditioning with a mixture of 3 parts sand and 1 part cement, mixed with 1 part latex cement mix and 1 part water shall be undertaken on surfaces containing air pockets. The maximum size of any one pocket shall not exceed 3/8 inch diameter by 1/4 inch deep.
  4. Air voids may not exceed greater than 50% of the circumference of a prestressing strand nor than 1 inch in depth.
  5. Corner breakage less than 1/2 inch deep and 1-1/2 inch along the end faces need not be repaired providing reinforcing wire is not exposed. If the wire is exposed, the breakage must be repaired.
  6. Corner breakage from 1/2 to 1-1/2 inch in depth must be repaired. Corner breakage in excess of that shall be rejected.
  7. Prestressing wires protruding more than 1/4 inch beyond the concrete surface of the end of the tie shall be cut back. Sharp ends which would be hazardous in handling shall be smoothed or cut back.

### 3.07 ACCEPTANCE TESTS FOR CONCRETE TIES AND RAIL FASTENING SYSTEMS

- A. Design Tests:
1. Testing shall be in accordance with AREMA Chapter 30, Part 4, Section 4.9.1. Prior to approval of the concrete tie design, the following tests shall be performed. The tie samples submitted will be subjected to testing for compliance with these Specifications.
  2. From a lot of not less than ten ties produced, in accordance with these Specifications, four ties shall be selected at random for laboratory testing. For design testing of the fastening system, the manufacturer shall also furnish a section of a tie or a concrete block with railseat and fastening system identical to the concrete ties furnished for testing. A separate test series shall be conducted for the standard cross tie and the restraining rail cross tie.
  3. Each of the four ties and the tie block submitted for testing shall be carefully measured and examined to determine their compliance with the requirements specified below. Upon satisfactory completion of the examination, the tie block and two ties, designated as Tie "1" and Tie "2" shall be subjected to the specified performance tests. The remaining two ties which will be designated as Tie "3" and Tie "4" will be retained for further test use and as a control for dimensional tolerances and surface appearance of ties subsequently produced.
- B. Sequence of Design Tests for Tie "1", Tie "2" and Tie Block shall be in accordance with AREMA Chapter 30, Part 4, Sections 4.9.1.1, 4.9.1.2 and 4.9.1.3.
- C. Rail Seat Vertical Load Tests shall be performed in accordance with AREMA Chapter 30, Part 4, Section 4.9.1.4.
- D. Rail Seat Repeated Load Tests shall be performed in accordance with AREMA Chapter 30, Part 4, Section 4.9.1.5.
- E. Center Negative Bending Moment Tests shall be performed in accordance with AREMA Chapter 30, Part 4, Section 4.9.1.6.
- F. Center Positive Bending Moment Tests shall be performed in accordance with AREMA Chapter 30, Part 4, Section 4.9.1.7.
- G. Bond Development, Tension Anchorage, and Ultimate Load Tests shall be performed in accordance with AREMA Chapter 30, Part 4, Section 4.9.1.8.
- H. Fastening Insert Tests shall be performed in accordance with AREMA Chapter 30, Part 4, Section 4.9.1.9.
- I. Fastening Uplift Tests shall be performed in accordance with AREMA Chapter 30, Part 4, Section 4.9.1.10.
- J. Electrical Impedance Tests shall be performed in accordance with AREMA Chapter 30, Part 4, Section 4.9.1.14.

### **3.08 ACCEPTANCE OF DESIGN TESTS FOR FASTENING SYSTEM**

- A. Fasteners shall be subjected to the acceptance tests as specified below. Failure of fastening system to pass tests will be cause for rejection. Certified laboratory test reports shall be submitted in sufficient detail to the PATH.
- B. Acceptance of design testing of the fastening system consists of testing of components cast into the concrete tie, in addition to tests conducted on the external components and consists of the following tests.
- C. Fastening Repeated Load Tests shall be performed in accordance with AREMA Chapter 30, Part 4, Section 4.9.1.11.
- D. Fastening Longitudinal Restraint Tests shall be performed in accordance with AREMA Chapter 30, Part 4, Section 4.9.1.12.
- E. Fastening Lateral Load Restraint Tests shall be performed in accordance with AREMA Chapter 30, Part 4, Section 4.9.1.13
- F. Tie Pad Tests shall be performed in accordance with AREMA Chapter 30, Part 4, Section 4.9.1.15.
- G. Tie Pad Attenuation Tests shall be performed in accordance with AREMA Chapter 30, Part 4, Section 4.9.1.16.
- H. Wear/Abrasion Tests shall be performed in accordance with AREMA Chapter 30, Part 4, Section 4.9.1.17.
- I. Single Tie Lateral Push Tests shall be performed in accordance with AREMA Chapter 30, Part 4, Section 4.9.1.18.

