



# STANDARD CONSTRUCTION SPECIFICATIONS

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# GENERAL CONDITIONS

## 110 – GENERAL

### 1 GENERAL

- 1.1 These General Conditions are adopted by Railroad and are supplemental and complimentary to the requirements of the Agreement issued by Railroad to Contractor for the purpose of performing construction and maintenance of Railroad's infrastructure as specified in the Contract Documents. They apply to Contractor, its employees, agents, invitees and subcontractors.
- 1.2 DEFINITIONS (2015)
  - 1.2.1 Authorized Representative shall mean the Railroad Employee or Consulting Engineer contracted by the Railroad and designated by the Railroad to provide engineering services.
  - 1.2.2 Bid shall mean the Bidder's good faith proposal to perform the Work as submitted in the Proposal.
  - 1.2.3 Bidder shall mean that individual or firm invited to propose on performing the Work.
  - 1.2.4 Contract shall mean the Contract and Contract Documents, all considered as a whole, between Railroad and Contractor governing the Work to which these specification are being applied.
  - 1.2.5 Contract Documents shall mean Invitation to Bid, Scope of Work, Proposal, Contract, Special Conditions, General Conditions, Material Specifications, Standard Specifications, Construction Specifications, Plans, all Addenda issued prior to award of Contract and all Change Orders issued after award of Contract, all considered as a whole.
  - 1.2.6 Contractor shall mean the successful bidder employed by Railroad and responsible for the Work to which these specifications are being applied.
  - 1.2.7 Engineer shall mean the Regional Vice President Engineering, or his authorized representative, who is the authorized engineering representative of Railroad.
    - 1.2.7.1 For Structures related work, Engineer shall mean the GRSI Vice President, Structures, or his authorized representative.
  - 1.2.8 Inspector shall mean the authorized field representative of Engineer.
  - 1.2.9 Right-of-way shall mean land which Railroad owns, leases, or has an interest in, sufficient to permit performance of the work.
  - 1.2.10 Railroad shall mean the G&W subsidiary railroad property where the work will be performed.
  - 1.2.11 Subcontractor shall mean a party who has a direct contract with Contractor for the performance of a designated portion of the Work, or the supply of specific material or equipment.
  - 1.2.12 Flagman shall mean the authorized field safety representative of Railroad. For purposes of the Work, Flagman is a generic term that applies to all personnel assigned by Railroad to perform general safety, bridge worker safety and roadway worker safety duties.
  - 1.2.13 Work shall mean those activities contracted by Railroad and includes all labor, equipment and material necessary to produce such activities and clean-up.
- 1.3 PLANS AND SPECIFICATIONS
  - 1.3.1 The Plans provide location and layout information for the work.
  - 1.3.2 The Specifications set the minimum technical, performance, and quality standards for the Work.



- 1.3.3 The Plans and Specifications are subject to change up to, including and after the date of the Notice of Award.

**1.4 OTHER SPECIFICATIONS**

- 1.4.1 The requirements of the American Railway Engineering and Maintenance of Way Associations (AREMA) Manual for Railroad Engineering (MRE) are incorporated into these General Conditions by reference and shall govern Contractor's activities as if written out in full.
- 1.4.2 Generally accepted industry standard practice and manufacturer recommendations not inconsistent with the Contract Documents and the above rules and specifications are incorporated into these General Conditions by reference.
- 1.4.3 Where these reference specifications are in conflict with any portion of the Contract Documents, the requirements of the Contract Documents shall govern in the following order of precedence: Contract; Change Orders; Scope of Work; Plans; Addenda; Proposal; Special Conditions; General Conditions; Material Specifications; Standard Specifications, Construction Specifications; Invitation to Bid; Manufacturer's Recommendations; Reference Specifications.
- 1.4.4 Contractor shall maintain copies of the appropriate reference specifications available at the site for use by Contractor's supervision and craft employees.

**2 MATERIALS**

- 2.1 This section not used.

**3 SUBMITTALS**

- 3.1 This section not used.

**4 EXECUTION**

- 4.1 This section not used.

**5 MEASUREMENT AND PAYMENT**

- 5.1 This section not used.

END OF SECTION

**REVISION HISTORY**

The following is the revision history for this standard:

7/15/2015 – Update Definitions

4/29/2013 – Initial Issue



# GENERAL CONDITIONS

## 120 – EXECUTION

### 1 GENERAL

- 1.1 These General Conditions are adopted by Railroad and are supplemental and complimentary to the requirements of the Agreement issued by Railroad to Contractor for the purpose of performing construction and maintenance of Railroad's infrastructure as specified in the Contract Documents. They apply to Contractor, its employees, agents, invitees and subcontractors.
- 1.2 CONTRACT DOCUMENTS (2015)
  - 1.2.1 The general intent of the Contract Documents is that Contractor:
    - 1.2.1.1 Shall, for the compensation set forth, furnish all additional design and or fabrication drawings, tools, labor, material, equipment, superintendence, services, assurances and guarantees, assumptions of risk and responsibility for the Work, unless otherwise specifically provided.
    - 1.2.1.2 Shall begin work promptly and proceed expeditiously and continuously without cessation or shutdown of work unless specifically approved in writing by Engineer.
    - 1.2.1.3 Shall perform, complete, and make ready for its intended purpose, within the times specified, the Work covered by the contract, all in accordance with the Contract Documents.
  - 1.2.2 The Contract Documents are complementary, and what is required by any one shall be binding as if required by all. If any portion of the Contract Documents is in conflict with any other portion, the various documents comprising the Contract Documents shall govern in the following order of precedence: Contract; Change Orders; Scope of Work; Plans; Addenda; Proposal; Special Conditions; General Conditions; Material Specifications; Standard Specifications, Construction Specifications; Invitation to Bid; Manufacturer's Recommendations; Reference Specifications.
- 1.3 AUTHORITY OF ENGINEER (2015)
  - 1.3.1 Engineer is the Authorized Representative of Railroad.
    - 1.3.1.1 The Work will be done under the oversight of Engineer or his authorized representative, to his satisfaction, and in accordance with the Contract Documents.
    - 1.3.1.2 Engineer will decide all questions which may arise as to the quality or acceptability of materials furnished and work performed.
    - 1.3.1.3 Deviations from the Contract Documents may be required by the contingencies of construction and shall in all cases be determined by Engineer and authorized in writing.
- 1.4 CONTRACTOR RESPONSIBILITY (2015)
  - 1.4.1 Contractor is solely responsible for determining the means and methods best suited for the safe, efficient and expeditious execution of the Work.
    - 1.4.1.1 If, in the opinion of Engineer, Contractor's means and methods are not in conformance with the requirements of the Contract Documents, create unsafe conditions, or do not provide the highest reasonable level of quality and workmanship, Contractor shall revise his means and methods as necessary to achieve compliance with the intent of the Contract Documents.



- 1.4.2 Contractor shall be fully responsible to Railroad for the acts and omissions of Contractor's Subcontractors, and of persons either directly or indirectly employed by the Subcontractor.

### 1.5 WORK UNDER TRAFFIC (2015)

- 1.5.1 Except for new construction on a new alignment, Contractor shall plan to perform all work under traffic within only those work windows approved by Railroad.
- 1.5.2 All work windows shall be planned in advance as mutually agreed between Contractor and Railroad in accordance with the requirements of General Condition 130 – Delay of Trains.

## 2 MATERIALS

- 2.1 This section not used.

## 3 SUBMITTALS

- 3.1 Contractor shall submit to Engineer the name and contact information of Contractor's Superintendent for the Work.
- 3.2 Contractor shall submit to Engineer for approval Contractor's proposed plan and schedule for the Work.
  - 3.2.1 Contractor shall submit updates to the plan and schedule with each pay application.
- 3.3 Contractor shall submit to Engineer the name of any subcontractor not identified in the Proposal.

## 4 EXECUTION

### 4.1 AUTHORITY TO PROCEED (2015)

- 4.1.1 The only authority to proceed with work on Railroad right of way is a fully executed Contract and a written Notice to Proceed issued to Contractor by Railroad.
- 4.1.2 The Notice to Proceed will be issued only after Engineer and Contractor agree upon the schedule for the Work.

### 4.2 CONTRACTOR EXECUTION

- 4.2.1 Contractor shall furnish proper and sufficient equipment, tools, materials, and superintendence for the completion of the work to be done in accordance with the Project Plans and Specifications, approved construction schedule and the completion time given in the Proposal, and as directed by the Engineer.
  - 4.2.1.1 Should Contractor fall behind schedule, he shall take such steps as may be necessary to improve progress.
  - 4.2.1.2 In the event contractor does not complete the Work in accordance with the completion time given in the Proposal, Railroad may, at its own discretion, withhold from the final payment penalty in accordance with the schedule given in the Contract.
- 4.2.2 Contractor shall schedule regular construction progress meetings for the duration of the Work. Contractor shall ensure key subcontractor and supplier personnel as appropriate attend these meetings.
  - 4.2.2.1 The meeting agenda shall address: Safety Concerns; Progress since last meeting; Planned progress for next construction period; Effects on Railroad operations; Overall project Schedule; Coordination with outside parties; Submittals; Problems, conflicts, and observations; Quality control and Coordination needs.



- 4.2.2.2 Engineer may require Contractor to increase the frequency of the progress meetings if, in the opinion of Engineer, Contractor's progress and execution are not in keeping with the intent of the Contract Documents.
  - 4.2.3 Contractor shall furnish all labor and materials to complete the work and assist in track-work, except as otherwise provided in the Specifications.
  - 4.2.4 Whether provided by Railroad or Contractor, Contractor shall unload all material. No material or equipment shall be placed closer than seven (7) feet to the nearest rail.
  - 4.2.5 Contractor shall comply with the requirements of any material or operation specified by reference to published specifications of a manufacturer or any other industry standard in effect on the date of Contract execution. In the event of conflict between referenced documents, the specification having the more stringent requirements shall govern.
  - 4.2.6 At completion of work Contractor shall remove all surplus material and rubbish from the Railroad premises to the satisfaction of the Engineer
  - 4.2.7 A waiver on the part of Railroad, of any term, provision or covenant of the Contract Documents shall not constitute a precedent, nor bind Railroad, to a waiver of any succeeding breach of the covenants of the Contract Documents.
  - 4.2.8 It is the responsibility of Contractor, as bidder, to examine the Plans and Specifications and to have reported to Engineer any errors or discrepancies found therein.
  - 4.2.9 If Contractor, in the course of performing the Work, finds any discrepancy between the Contract Documents and the conditions of the site or any applicable code or ordinance, Contractor shall immediately notify Engineer. Engineer shall make any necessary adjustments to the Contract Documents in writing. Such adjustment does not automatically guarantee a change to the schedule and compensation set by the Contract Documents.
  - 4.2.10 In the event Engineer determines that concealed conditions encountered in the performance of the Work are inconsistent with the conditions indicated by the Contract Documents, the contract price may be equitably adjusted in accordance with the provisions of the Contract Documents.
  - 4.2.11 Contractor will take proper precautions to protect the public and employees of the Railroad from any and all damages from Contractor's operations.
    - 4.2.11.1 All responsibility for damage, theft and vandalism to material and/or equipment furnished by the Contractor, as well as all Railroad furnished material while stored on site, until included in the work, and accepted by the Engineer as final and complete shall be the responsibility of Contractor.
  - 4.2.12 Contractor shall at all times have one complete set of all contract documents (Project Plans, Standard Specifications, Project Specifications, Bulletins, etc.) maintained at the Project Site and the Contractor's person in charge must be familiar with all phases of the Project.
- 4.3 CONSTRUCTION SUPERVISION
- 4.3.1 Before the start of work, Contractor shall appoint one competent individual as Project Superintendent and provide Engineer with all appropriate contact information. Such individual shall be capable of supervising the Work, understanding the plans and specifications, and shall have the necessary authority to receive and promptly execute instructions and orders from Engineer.



- 4.3.1.1 The Project Superintendent shall be present and available while the Work is in progress.
  - 4.3.1.2 The Project Superintendent shall be available to manage any situation that may arise with respect to the Work, the job site or any other related matter both during and after working hours.
  - 4.3.1.3 In the event the Project Superintendent is not available, Contractor shall make available another individual to act in his place with the same level of authority and responsibility.
- 4.3.2 If, in the opinion of Engineer, Contractor's supervisory personnel do not display the necessary level of competence or experience, Engineer may request Contractor to reassign the personnel. Such request by Engineer shall not be unreasonably made. Compliance with such request by Contractor shall not be unreasonably withheld.
- 4.3.3 Contractor shall be responsible to Railroad for the acts and omissions of its employees, subcontractors and their agents and employees and shall ensure their compliance with minimum safety requirements set forth in the Contract Documents.
- 4.3.4 When so ordered by Engineer, Contractor shall immediately remove from the Work any person detected doing improper and unsafe acts, performing defective work, refusing the direction of Engineer, or who shall be deemed incompetent or disorderly.
- 4.4 HOURS OF WORK (2015)
  - 4.4.1 For this Work, normal working hours are defined as Monday through Friday, 0700 to 1700, in the time zone where the Work is being performed.
  - 4.4.2 To facilitate inspection, testing and supervision of the Work, no work shall be performed outside of the normal working hours except as provided for elsewhere in the contract documents without the prior approval of Engineer.
  - 4.4.3 No work shall be performed on Railroad observed Holidays without prior written approval of Railroad
  - 4.4.4 Engineer may consider alternative working hours proposed by Contractor upon demonstration of benefits to justify Railroad's overtime expense.
- 4.5 CONSTRUCTION SCHEDULE
  - 4.5.1 Prior to commencing Work, Contractor shall submit to Engineer in writing, his proposed detailed plan and schedule for the Work and the equipment and methods he intends to employ.
  - 4.5.2 Contractor shall consider the following when preparing his plan:
    - 4.5.2.1 The Work will be performed under traffic in work windows approved by Railroad.
    - 4.5.2.2 Continuous work, including night operations, may be required during certain tasks to minimize rail traffic interruption.
    - 4.5.2.3 When track outages are granted, Contractor should plan for concurrent activities in order to maximize the opportunity of the track outage.
    - 4.5.2.4 Contractor shall furnish sufficient resources to ensure the execution of the Work in accordance with the approved schedule.
  - 4.5.3 The schedule shall show the complete sequence of construction activity, identifying work of separate stages and other logically grouped activities.





- 4.5.4 The proposed schedule shall give expected start and finish dates for those primary and subordinate tasks as necessary to adequately portray the plan of execution in detail.
- 4.5.5 The schedule shall indicate dates for all required submittals regardless of whether they are on the critical path.
- 4.5.6 Contractor shall submit revised schedules with each Application for Payment, identifying changes since the previous version. The monthly pay estimate will not be paid until the schedule updates have been submitted.
- 4.5.7 Project scheduling shall utilize Microsoft Project or other software approved by Engineer.
- 4.5.8 In the event Engineer determines that methods, procedures, tools or equipment are unsafe or are inadequate to carry out the Work, Engineer may direct their removal from the plan.
  - 4.5.8.1 Contractor shall revise and resubmit the plan for further review by Engineer.
  - 4.5.8.2 Such action by Engineer is not to be viewed as directing means or methods.
- 4.5.9 If, in the opinion of Engineer, Contractor falls behind schedule, he shall take such steps as may be necessary to improve his progress.
  - 4.5.9.1 The costs of these increases to the construction force necessary to maintain Contractor's schedule shall be borne by Contractor.
- 4.5.10 Obstructions to the Work encountered by Contractor are considered part of the pay item for the task being performed.

#### 4.6 CHANGES

- 4.6.1 After Agreement execution Railroad shall have the right to make any changes in the Work as it deems necessary by submitting written Change Orders to Contractor. Such Change Orders shall in no way affect or void the obligations of this contract.
  - 4.6.1.1 In the event changes affect the quantities of the original scope of work, then the cost of the change shall be in accordance with the add and deduct unit costs given in the Proposal.
  - 4.6.1.2 In the event the changes involve work not originally included in the scope of work, then the cost of the change shall be as mutually agreed upon by Railroad and Contractor.
  - 4.6.1.3 All such work shall be executed under the conditions of the original contract except that any claim for extension of time and additional costs caused thereby shall be determined at the time of ordering such change.
- 4.6.2 Engineer may authorize field changes in the Work not involving extra cost and not inconsistent with the intent of the Contract Documents.
- 4.6.3 Upon receipt of an approved contract change order, Contractor shall proceed with the ordered work.
- 4.6.4 If the parties to this Contract fail to agree on a basis of payment, Engineer may order the work done on a force account basis, or do the work or cause the work to be done by such other agents or means than Contractor without invalidating the Contract or Contract Bond, where applicable.
- 4.6.5 No payment will be made for work performed on an actual cost basis until Contractor has furnished Engineer with itemized statements of the cost of such work detailed as follows:
  - 4.6.5.1 Name, classification, date, daily hours, total hours, rate extension for each laborer and foreman.





- 4.6.5.2 Designation dates, daily hours, total hours, rental rate and extension for each unit of machinery and equipment.
  - 4.6.5.3 Quantities of materials, prices and extensions. Material charges shall be substantiated by vendor's invoices.
  - 4.6.5.4 Transportation of materials.
  - 4.6.5.5 Contractor shall render billing for such extra work at the end of each calendar month.
- 4.6.6 Additional work performed by Contractor without written authorization from Engineer shall be at the expense of Contractor and will not entitle Contractor to extension of time.
- 4.6.7 If Contractor deems extra compensation is due him for work or materials not clearly covered in the Contract Documents, Contractor shall notify Engineer in writing of his intention to make a claim for such extra compensation before he begins the work on which he bases the claim. If such notification is not given, or Engineer is not furnished proper documentation by Contractor keeping strict account of actual cost, then no payment will be made to Contractor for this unauthorized work.
  - 4.6.7.1 Foreseeable obstructions to the Work encountered by Contractor are considered part of the pay item for the task being performed and will not be considered for extra compensation.
- 4.7 EMERGENCY WORK
  - 4.7.1 In an emergency endangering life or posing clear and imminent danger of grievous property damage, the Contractor, without special instructions or authorization from the Engineer, shall act to prevent such loss or injury until such time as the Engineer or his authorized representative can be contacted for an assessment of the situation. Contractor shall also act, without appeal, if so authorized or directed by the Engineer or his authorized representative.
  - 4.7.2 Any compensation requested by the Contractor on account of such emergency work shall be as mutually agreed between Contractor and Railroad.
  - 4.7.3 Contractor shall maintain records sufficient to distinguish the direct cost of emergency work from the cost of other operations and shall itemize all costs for labor, material, and equipment rental in connection with emergency work.
- 4.8 SUBCONTRACTING (2015)
  - 4.8.1 Unless identified in his bid, Contractor shall not subcontract any portion of the Work to a third party without the prior written consent of Railroad.
- 4.9 CONSTRUCTION SURVEYING. (2015)
  - 4.9.1 Contractor shall establish initial field control points for this project based upon input from Engineer.
  - 4.9.2 Contractor shall maintain such points and provide any additional construction surveying required for the execution of the Work.
  - 4.9.3 Contractor shall provide all necessary layout surveys, elevations, etc., for construction of the Project. Upon request, these surveys shall be made available to Railroad as part of the Record Project Documents.
- 4.10 PERMITS, TAXES AND FEES (2015)
  - 4.10.1 Contractor shall conduct his work and related activities in full compliance with all Federal, State, and Local statutes, regulations, and/or ordinances.



- 4.10.2 Where Railroad has acquired certain permits to accelerate the work, Contractor shall comply with all provisions of Railroad acquired permits
  - 4.10.3 Contractor shall, at his sole cost and expense, secure and pay for all other construction permits, authorities, licenses, fees, sales taxes required for the performance of the Work.
  - 4.10.4 It is assumed that Contractor's proposal includes all applicable sales and use taxes as part of Contractor's base bid.
  - 4.10.5 Contractor shall arrange for all construction access easements and construction permits as necessary beyond those already acquired by the Railroad.
  - 4.10.6 Contractor shall comply with all Federal, State, and Local requirements and regulations with regard to water quality, erosion control, environmental compliance, construction permitting, vehicular detours, access agreements, etc. This work may include, but is not necessarily limited to the use of silt fences, hay bales, mulches, slope ditches, sediment traps, etc., and will be applicable to the entire project, including access easements, embankment fill, off-site borrow pits, waste disposal sites, etc. All work under this item shall be performed in strict accordance with the approved Department of Natural Resources, US Army Corps of Engineers and Water Management District environmental permits for such work.
- 4.11 MOBILIZATION/DEMOBILIZATION (2015)
- 4.11.1 Mobilization consists of the preparatory work and operations to stage for the project including, but not limited to: the training and movement of personnel to the job site; staging of equipment, materials and incidentals at the job site; establishing of all offices, buildings, and other facilities necessary for the work on the project; preparing project specific plans and submittals; and for all other work and operations which must be performed or costs incurred in preparing to begin Work.
  - 4.11.2 Demobilization includes moving equipment from the project site; removing all temporary construction and facilities; cleanup of the project; closing out all permits and preparing as-built plans as required at the conclusion of the project.

## 5 MEASUREMENT AND PAYMENT (2015)

- 5.1 The Contractor shall only be paid for one (1) mobilization or one (1) mobilization and one (1) demobilization during the contract term as spelled out in the bid documents.
  - 5.1.1 Contractor may invoice Railroad for mobilization after receiving the notice-to-proceed and upon substantial completion of mobilization.
  - 5.1.2 Where included in the bid documents, Contractor may invoice railroad for demobilization upon completion of all work assigned during the contract term and substantial completion of demobilization.

END OF SECTION

## REVISION HISTORY

The following is the revision history for this standard:

7/15/2015 – General Update  
4/29/2013 – Initial Issue



# GENERAL CONDITIONS

## 124 – CONTROL OF MATERIALS

### 1 GENERAL

- 1.1 These General Conditions are adopted by Railroad and are supplemental and complimentary to the requirements of the Agreement issued by Railroad to Contractor for the purpose of performing construction and maintenance of Railroad's infrastructure as specified in the Contract Documents. They apply to Contractor, its employees, agents, invitees and subcontractors.

### 2 MATERIALS

- 2.1 This section not used.

### 3 SUBMITTALS

- 3.1 Prior to the start of Work, Contractor shall submit to Engineer a written plan for the collection, containment, storage, transportation for disposal, and disposal of materials and waste. At the minimum, the plan should consider:
  - 3.1.1 Collection, on-site storage and disposal of solid waste and construction debris.
  - 3.1.2 Collection, on-site storage and disposal of chemicals and hazardous waste.
- 3.2 Prior to final pay application, Contractor shall submit to Engineer documentation of disposal of all released material.

### 4 EXECUTION

#### 4.1 MATERIALS FURNISHED BY RAILROAD

- 4.1.1 Railroad may elect to furnish without cost to Contractor a portion of the materials required for the project. All such provided materials will be specified in the Contract Documents.
- 4.1.2 Railroad provided materials will be furnished at the locations specified in the contract documents. Contractor shall furnish all labor and equipment necessary to handle, haul and store this material and also to sort and load any excess material at the completion of the project. Contractor shall take possession of the materials as directed by Engineer.
- 4.1.3 Contractor shall check all material upon receipt for quantity and condition, and, after acceptance, shall be fully responsible for protecting the material from loss or damage. Any materials lost or damaged after acceptance shall be replaced at Contractor's expense.
- 4.1.4 Work associated with materials furnished by Railroad shall be considered incidental to other items of the contract and no additional payment will be made for any costs involved.

#### 4.2 WORK FURNISHED BY RAILROAD FORCES

- 4.2.1 Construction activities performed by Railroad in support of the Work will be limited.
- 4.2.2 Contractor is responsible to determine the scope and schedule of work to be performed by railroad.
  - 4.2.2.1 Unless Railroad specifically identifies in writing activities to be performed by Railroad, Contractor is responsible for all Work and its subordinate tasks.
- 4.2.3 Scheduling for Railroad activities shall be as mutually agreed between Contractor and Railroad as allowed by Railroad requirements of service.
  - 4.2.3.1 In the event other requirements of service prevent Railroad from meeting the agreed upon timetable for the above tasks, the activities shall be rescheduled as soon as reasonably possible.



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4.2.3.2 Contractor shall not be entitled to any claim resulting from this rescheduling.

### 4.3 OWNERSHIP OF SCRAP STEEL AND OTHER RELEASED MATERIAL (2015)

4.3.1 All metal material released from the Work shall become the property of the Railroad. Contractor shall stockpile such steel material at a location designated by the Engineer.

4.3.2 All timber material released from the work shall be first sorted to identify salvageable material.

4.3.2.1 Contractor shall stockpile such salvageable timber material at a location designated by the Engineer.

4.3.2.2 All other timber material shall become the property of Contractor who shall dispose of same in accordance with all applicable laws and regulations.

4.3.3 All concrete material released from this Project shall become the property of Contractor who shall dispose of same in accordance with all applicable laws and regulations.

4.3.4 All refuse and trash released from this Project shall become the property of Contractor who shall dispose of same in accordance with all applicable laws and regulations.

4.3.5 All ballast and excavated soils shall either be neatly wasted at the project or become property of Contractor as spelled out in the Scope of Work. Ballast and excavated that become the property of Contractor shall be disposed of in accordance with all applicable laws and regulations.

4.3.6 While recycling of all released material is highly encouraged, no sales of any released material may be made to private individuals.

4.3.7 Contractor shall provide documentation of proper disposal of all released materials before final pay application will be accepted.

## 5 MEASUREMENT AND PAYMENT (2015)

5.1 Control of Materials is considered incidental to the Work and shall not be measured for payment.

END OF SECTION

### REVISION HISTORY

The following is the revision history for this standard:

7/15/2015 – Update ballast and soil disposal

4/29/2013 – Initial Issue



# GENERAL CONDITIONS

## 128 – TEMPORARY CONSTRUCTION

### 1 GENERAL

- 1.1 These General Conditions are adopted by Railroad and are supplemental and complimentary to the requirements of the Agreement issued by Railroad to Contractor for the purpose of performing construction and maintenance of Railroad's infrastructure as specified in the Contract Documents. They apply to Contractor, its employees, agents, invitees and subcontractors.

### 2 MATERIALS

- 2.1 This section not used.

### 3 SUBMITTALS

- 3.1 Prior to the start of work, Contractor shall submit to Engineer a site plan indicating the proposed location and dimensions of any temporary facilities such as areas to be fenced for laydown, office and storage trailers, avenues of ingress/egress, graveled areas to prevent the tracking of mud.
- 3.2 Prior to the start of work, Contractor shall submit to Engineer a request in writing for approval of all temporary grade crossings. If the temporary grade crossing is authorized by Railroad, Railroad may require its installation to be performed by railroad personnel at the expense of Contractor; otherwise the responsibility for installation belongs to Contractor.
- 3.3 Where contractor installs temporary in-water construction, Contractor shall submit to Engineer final acceptance of the remediated site from the appropriate permitting agencies. Such submittal shall be made prior to final payment for the work.

### 4 EXECUTION

#### 4.1 TEMPORARY CONSTRUCTION

- 4.1.1 Contractor shall provide barriers necessary to prevent unauthorized entry to construction areas, to allow for Railroad use of the site, and to protect existing facilities and adjacent properties from damage from construction operations and demolition.
- 4.1.2 Contractor shall provide the necessary sanitary conveniences for the use of workmen on the project. Such facilities shall be constructed and maintained by Contractor in such manner and at such points as will be approved by Engineer. Their use shall be strictly enforced by Contractor.
- 4.1.3 Contractor shall furnish, install and maintain all temporary water and electrical service for the proper performance of Work. At the completion of the work all temporary services shall be removed. The cost of these temporary services is incidental to the Work.
- 4.1.4 Contractor shall arrange for and provide access to the work from existing public roads, private property, or along the right-of-way of Railroad. To the extent possible, existing roads and trails shall be used for access to the Work. Construction of new access roads or use of existing roads shall be subject to approval by the landowner and the appropriate governmental agencies.
- 4.1.5 Contractor shall meet all applicable federal, state and local agency guidelines governing the rehabilitation and reclamation of temporary access roads. The roads shall be graded to conform to original topography to the degree possible. Cut slopes associated with temporary access roads shall be reduced to a grade consistent with adjacent topography, erosion protected, and revegetated, when no longer needed or when not requested by Railroad.
- 4.1.6 Where it is necessary to occupy an area off of Railroad's right-of-way, Contractor shall obtain written release from owner and tenant for the land involved. At the completion of



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the project, the area used by Contractor shall be returned to a condition satisfactory to the landowner and governing environmental agencies.

### 4.2 TEMPORARY ROAD CLOSURES AND DETOURS (2015)

- 4.2.1 Contractor shall be responsible for making all necessary arrangements with appropriate governmental agencies, including notice to the general public and public service organizations, for the scheduling of all road closures and detours necessitated by the work.
- 4.2.2 The furnishing, installation, maintaining and removal of any barricades, signing, temporary detour roads, crossings and lighting shall be the responsibility of Contractor and shall be in accordance with the Manual on Uniform Traffic Control Devices (MUTCD) and the specifications of the appropriate governing agency.

### 4.3 TEMPORARY GRADE CROSSINGS

- 4.3.1 Prior to the start of work, Contractor shall submit to Engineer a request in writing for approval of all temporary grade crossings. If the temporary grade crossing is authorized by Railroad, Railroad may require its installation to be performed by railroad personnel at the expense of Contractor; otherwise the responsibility for installation belongs to Contractor.
  - 4.3.1.1 Railroad is not obligated to authorize the installation of temporary grade crossings. Denial of such request will not be considered as a basis for Contractor claims for additional compensation.
  - 4.3.1.2 When in use, any temporary grade crossing authorized by Railroad shall be protected by a Railroad Flagmen, the cost of which shall be borne by contractor,
  - 4.3.1.3 When not in use, any temporary grade crossing authorized by Railroad shall be protected by locked gates to prevent unauthorized access.

### 4.4 TEMPORARY IN-WATER CONSTRUCTION

- 4.4.1 Contractor shall be responsible for making all necessary arrangements with appropriate governmental agencies, including notice to the general public and public service organizations, for the installation of temporary in-water construction such as water way diversions, earth works for work areas and temporary bridging.
- 4.4.2 The installation, maintenance and removal of any such temporary construction shall be the responsibility of Contractor and shall be in accordance with the specifications of the appropriate governing agencies.

### 4.5 FIELD OFFICE

- 4.5.1 Unless otherwise specified and provided Contractor can effectively manage all administrative operations to the satisfaction of Engineer, a specific field office is not required for this project.
- 4.5.2 Should Contractor desire to establish a field office, Contractor shall provide and maintain the required facilities at his expense. Any additional grounds in other locations that Contractor may require for his operations shall be provided by Contractor at his expense.
- 4.5.3 Installation of the field office shall be in accordance with all local codes and ordinances.
- 4.5.4 Contractor shall provide all temporary water, electrical, communications and sanitary utilities for the field office.



## 128 – TEMPORARY CONSTRUCTION

- 4.5.5 At completion of the project, any such field office shall remain the property of Contractor and shall be removed from the site.
- 4.5.6 Utilities shall be connected and disconnected in accordance with local codes and to the satisfaction of Engineer.
- 4.5.7 Regardless of whether Contractor establishes a field office for this project, Contractor shall still comply with all laws, rules and regulations with respect to workplace posting and reporting.
- 4.5.8 Regardless of whether Contractor establishes a field office for this project, Contractor shall maintain on the job site:
  - 4.5.8.1 A complete set of the Contract Documents.
  - 4.5.8.2 Any required site specific plans.
  - 4.5.8.3 Copies of all reference specifications.
  - 4.5.8.4 Copies of all submittals.
  - 4.5.8.5 Copies of all significant correspondence.
  - 4.5.8.6 Other documents required by other specifications or Engineer.
- 4.5.9 Contractor shall not display any signs or other advertising matter in or around the project site without the specific approval in writing by Engineer. In addition, no advertising copy mentioning Railroad or quoting the opinions of its employees may be released unless such copy is approved by Railroad before release.
- 4.5.10 Contractor's office and storage trailers, laydown areas and employee parking shall present a clean and neat exterior appearance and shall be kept in a state of good repair.

### 5 MEASUREMENT AND PAYMENT (2015)

- 5.1 Temporary Construction is considered incidental to the Work and shall not be measured for payment.

END OF SECTION

### REVISION HISTORY

The following is the revision history for this standard:

7/15/2015 – Reaffirmation

4/29/2013 – Initial Issue





# GENERAL CONDITIONS

## 130 – DELAY OF TRAINS

### 1 GENERAL (2015)

- 1.1 These General Conditions are adopted by Railroad and are supplemental and complimentary to the requirements of the Agreement issued by Railroad to Contractor for the purpose of performing construction and maintenance of Railroad's infrastructure as specified in the Contract Documents. They apply to Contractor, its employees, agents, invitees and subcontractors.
- 1.2 With respect to train operations, Railroad's expectation is that all work will be performed under traffic without causing delays to trains. Track, right of way, and structures shall be returned to a condition safe for the passage of trains by the close of the work window.
- 1.3 Track outages for work that cannot be performed during normal work windows shall be as mutually agreed between Railroad and Contractor.

### 2 MATERIALS

- 2.1 This section not used.

### 3 SUBMITTALS (2015)

- 3.1 Fifteen (15) days in advance of any extended track outage, Contractor shall submit his work plan of the outage to Engineer for approval.

### 4 EXECUTION

#### 4.1 TRACK OUTAGES

- 4.1.1 All tracks will remain in service for the duration of the project and Contractor shall execute the Work under traffic conditions.
  - 4.1.1.1 Contractor shall be granted work windows to the extent allowed by train operations.
  - 4.1.1.2 Except as provided below, no claim by Contractor will be allowed for delay caused by railway traffic.
- 4.1.2 Extended track outages may be granted on a limited basis and then only for those tasks where interrupting train service is the only reasonable means of accommodating the Work.
  - 4.1.2.1 The timing of such outages is at the discretion of Railroad.
  - 4.1.2.2 Contractor will work closely with Engineer and Railroad in developing a plan for any work to be performed during an outage.
    - 4.1.2.2.1 Such plan shall consider safe, continuous operations until train service can be restored.
    - 4.1.2.2.2 Contractor's plan shall include provisions for completing the work in a timely fashion if there are equipment breakdowns or other problems.
  - 4.1.2.3 Contractor shall submit his proposed method of executing the work at least 15 days in advance of the date for the agreed upon outage.
  - 4.1.2.4 Unless otherwise specified, during the outage, Contractor shall work continuously until the tracks are back in service.

#### 4.2 TRAIN DELAY

- 4.2.1 Unless otherwise specified Contractor shall not delay movement of train traffic except during agreed track outage windows.



4.2.2 Contractor will be charged for non-planned train delay at the rate of one thousand dollars (\$1,000) per hour.

4.2.3 Train delay includes time by which Contractor overruns the scheduled end of a planned track outage.

### 4.3 STANDBY TIME

4.3.1 As directed by Engineer, Contractor's work may be interrupted or delayed during a scheduled extended track outage due to conflict with Railroad's operations.

4.3.2 If Contractor cannot reasonably adjust his work and must suspend operations, the provisions for standby time shall apply.

4.3.3 Standby time is defined as time Contractor is prohibited from performing work due to Railroad's operations during a prearranged track outage.

4.3.4 In order to claim standby time, Contractor shall have first advised Engineer at the time of the interruption so that the nature and extent of the delay is properly documented. Claims for Standby time made without this documentation will not be honored.

## 5 MEASUREMENT AND PAYMENT

### 5.1 TRAIN DELAY

5.1.1 Unless otherwise specified Contractor will be charged for non-planned train delay at the rate of one thousand dollars (\$1,000) per hour.

5.1.2 Train delay includes time by which Contractor overruns the scheduled end of a planned track outage.

### 5.2 STANDBY TIME

5.2.1 Standby time will be paid at the hourly rate shown in Contractor's List of Equipment and Labor Rates for "Standby Time". Contractor shall submit Schedule of Equipment and Labor Rates with Contractor's Bid.

5.2.2 Standby time applies only to extended track outages approved by Engineer in accordance with the above. It does not apply to interruptions inherent to working under traffic.

END OF SECTION

## REVISION HISTORY

The following is the revision history for this standard:

7/15/2015 – Revise Submittal Requirements

4/29/2013 – Initial Issue



# GENERAL CONDITIONS

## 140 – SUBMITTALS

### 1 GENERAL

- 1.1 These General Conditions are adopted by Railroad and are supplemental and complimentary to the requirements of the Agreement issued by Railroad to Contractor for the purpose of performing construction and maintenance of Railroad's infrastructure as specified in the Contract Documents. They apply to Contractor, its employees, agents, invitees and subcontractors.

### 2 MATERIALS

- 2.1 This section not used.

### 3 SUBMITTALS

- 3.1 This section not used.

### 4 EXECUTION

#### 4.1 SUBMITTALS

- 4.1.1 After checking and verifying all field measurements and after complying with applicable procedures specified in the Contract Documents, Contractor shall submit to Engineer all information required by the Contract Documents at the timing and level of detail specified.
- 4.1.1.1 Where two or more sections require related information, Contractor is encouraged to make one submittal provided he clearly indicates the submittal requirements being met.
- 4.1.1.2 All submittals will be referenced to applicable specification section(s).
- 4.1.2 Unless otherwise specified, submittals shall be furnished to Engineer at least 30 days before scheduled start of applicable work.
- 4.1.3 Engineer will evaluate the submittal for conformance to the Contract Documents.
- 4.1.4 Contractor shall make corrections required by Engineer, and shall resubmit the information as directed. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.
- 4.1.5 No work may commence on any task until the required submitted information has been approved by Engineer.
- 4.1.6 Engineer's approval of the submitted information in no way shall relieve Contractor of:
- 4.1.6.1 Responsibility for constructability, erectability, fabrication or fit in the field.
- 4.1.6.2 Satisfactory performance in the field.

### 5 MEASUREMENT AND PAYMENT (2015)

- 5.1 Submittals are incidental to the Work and shall not be measured for payment.

END OF SECTION

### REVISION HISTORY

The following is the revision history for this standard:

7/15/2015 – Reaffirmation

4/29/2013 – Initial Issue



# GENERAL CONDITIONS

## 160 – LEGAL RELATIONS AND RESPONSIBILITY

### 1 GENERAL

- 1.1 These General Conditions are adopted by Railroad and are supplemental and complimentary to the requirements of the Agreement issued by Railroad to Contractor for the purpose of performing construction and maintenance of Railroad's infrastructure as specified in the Contract Documents. They apply to Contractor, its employees, agents, invitees and subcontractors.
- 1.2 Upon execution of the Agreement, it is understood and agreed that Railroad is the interpreter of the requirements of the Contract Documents. Any claim or dispute which may arise between the parties to this Agreement, relative to same, shall be referred initially to Railroad for decision.

### 2 MATERIALS

- 2.1 This section not used.

### 3 SUBMITTALS

- 3.1 This section not used.

### 4 EXECUTION

#### 4.1 ARBITRATION (2015)

- 4.1.1 If dispute arises under this contract, the parties shall make a good-faith effort to resolve the dispute. If after such good-faith efforts are made and the dispute remains unresolved, the dispute shall be settled through binding arbitration as provided herein.
- 4.1.2 As established in the Agreement, Contractor may obtain arbitration of any decision rendered by Railroad pursuant to this Section, so long as Contractor initiates such arbitration action within thirty (30) days after the date of Railroad's decision.
  - 4.1.2.1 Failure to initiate arbitration within the required thirty (30) day period will result in Engineer's decision becoming final, conclusive, and unappealable.
- 4.1.3 Arbitration of disputes under the Agreement shall be conducted under the currently applicable Commercial Arbitration Rules of the American Arbitration Association (AAA).
  - 4.1.3.1 Unless specified in the Agreement, the governing law shall be that of the state in which Railroad's General Office is located.
  - 4.1.3.2 In the event of any conflict between such rules and this Section, the terms of this Section shall control.
- 4.1.4 Within 30 days of the service of a notice of request to arbitrate, Railroad and Contractor will appoint one arbitrator who is mutually agreeable to both Railroad and Contractor.
  - 4.1.4.1 Such arbitrator shall be chosen from a list of AAA qualified arbitrators.
  - 4.1.4.2 Such arbitrator shall have a minimum of ten (10) years of railroad construction contract experience.
  - 4.1.4.3 If Railroad and Contractor cannot agree upon an arbitrator, each party shall select one arbitrator, and the two arbitrators shall then select a third arbitrator who shall serve as the arbitrator of any dispute hereunder.
- 4.1.5 In no event shall the demand for arbitration be made after the date when institution of legal or equitable proceedings passed or the dispute is barred by statute of limitations.
- 4.1.6 The arbitrator shall have the power to grant appropriate legal and equitable relief, other than punitive damages, as may be granted by a U.S. court to enforce the terms of the Agreement.



## 160 – LEGAL RELATIONS AND RESPONSIBILITY

- 4.1.7 Railroad and Contractor expressly waive any right to punitive damages arising out of any dispute under this Agreement.
- 4.1.8 The arbitrator shall be required to follow the terms and provisions of this Agreement and the law then applicable to the dispute.
- 4.1.9 All awards and orders of the arbitrator shall be final and binding on the parties, and judgment on the award may be entered in any court of competent jurisdiction.
- 4.1.10 With respect to the decision rendered, both parties hereby renounce all right to take legal measures, except to enforce the decision.
- 4.1.11 Unless mutually agreed otherwise, arbitration shall be held at Railroad's General Office.
- 4.1.12 Costs and fees of the arbitrator shall be borne equally by the parties.
- 4.1.13 Each party shall bear its own attorney's fees, and expert and non-expert witness costs and expenses in connection with the arbitration proceeding.
- 4.1.14 Notwithstanding the foregoing, Railroad reserves all of its rights to, and Contractor agrees that Railroad may, seek all available relief, including emergency equitable and injunctive relief, mandatory or otherwise, through any court of competent jurisdiction.
- 4.1.15 Failure of either party to abide by the decision shall be considered breach of this Agreement.
- 4.2 NOTICE
  - 4.2.1 All notices, requests and other communications hereunder shall be in writing and will be deemed to have been duly given if personally delivered, or if mailed by common postal courier, or if emailed with a return receipt received, to the other party at the addresses given in the Contract.
- 4.3 INSURANCE (2015)
  - 4.3.1 In addition to Contractor's insurance obligations set forth in the Agreement, any professional engineer employed by Contractor for design and other work requiring sealed drawings shall furnish Professional Liability coverage in the amount of \$5,000,000.
  - 4.3.2 The required coverage shall be kept in force until all of Contractor's obligations under this Agreement have been fully discharged and fulfilled, or until Contractor has been specifically released there from in writing by an authorized officer of Railroad.
  - 4.3.3 Notwithstanding any provisions of this article, the liability assumed by Contractor shall not be limited to the required insurance coverage.
  - 4.3.4 These requirements extend to all subcontractors hired by Contractor for the Work.

## 5 MEASUREMENT AND PAYMENT

- 5.1 This section not used.

END OF SECTION

### REVISION HISTORY

The following is the revision history for this standard:

- 7/15/2015 – Revise Arbitration section
- 4/29/2013 – Initial Issue



# GENERAL CONDITIONS

## 170 – SAFETY

### 1 GENERAL

- 1.1 These General Conditions are adopted by Railroad and are supplemental and complimentary to the requirements of the Agreement issued by Railroad to Contractor for the purpose of performing construction and maintenance of Railroad's infrastructure as specified in the Contract Documents. They apply to Contractor, its employees, agents, invitees and subcontractors.
- 1.2 Trains, locomotives or cars may be expected at any time, on any track, in either direction.
- 1.3 Contractor shall proceed with the Work so as to afford optimum protection for all personnel on and adjacent to the job site.
- 1.4 Job briefings are critical to all personnel being aware of the risks associated with the planned work and the engineering controls and procedures necessary to execute the work safely. It is expected that any contractor working on Railroad property aggressively pursue a comprehensive job briefing program that instantly responds to changing conditions.
- 1.5 REFERENCE SPECIFICATIONS (2015)
  - 1.5.1 The following Genesee and Wyoming Railroad Services and Railroad specifications are incorporated into these General Conditions by reference and shall govern Contractor's activities as if written out in full.
    - 1.5.1.1 Contractor Safety Rules.
    - 1.5.1.2 Engineering Safety Rules.
    - 1.5.1.3 Bridge Worker Safety and Fall Protection Rules.
    - 1.5.1.4 Roadway Worker Protection, Roadway Maintenance Machines and On-Track Safety Rules
    - 1.5.1.5 Timetable and Special Instructions of the road where the work is to be performed.
  - 1.5.2 The following Industry Rulebooks specifications are incorporated into these General Conditions by reference and shall govern Contractor's activities as if written out in full.
    - 1.5.2.1 General Code of Operating Rules (GCOR).
    - 1.5.2.2 Canadian Rail Operating Rules (CROR).
    - 1.5.2.3 Norfolk Southern Operating Rules (for CFE only)
  - 1.5.3 The following Federal Safety Regulations are incorporated into these General Conditions by reference and shall govern Contractor's activities as if written out in full.
    - 1.5.3.1 29 CFR 1926 – Construction Industry Safety.
    - 1.5.3.2 49 CFR 214 – Railroad Workplace Safety.
    - 1.5.3.3 SOR/86-304 – Canada Occupational Health and Safety Regulations.

### 2 MATERIALS

- 2.1 This section not used.

### 3 SUBMITTALS (2015)

- 3.1 Prior starting work, Contractor shall develop and submit a site specific Emergency Plan for approval. The plan must be in compliance with all state, federal, FRA (Federal Railroad Administration) / TC (Transport Canada), and Railroad safety regulations. At the minimum, the plan shall include:



- 3.1.1 Anticipated hazards and the appropriate mitigation measures and responses.
- 3.1.2 Emergency Contacts (Police, Fire and Rescue, etc.).
- 3.1.3 Directions to site and ingress/egress points.
- 3.1.4 Maps of the local area indicating emergency facilities such as hospitals, clinics, etc.
- 3.1.5 Railroad key contacts.
- 3.1.6 Contractor and Subcontractor key contacts.
- 3.1.7 Emergency Rescue and Evacuation Plan
- 3.1.8 Trauma incident response procedures.
- 3.1.9 Additional plans as required by the above safety rules.
- 3.2 Prior to entering the property, Contractor shall prepare a Project Safety Sheet as a quick reference of the above Emergency Plan for use in the field.
- 3.3 Prior to entering the property, Contractors working in the US shall submit to Railroad proof of completion of the G&W Roadway Worker Protection Training for Railroad Contractors (RWT Website) for each and every Contractor and Subcontractor employee that will enter Railroad property.
- 3.4 Where applicable, and prior to the start of work, Contractor shall develop and submit a Worker Health and Safety Plan in accordance with the applicable US or Canadian law for lead exposure in construction.
- 3.5 Copies of all emergency and safety plans shall be maintained on the job site and within easy access of all affected employees.

#### 4 EXECUTION

- 4.1 PRECAUTIONS FOR SAFETY OF PERSONNEL (2015)
  - 4.1.1 Contractor shall proceed with the Work so as to afford optimum protection for all personnel on and adjacent to the job site.
  - 4.1.2 Before the start of Work, Contractor shall identify a responsible individual whose duties shall enable him to also act in the capacity of Safety Officer who shall be on site at all times work is underway.
    - 4.1.2.1 This Safety Officer will be responsible for ensuring Contractor maintains a safe working environment in accordance with all Contractor, Railroad, state, and federal rules and regulations.
  - 4.1.3 Prior to entering the property of Railroad, Contractor shall require every Contractor and Subcontractor Employee to successfully complete the G&W Roadway Worker Protection Training for Railroad Contractors on the RWT website using the following instructions. This training shall be completed annually for the duration of the work.
    - 4.1.3.1 Start at website [www.rtrainers.com](http://www.rtrainers.com)
    - 4.1.3.2 Click on the “Online Classes” button
    - 4.1.3.3 Select the G&W course by clicking on the course name
    - 4.1.3.4 On the top of the page select “New User Registration”
    - 4.1.3.5 Fill out all of the fields on the registration page and submit
    - 4.1.3.6 After receiving the username and password via email go back to the G&W course, log in, add the course to your cart and checkout.





- 4.1.3.7 Complete the training and print a copy of the certificate for submittal to Railroad.
- 4.1.4 Prior to entering the property of Railroad, Contractor shall demonstrate it has an effective safety program in each of the following areas:
  - 4.1.4.1 29 CFR 1926 - Safety and Health Regulations for Construction.
  - 4.1.4.2 49 CFR 214 Part C - Roadway Worker Protection.
  - 4.1.4.3 If engaged in bridge work: 49 CFR 214 Part B - Bridge Worker Safety Standards.
  - 4.1.4.4 If working in Canada: SOR/86-304 – Canada Occupational Health and Safety Regulations.
- 4.1.5 For each of the above programs, Contractor shall ensure all personnel engaged in the Work are current and proficient in the required training. Proof of this training for each individual employee shall be submitted as required by Engineer.
- 4.1.6 Contractor's Emergency Plan shall be fully briefed to all personnel engaged in the Work as well as to any visitors to the site.
- 4.1.7 A copy of the Project Safety Sheet shall be kept on each piece of equipment and in each vehicle. A copy shall also be placed in the job site trailer or field office.
- 4.1.8 Safety equipment such as first aid kits, and emergency supplies must be kept on site at all times, and must be maintained and updated as required.
- 4.1.9 At the start of each day, after breaks and prior to starting any new work task, Contractor shall conduct a job briefing to ensure all job site personnel are fully aware of the hazards, protective measures and emergency response procedures.
  - 4.1.9.1 This job briefing shall specifically address on-track safety and bridge worker safety requirements and provisions in effect as well as any other safety measure germane to the work.
  - 4.1.9.2 Contractor shall hold such additional job briefings during the course of the task as necessary to reflect changes in the work or environment.
  - 4.1.9.3 Job briefings shall be recorded on the Contractor Daily Job Briefing Form.
- 4.1.10 In addition to the Occupational Safety and Health Administration (OSHA) requirements, Contractor personnel shall comply with Railroad's personal protective equipment (PPE) rules. At the minimum, these include hardhats, reflective vests, eye protection with side shields, hearing protection and lace-up safety toed boots with distinct heels. Additional PPE appropriate for specific task at hand shall also be utilized.
- 4.1.11 Hazard communication and employee "Right to Know" information is required and shall be freely exchanged between Railroad and Contractor.
- 4.1.12 Railroad has a copy of Railroad's Hazard Communication and Employee Right to Know Program that is open to inspection by Contractor as required.
- 4.1.13 If appropriate to the work, Contractors Lead Hazard plan shall be available for inspection as determined by Engineer and shall be fully briefed to all personnel engaged in the Work as well as to any visitors to the site.
- 4.1.14 Contractor shall proceed with the Work so as to afford optimum protection for all personnel on and adjacent to the job site.



- 4.1.15 Should Contractor become aware of any condition that potentially affects the safety personnel on site, or persons or property near the site, the Work shall immediately cease, and Engineer shall be notified. Work shall not be continued until the condition is corrected to the satisfaction of Engineer.
- 4.1.16 At the close of each work day Contractor shall inspect his work sites to ensure there are no conditions which present unnecessary risk to authorized or unauthorized persons entering the site.
- 4.2 ACCIDENT, INCIDENT AND INJURY REPORTING (2015)
  - 4.2.1 Contractor shall report to Engineer all accidents, mishaps, injuries and close calls, regardless of their severity, as soon as reasonably possible:
    - 4.2.1.1 A verbal report shall be made to the Engineer or Railroad representative as soon as the injured are cared for and the scene is made safe.
    - 4.2.1.2 A written report of the incident shall be submitted to the Engineer within twelve (12) hours of the incident and shall include the known details of who, what, when, where and why. This written report shall be updated as the Contractor's investigation reveals additional information.
- 4.3 WORKING ON OR ABOUT TRACKS
  - 4.3.1 Proper attention and protection are essential to personal safety when working near railroad tracks. Contractor shall ensure all personnel look out for approaching trains and keep clear of such movements.
  - 4.3.2 Contractor personnel shall not occupy any space within the horizontal distance of 25 feet of either side of the centerline of any track (foul the track) without first ensuring roadway worker protection appropriate to the task is established in accordance with Railroad's operating rules.
  - 4.3.3 Only personnel trained in accordance with a Roadway Worker Safety program acceptable to Railroad and in the Railroad's Operating Rules may establish roadway worker protection for Contractor personnel engaged in the Work.
  - 4.3.4 When necessary for Contractor personnel to foul the track, as defined above, in the performance of the Work, Contractor shall provide Engineer a plan and schedule of the specific tasks to be performed at least two (2) working days (48 hours) in advance of the Work.
    - 4.3.4.1 If Engineer or Railroad determine a Flagman is required to establish the appropriate form of roadway worker protection, such personnel will be furnished at Railroad's expense.
    - 4.3.4.2 Railroad is not obligated to provide Flagmen on Contractor's schedule. If Engineer and Railroad determine a Flagman is required but cannot be scheduled, the work shall not proceed until a Flagman is scheduled. The Failure of Railroad to provide such Flagmen will not be considered as a basis for Contractor claims for additional compensation.
    - 4.3.4.3 If Contractor fails to make effective use of the opportunities afforded by the assigned Flagmen, Railroad has the right to seek reimbursement for the costs of providing such personnel.
  - 4.3.5 Contractor shall require his employees, agents and subcontractor personnel to comply with any and all instructions or warnings of the Flagman while the Flagman is providing roadway worker protection for personnel on or about the tracks.



- 4.3.6 Any work within 25 feet of the rail, without consideration to height, must be stopped in the clear to acknowledge approaching and passing trains.
- 4.3.7 Tools or work materials must not be left in close proximity to tracks.
- 4.3.8 At the end of each work day, Contractor shall remove all materials within 25 feet of the centerline of track.
- 4.3.9 All machinery and equipment left unattended on the right-of-way must be left inoperable and secured against movement.
- 4.3.10 All excavations shall be closed when unattended.
- 4.4 **WORKING ON OR ABOUT BRIDGES**
  - 4.4.1 Contractor personnel shall not occupy a railroad bridge without first ensuring bridge worker protection, appropriate to the task, is established in accordance with Contractor's Bridge Worker Safety program.
  - 4.4.2 Only personnel trained in accordance with a Bridge Worker Safety program acceptable to Engineer may establish bridge worker protection for Contractor personnel engaged in the Work.
- 4.5 **PRECAUTIONS FOR SAFETY OF TRAINS**
  - 4.5.1 Before entering onto the property of Railroad, Contractor shall secure permission from Engineer for the occupancy and use of Railroad property and shall confer with Engineer relative to the requirements for railroad clearances, operations and general safety regulations.
  - 4.5.2 If Railroad determines the Work, or Contractor's execution thereof, affects the safety of trains, Engineer may require such precautions as he deems necessary to ensure safety. The cost of these precautions shall be the responsibility of Contractor.
  - 4.5.3 Railroad has the right, but not the responsibility, to assign a Flagman to observe the Work for the purpose of ensuring that the operations of Railroad are not interrupted or jeopardized.
  - 4.5.4 The Flagman shall have absolute authority with respect to Contractor's operations as they affect the safety and continuity of Railroad's operations. At the direction of the Flagman, Contractor shall suspend operations, relocate or reposition equipment, vehicles, materials, persons or other objects and otherwise obey instructions which are issued to ensure safe and unrestricted passage of railroad operations.
  - 4.5.5 Contractor shall not cross Railroad's right-of-way or tracks with vehicles or equipment, except at crossings that are either open to the public or other crossings previously approved by Railroad.
  - 4.5.6 The following temporary clearances are the minimum which must be maintained at all times during the construction operations:
    - 4.5.6.1 Vertical: Twenty three feet (23') above top of highest rail unless otherwise noted on the Plans.
    - 4.5.6.2 Horizontal: Nine feet (9') from centerline of the nearest track to the edge of obstruction.
    - 4.5.6.3 In the event that lesser clearances than the above are required for any part of the work, Contractor must secure written authorization from Railroad for such lesser clearances in advance of the start of the Work on that portion of the project.



4.5.7 Falsework and shoring plans must be prepared and stamped by an engineer licensed in the state where the work is to be done, and will be forwarded to Engineer for final authorization.

4.5.8 Should Contractor become aware of any condition that potentially affects the safety of train operations the Work shall immediately cease, and Railroad shall be notified. Work shall not be continued until the condition is corrected to the satisfaction of Engineer.

#### 4.6 HOUSEKEEPING AND SITE MAINTENANCE

4.6.1 Throughout all phases of operations, including suspension of work, and until final acceptance of the project, the Contractor shall keep the worksite clean and free from rubbish and debris.

4.6.2 Contractor shall maintain the construction site to minimize dust conditions that would adversely affect construction or railroad operations, including equipment operation and worker safety.

4.6.3 Contractor shall not perform operations which generates debris over open water unless he has taken precautions to prevent the debris from entering the water (preferred) or has work practices in place to collect and remove the debris from the water as soon as reasonably possible but no later than the end of the day's work.

4.6.4 Dust or dirt from the construction site, which accumulates on adjacent public or private streets, highways, or roads, shall be promptly swept or washed off the roadway surface.

4.6.5 Contractor shall control dust conditions through the use of water spray applied at an appropriate rate and interval to settle the dust without creating muddy or sloppy conditions. Water and any dust control additives shall be environmentally safe.

#### 4.7 RIGHT OF WAY SIGNAGE

4.7.1 Contractor shall restore any milepost, bridge number, no trespassing signs, etc. adversely affected by the work.

4.7.2 Any signs replaced by contractor shall match other signs adjacent to the site of the work.

### 5 MEASUREMENT AND PAYMENT (2015)

5.1 Safety is of primary concern for any work activity. Plan development, submittals and training are incidental to the Work and shall not be measured for payment.

END OF SECTION

### REVISION HISTORY

The following is the revision history for this standard:

7/17/2015 – General Revision

4/29/2013 – Initial Issue



# 170 – SAFETY

## APPENDIX A – REFERENCE SAFETY DOCUMENTS

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This appendix contains the applicable G&W and Railroad safety documents referenced in Sections 1.5.1., 3.2. and 4.1.9.3.

The following documents may be contained below or attached as separate files:

- Contractor Safety Rules

- Engineering Safety Rules

- Bridge Worker Safety and Fall Protection Rules

- Roadway Worker Protection, Roadway Maintenance Machines and On-Track Safety Rules

- Timetable and Special Instructions of the road where the work is to be performed

The following documents are contained below:

- Project Safety Sheet

- Contractor Daily Job Briefing Form



## PROJECT SAFETY SHEET

**G&W Contractor Safety Rules shall be posted on-site, accessible to all workers, and shall be adhered to.**

All Items on this form must be discussed during all job briefings for any work and a copy of this completed form shall be posted in a conspicuous location, in each vehicle and on each machine.

**Project Description:** \_\_\_\_\_

**Location (Name of Yard, Station, Street Address, Subdivision, Milepost, etc):**

**Railroad Managers Responsible for the Work / Location (Name, Title, Phone Number):**

**Emergency Phone Numbers:**

**G&W Inc. Claims Office (904)-596-7800**

- Is this an active 911 coverage area? (Yes/no): \_\_\_\_\_
- Rescue / EMT: \_\_\_\_\_
- Police: \_\_\_\_\_
- Fire: \_\_\_\_\_
- Name and Location of Nearest Hospital: \_\_\_\_\_

**Daily Safety Job Briefings are required & shall be recorded on a Job Briefing Form**

- Discuss the sequence of job steps
- Inspect tools and equipment before use
- Identify, eliminate, contain, or communicate all potential hazards related to the job
- Identify proper PPE for the job task
- Follow up to ensure compliance w/ safe practices
- Ensure understanding of the planned sequence of events

**Do Roadway Worker Rules apply for the project? (Yes/no):** \_\_\_\_\_

- If yes, all workers must be on-track worker trained in accordance with the contract
- Employee in Charge: \_\_\_\_\_

**Required G&W Documentation at Jobsite:**

PROJECT EIC

- Operating Rules Manual
- Current Timetable and Bulletins
- Engineering Safety Rules
- Roadway Worker Rules

CONTRACTORS & SUBS

- Emergency Plan
- Contractor Safety Rules
- Fall Protection Training & Retrieval Plan
- Roadway Worker Certifications

**The following PPE shall be worn at all times: Hard Hats, Safety Glasses with Side Shields, Safety Toe Work Boots at least 6" high, & Railroad Approved Reflective Apparel. Hearing Protection must be available. Jewelry may not be worn. Other Personal Protective Equipment may also be required as per G&W Contractor Safety Rules.**

**Contractor Name**

**Phone Number**

**Emergency Number**



## CONTRACTOR DAILY JOB BRIEFING FORM

**SUPERVISOR:** \_\_\_\_\_ **911 Area:** Y\_\_ N\_\_

**DATE/TIME:** \_\_\_\_\_ **WEATHER CONDITIONS:** \_\_\_\_\_

**HOSPITAL LOCATION/NUMBER:** \_\_\_\_\_

**WORK LOCATION:** \_\_\_\_\_

**DESCRIPTION OF WORK TO BE DONE:** \_\_\_\_\_

**HAZARDS INVOLVED & SPECIAL WORK CONDITIONS:** \_\_\_\_\_

**CPR QUALIFIED INDIVIDUALS:** \_\_\_\_\_

**FALL PROTECTION REQUIRED FOR THIS JOB?** Y\_\_ N\_\_ **IF SO, WHAT TYPE & RECOVERY?** \_\_\_\_\_

**ALL TOOLS & EQUIPMENT INSPECTED:** Y\_\_ N\_\_ **Who:** \_\_\_\_\_

**DEFECTIVE TOOLS TAKEN OUT OF SERVICE:** Y\_\_ N\_\_ **Why:** \_\_\_\_\_

**PPE IS REQUIRED: (Check for Compliance)**

☐ **Hard Hats / Safety Toe Shoes / Safety Glasses w/ Side Shields / Long Pants / Shirts with Sleeves**

☐ **Hearing Protection**

☐ **ADDITIONAL PPE REQUIRED:** \_\_\_\_\_

**NO JEWELRY ALLOWED: Bracelets, Rings, Ear Rings, Mouth, Tongue, or Face Piercings**

**DO ON-TRACK SAFETY RULES APPLY TO THIS DAY'S WORK?** Y\_\_ N\_\_

**Where are the On-Track Safety rules located?** \_\_\_\_\_

**Do all employees have proof of Roadway Worker Training available?** Y\_\_ N\_\_

**Who is the Employee In Charge (EIC) for on-track protection?** \_\_\_\_\_

**What type of On-Track Safety is provided for the Occupied Track?**

☐ **Exclusive Track Occupancy: Method / Order #:** \_\_\_\_\_

☐ **Inaccessible Track: Method & Location:** \_\_\_\_\_

☐ **Train Approach Warning: Method of Warning:** \_\_\_\_\_

**What are the limits of the protection?** \_\_\_\_\_

**Where is the place of safety?** \_\_\_\_\_

**What type of On-Track Safety is provided for the Adjacent Track?** \_\_\_\_\_

**Do all members of the Work Group understand all aspects of the Job Briefing?** Y\_\_ N\_\_

**Employees Briefed:** \_\_\_\_\_

**Newcomers Briefed:** \_\_\_\_\_





# GENERAL CONDITIONS

## 180 – PROTECTION OF THE ENVIRONMENT

### 1 GENERAL

- 1.1 These General Conditions are adopted by Railroad and are supplemental and complimentary to the requirements of the Contract issued by Railroad to Contractor for the purpose of performing construction and maintenance of Railroad's infrastructure as specified in the Contract Documents.
- 1.2 They apply to Contractor, its employees, agents, invitees and subcontractors.
- 1.3 These specifications shall govern Contractor work practices with respect to protecting the environment and natural resources in and around the project site and include the installation and maintenance of protective measures.
- 1.4 Contractor is responsible for performing all environmental protection compliance with current local, state, and federal regulations and any requirements contained in the permits governing the work.
- 1.5 When shown on the Plans, or when directed by Engineer, contractor shall install erosion and sedimentation control measures appropriate to the work and to the satisfaction of the permitting authority. Such protective measures shall be maintained for the duration of the Work.

### 2 MATERIALS

- 2.1.1 This section not used.

### 3 SUBMITTALS (2015)

- 3.1 Prior to commencing operations, Contractor shall submit an environmental protection plan with at least the following elements:
  - 3.1.1 A list of Federal, State, and local laws, regulations, and permits concerning environmental protection, pollution control and abatement that are applicable to Contractor's proposed operations and the requirements imposed by those laws, regulations, and permits.
  - 3.1.2 Methods for protecting features to be preserved within authorized work areas such as vegetation, landscape features, air and water quality, fish and wildlife, soil, historical, archaeological, and cultural resources.
  - 3.1.3 Methods to provide the required environmental protection, to comply with the applicable laws and regulations, and to correct pollution due to accident, natural causes, or failure to follow the procedures of the environmental protection plan.
  - 3.1.4 Location of the solid waste disposal area.
  - 3.1.5 Drawings showing locations of any proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials.
  - 3.1.6 Environmental monitoring plans for the job site, including land, water, air, and noise.
  - 3.1.7 Traffic control plan including measures to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather, and the amount of mud transported onto paved public roads by vehicles or runoff.
  - 3.1.8 Methods and locations of systems for protecting surface and ground water during construction activities.
  - 3.1.9 A contingency plan for cleanup of accidental spillage of hazardous materials and for restoration of contaminated soils to near-natural conditions
- 3.2 Approval of Contractor's plans will not relieve Contractor of responsibility for adequate and continuing control of pollutants and other environmental protection measures.



## 180 – PROTECTION OF THE ENVIRONMENT

- 3.3 Upon completion of the work, Contractor shall submit to railroad documentation showing the proper disposal of all hazardous and special waste from the project.

### 4 EXECUTION

- 4.1 Contractor shall perform the Work minimizing environmental pollution and damage to natural resources resulting from construction operations.
- 4.2 Contractor shall be responsible for ensuring compliance with this section by all subcontractors.
- 4.3 Contractor's personnel shall be trained as required by applicable rules and regulations governing environmental and natural resource protection.
- 4.4 Unless directed by the Engineer, Contractor shall investigate and shall obtain all required permits, such as national pollutant discharge elimination system (NPDES). Contractor shall be responsible for implementing the terms and requirements of the appropriate permits and for payment of all fees.
- 4.5 In the event Contractor is found to be out of compliance with applicable laws or regulations, permits, and other elements of the environmental protection plan, Contractor shall take the appropriate corrective action. If Contractor fails to return to compliance within 48 hours, Engineer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No time extensions shall be granted or costs or damages allowed to Contractor for any such suspensions.
- 4.6 If work is suspended, delayed, or interrupted due to a court order of competent jurisdiction, Engineer will determine whether the order is due in any part to the acts or omissions of Contractor. If it is determined that the order is not due to Contractor's failing, such suspension, delay, or interruption shall be considered as ordered by Engineer.
- 4.7 Contractor shall thoroughly clean all construction equipment previously used at other sites before it is brought into the work areas, ensuring that soil residuals are removed and no noxious weeds or pests brought onto the project.
- 4.8 Except for daily preventative maintenance checks and services, and routine minor running repair, no other vehicle or equipment servicing or repairing shall be conducted on Railroad property.
- 4.9 In the event of equipment failure, all work shall cease until the area is determined to be free from a hazardous materials spill.
- 4.10 Contractor shall take sufficient measures to prevent spillage of hazardous and toxic materials during dispensing and shall collect waste in suitable containers observing compatibility. Contractor shall transport hazardous waste off Railroad property and dispose of it in compliance with Federal and local laws and regulations.
- 4.10.1 Spills of hazardous or toxic materials shall be immediately reported to Engineer.
- 4.10.2 Contractor shall provide and have on location the required spill kits, drip pans, and other necessary equipment to prevent and mitigate accidental spillage.
- 4.11 When working over or near water, Contractor shall frequently inspect tools and equipment for leaking fluids. Any such leaks discovered shall be immediately remedied in order to prevent contamination of the water.
- 4.12 Contractor shall indemnify, hold harmless and defend Railroad from and against any claims arising from or alleged to arise from a violation of any environmental law, rule, or regulation where such violation shall have been caused by the fault of Contractor.
- 4.13 Contractor shall maintain the construction site to minimize dust conditions that would adversely affect construction or railroad operations, including equipment operation and worker safety.
- 4.13.1 Dust or dirt from the construction site, which accumulates on adjacent public or private streets, highways, or roads, shall be promptly swept or washed off the roadway surface.



## 180 – PROTECTION OF THE ENVIRONMENT

- 4.13.2 Contractor shall control dust conditions through the use of water spray applied at an appropriate rate and interval to settle the dust without creating muddy or sloppy conditions. Water and any dust control additives shall be environmentally safe.
- 4.14 Contractor is solely responsible for compliance with federal, state and local stormwater runoff requirements as they relate to the Work.
- 4.15 Contractor is solely responsible for providing all temporary erosion and sedimentation control measures in accordance with the requirements given in the DOT Standard Specifications for Road and Bridge Construction for state where the Work is performed.
- 4.16 Where Contractor's operations will disturb the soil above the normal high water line of any adjacent body of water, Contractor shall furnish, install, maintain and remove silt fencing designed to collect sediment/debris from work areas at locations determined by Contractor, or directed by Engineer, based on anticipated construction operations and stormwater runoff in order to preserve the surrounding water quality.
  - 4.16.1 Silt fence shall be installed according to the manufacturer's specifications, and in a manner approved by the Engineer prior to the start of construction
  - 4.16.2 Silt fence should be placed on the contour. On slopes greater than 7%, the silt fence should be located 5 feet beyond the base of the slope.
  - 4.16.3 The ends of the silt fence shall be turned upslope a sufficient distance to ensure the flow from a 10 year storm event is retained by the fence.
  - 4.16.4 The bottom edge of the silt fence must be entrenched to a depth of 4 inches with a 2" hook at the bottom. The backfill should be compacted to provide the effective filtration.
  - 4.16.5 Contractor shall have a program of regular maintenance to ensure the silt fence is functioning as intended.
- 4.17 Where Contractor's operations will disturb the soil below normal high water, Contractor shall furnish, install, maintain and remove a flotation silt curtain assembly, designed to collect sediment/debris from in-stream work areas at locations determined by Contractor, or directed by Engineer, in order to preserve the surrounding water quality.
  - 4.17.1 Prior to installing silt curtain, contractor shall develop a stream bed bottom profile.
  - 4.17.2 Silt curtains shall be installed according to the manufacturer's specifications and in a manner approved by the Engineer prior to the start of construction where work may affect water quality in the stream.
  - 4.17.3 The silt curtain assembly shall be installed in the stream in a configuration that prevents silt from traveling beyond the work area, but does not cause flooding upstream of the work area. The Silt curtain shall be sufficient to withstand ten-year flood event.
  - 4.17.4 Contractor shall have a program of regular maintenance to ensure the silt curtain is functioning as intended.
    - 4.17.4.1 Routine maintenance includes regular removal and disposal of excess sediment in contact with either side of the curtain, as directed by Engineer.
    - 4.17.4.2 Excess sediment is a sediment depth of four inches or greater.
    - 4.17.4.3 Contractor shall remove excess sediment between 48 and 72 hours prior to the removal of the silt curtain.
  - 4.17.5 Pumping of water contained within the silt curtain or any other structure shall be done in a manner approved by Engineer.
  - 4.17.6 The silt curtain assembly shall remain in place as required by the work.



## 180 – PROTECTION OF THE ENVIRONMENT

- 4.17.6.1 When allowed, Contractor shall remove the silt curtain in a manner that will prevent turbidity within the waterway.
  - 4.17.6.2 The silt curtain assembly shall remain the property of the Contractor.
- 4.18 To the extent possible, contractor shall not perform activities that generate dust and debris over water.
- 4.19 Where Contractor's operations will generate light construction debris, such as wood chips, etc., over still or moving water, Contractor shall furnish, install, maintain and remove a floating boom designed to collect floating debris from work areas at locations determined by Contractor, or directed by Engineer, based on anticipated construction operations in order to preserve the surrounding water quality.
  - 4.19.1 Floating booms shall be installed according to the manufacturer's specifications, and in a manner approved by the Engineer prior to the start of construction over the water or that may affect water quality. Additional anchorage may be required based on the flow characteristics and manufacturer's specifications.
  - 4.19.2 The boom assembly shall be installed in the water in a configuration that prevents floating debris from traveling beyond the work area. The boom shall be installed in a manner sufficient to withstand ten-year flood water level frequency.
  - 4.19.3 Contractor shall have a program of regular maintenance to ensure the boom is functioning as intended and is free of accumulated debris.
  - 4.19.4 The flotation boom assembly shall remain in place as long as required by the Work.
    - 4.19.4.1 When directed by Engineer, Contractor shall remove the flotation boom in a manner that will prevent release of the floating debris.
    - 4.19.4.2 The floating boom assembly shall remain the property of the Contractor.
- 4.20 Where Contractor's operations will generate heavy construction debris, such as rust and scale cleaned from steel members, or contaminated debris such as lead based paint and primer scrapings, Contractor shall furnish, install, maintain and remove a sturdy collection system beneath the work that is strong enough to catch and retain all falling debris.
  - 4.20.1 Such collection systems shall be installed according to the manufacturer's specifications and in a manner approved by the Engineer prior to the start of construction over the water or that may affect water quality.
  - 4.20.2 Such collection systems shall be cleaned daily to prevent accidental release of collected materials between work shifts.
  - 4.20.3 Contractor shall have a program of regular maintenance to ensure the collection system is functioning as intended and is free of accumulated debris.
  - 4.20.4 The collection system shall remain in place as long as required by the Work.
    - 4.20.4.1 When directed by Engineer, Contractor shall clean the collection system and remove it in a manner that will prevent release of the collected debris.
    - 4.20.4.2 The collection system shall remain the property of the Contractor.
- 4.21 Contractor shall confine all activities to areas defined by the Contract Documents. Prior to the beginning of any construction, Engineer shall identify the land resources to be preserved within the work area. Except in areas indicated on the drawings or specified to be cleared, Contractor shall not disturb land resources without permission.



## 180 – PROTECTION OF THE ENVIRONMENT

- 4.21.1 Isolated areas within the general work area which are to be saved and protected shall also be marked or fenced. Monuments and markers shall be protected before construction operations commence.
- 4.21.2 Contractor shall keep construction activities under surveillance, management, and control to avoid pollution of surface and ground waters. Monitoring of water areas affected by construction shall be Contractor's responsibility.
- 4.21.3 Contractor shall conduct all earthwork to minimize the duration of unprotected soils.
- 4.21.4 Contractor shall effectively prevent erosion and control sedimentation by managing stormwater runoff from the site through approved methods.
- 4.21.5 Contractor shall institute effluent quality monitoring programs as required by Federal, State and local environmental agencies.
- 4.21.6 Waste waters shall be collected into retention ponds where suspended material can be settled out or the water evaporated to separate pollutants from the water. Analysis shall be performed and results reviewed and approved before water in retention ponds is discharged. All construction of, and all water discharged from Contractor's retention ponds shall meet all applicable local, State and Federal rules and regulations.
- 4.21.7 Contractor shall perform all activities in accordance with all local and state rules and all Federal emission and performance laws and standards. Ambient Air Quality Standards set by the Environmental Protection Agency shall be maintained. Monitoring of air quality shall be Contractor's responsibility. Monitoring results will be periodically reviewed by Engineer to ensure compliance.
- 4.21.8 Dust particles; aerosols and gaseous by-products from construction activities shall be controlled at all times. Contractor shall maintain all facilities and other work areas free from particulates which would cause the air pollution standards to be exceeded or which would cause a hazard or a nuisance.
- 4.21.9 Known, existing historical, archaeological, and cultural resources within Contractor's work area will designated by Engineer. Contractor shall protect these and be responsible for their preservation during the life of the contract.
- 4.21.10 If during excavation or other construction activities any previously unidentified or unanticipated cultural or historic resources are discovered, all activities that may damage or alter such resources shall be temporarily suspended. Upon such discovery or find, Contractor shall immediately notify Engineer. It is understood that discovery of finds after beginning of construction may be reason for extending the project deadline.

### 5 MEASUREMENT AND PAYMENT

- 5.1 Installation, maintenance and removal of measures for the protection of the environment are incidental to the Work and shall not be measured for payment.

END OF SECTION

### REVISION HISTORY

The following is the revision history for this standard:

7/17/2015 – Reaffirmation

4/29/2013 – Initial Issue



# GENERAL CONDITIONS

## 185 – PROTECTION OF PROPERTY

### 1 GENERAL

- 1.1 These General Conditions are adopted by Railroad and are supplemental and complimentary to the requirements of the Agreement issued by Railroad to Contractor for the purpose of performing construction and maintenance of Railroad's infrastructure as specified in the Contract Documents. They apply to Contractor, its employees, agents, invitees and subcontractors.
- 1.2 Contractor shall proceed with the Work so as to afford optimum protection for all property in and around the site of the work.

### 2 MATERIALS

- 2.1 This section not used.

### 3 SUBMITTALS

- 3.1 This section not used.

### 4 EXECUTION

#### 4.1 PRECAUTIONS FOR THE PROTECTION OF UTILITIES

- 4.1.1 Contractor is responsible for locating and protecting all utilities that may be affected by the Work.
- 4.1.2 Contractor is cautioned of the existence of underground utilities and facilities which may not be shown on the Plans and relocations of which are essential in order to accommodate the Work. Should such utilities be discovered during the performance of the Work, Engineer will provide for their relocation by others.
- 4.1.3 Contractor shall cooperate with other forces engaged in removal, relocation and protection of utilities and signal cables. The sequence and timing of the Work shall be arranged to coordinate with the utility work.
- 4.1.4 Contractor shall contact the local One-Call System to locate and identify any other buried utilities. This contact shall be made in advance of any work that disturbs the earth and in accordance with the time requirements of the local One-Call System. Contractor shall maintain this locate for the duration of the project in accordance with the requirements of the One-Call System. Additional information on these requirements is available from the One-Call System.
- 4.1.5 Prior to commencing any excavation, Contractor shall contact Railroad signal representative in charge of the area to request an underground signal cable locate. No work may commence until this locate is completed.
- 4.1.6 Contractor shall call for additional locates as necessary to reflect any changes in the nature of the Work.
- 4.1.7 All work done in connection with utility protection, relocation, removal or construction will conform to the Utility Company's Specifications.
- 4.1.8 If any work is to be performed in close proximity to the underground utility or signal cable, the utility and/or Railroad signal representative assigned to the project must be present during the work.
- 4.1.9 Utilities damaged by Contractor shall be repaired to the satisfaction of the utility owner at the sole cost and expense of Contractor.
- 4.1.10 Railroad signal cable damaged by Contractor shall be repaired by Railroad at the sole cost and expense of Contractor.





## 185 – PROTECTION OF PROPERTY

### 4.2 PRECAUTIONS FOR THE PROTECTION OF OTHER PROPERTY

- 4.2.1 Contractor shall be responsible for the preservation of all public and private property along and adjacent to the construction and shall restore, at Contractor expense, any damage or injury to public or private property caused either directly or indirectly in the execution of the Work. Any such damaged property shall be restored to its original condition and to the satisfaction of the property owner at the expense of Contractor.
- 4.2.2 Contractor shall observe and comply with all Federal, State, County and local laws and regulations pertaining to the prevention, control and fighting of fire and conduct of burning operations to include obtaining all necessary permits and licenses. If any loss or damage shall result from fire, as a result of Contractor's operations, Contractor shall promptly repair such loss or damage free from all expense to Railroad.

### 4.3 PRECAUTIONS FOR THE SAFETY OF HIGHWAY TRAFFIC

- 4.3.1 Contractor shall conduct his operations with due regard for the safety of the motoring and pedestrian public traversing the project site adjacent to the work.
- 4.3.2 Where public or private roads cross or are closely adjacent to the Work, Contractor shall furnish and be responsible for protection of all roadway vehicular traffic in accordance with the requirement of the governmental authority having jurisdiction.
- 4.3.3 Contractor shall establish contact with the highway agency responsible for the adjacent roadway to keep them apprised of the status of the work.
- 4.3.4 Contractor is solely responsible for all coordination and permitting required for any lane closures necessary to facilitate the work and shall, at Contractor's cost, abide by any maintenance of traffic plans and measures required by the highway agency.

## 5 MEASUREMENT AND PAYMENT (2015)

- 5.1 Unless specifically called out in the in the scope of work as a pay item, such as Maintenance of Traffic, Protection of Property is incidental to the Work and shall not be measured for payment.

END OF SECTION

## REVISION HISTORY

The following is the revision history for this standard:

7/17/2015 – Reaffirmation

4/29/2013 – Initial Issue





# GENERAL CONDITIONS

## 190 – MEASUREMENT AND PAYMENT

### 1 GENERAL

- 1.1 These General Conditions are adopted by Railroad and are supplemental and complimentary to the requirements of the Agreement issued by Railroad to Contractor for the purpose of performing construction and maintenance of Railroad's infrastructure as specified in the Contract Documents. They apply to Contractor, its employees, agents, invitees and subcontractors.
- 1.2 Unless modified by change order, the Contract Price stated in the Agreement is total amount payable by Railroad to Contractor for performance of Work under this contract.

### 2 MATERIALS

- 2.1 This section not used.

### 3 SUBMITTALS (2015)

- 3.1 As Contractor performs the Work, Contractor shall submit to Engineer an electronic monthly progress bill for the work completed.

### 4 EXECUTION (2015)

- 4.1 Contractor shall submit monthly invoicing in a form approved by the Engineer.
- 4.2 The invoice submitted by the Contractor must at minimum include the following items:
  - 4.2.1 Purchase