### **3.09 DAILY PRODUCTION QUALITY CONTROL TESTS**

- A. Acceptance Tests:
  - 1. At the start of any production contract, a minimum of 6 rail seat positive, 6 tie center negative, and 6 shoulder pull-out tests shall be undertaken by the manufacturer on randomly selected ties to establish compliance with this specification. After the acceptance test load results are checked, additional loading shall be applied to the ties to produce the first crack greater than 25 mm (1 inch) in vertical length and these loads and crack lengths recorded.
- B. Routine Production Testing:
  - 1. Routine acceptance testing shall be carried out on all beds cast. One tie selected from every 200 ties, or fraction thereof from one form, selected at random from each bed cast, shall be load tested as follows:
    - a. Center Positive Bending Moment Test as detailed in Section 3.07.F of this specification.

2. If structural cracking occurs in the tests, two additional ties from the same lot shall be subjected to the same test and acceptance of the lot shall be based on the following conditions:
  - a. If both retest ties meet the test requirements, the lot shall be accepted.
  - b. If either of the retest ties fails to meet the test requirements, the remaining ties shall be tested in accordance with a statistical sampling plan.
3. One tie selected at random from every 200 ties, or fraction thereof, produced each day shall be subjected to testing the distance from the center of track to the center of rail seats by use of a template. The rail seat configuration and shoulder insert location shall be verified.
4. One tie per 1000 cast shall be selected at random from those ties previously subjected to the Rail Seat Positive Bending Moment Test (one of every five of such ties) shall additionally be tested for Bond Development and Tension Anchorage as detailed in Section 3.07.G of this specification.
  - a. If strand slippage does not exceed 0.001 inches, the requirements of this test will have been met.
  - b. If strand slippage exceeds 0.001 inches, three additional ties shall be tested. If any of the three ties does not meet the requirements of the test, the remaining ties in the lot shall be tested in accordance with a statistical sampling plan.

### **3.10 INSPECTION**

- A. The Engineer may inspect ties at any time before, during, or after treatment for conformance to the Specifications. Additional inspection after delivery may be made to ensure ties conform to the Specifications.

### **3.11 DELIVERY**

#### **A. Shipping and Handling of Concrete Ties**

1. Provide railcar transportation for concrete ties from manufacturing facility to PATH at 120 Academy Street, Jersey City, NJ. The vendor shall be responsible for procuring the flat cars and managing this service which shall include the following:
2. Ship concrete ties with plastic caps or plugs securely installed in all inserts.
3. Securely brace ties for transportation to prevent any movement that could cause damage.
4. Ship ties in a horizontal position, braced with wooden spacer blocks so that the top surface or embedded shoulders do not come into contact with ties loaded above. Do not load ties higher than six layers deep.
5. Do not drop or skid the ties.

6. Provide total fleet management services including tracking shipment, expediting, scheduling of pick-ups and deliveries with the local railroad switching crew and all railroad related paperwork (i.e. rail bill of lading, etc.).
7. The Manufacturer shall furnish, with each load of ties, a notarized certificate of compliance stating that the ties meet the requirements of these specifications.
8. Package other parts to prevent damage during shipment and to facilitate handling. Do not mix different parts in the same package.
9. Provide daily tracking reports and other shipment status reports as requested by PATH, reports to be sent to Port Authority Trans Hudson Corporation, One PATH Plaza, 7th Floor, Jersey City, NJ, 07306, Attn. Leong Chan, and/or email report to [lchan@panynj.gov](mailto:lchan@panynj.gov).
10. Shall be responsible for a pool of flat cars to handle the order.

B. Shipping and Handling of Fasteners

1. All fastener shipments shall be adequately prepared to preclude damage during shipment. Handle all fasteners in a manner which will prevent damage during packaging, loading and transporting.

**3.12 MEASUREMENT AND PAYMENT**

- A. Measurement of acceptable material shall be the actual number of each concrete crossties manufactured and delivered in accordance with the specifications.
- B. Payment shall be made for each concrete crosstie delivered and accepted in accordance with the specifications in the amount bid.
- C. Material not meeting the requirements of the specifications will be rejected. Rejected material shall be returned to the vendor at his expense.

**END OF SECTION**

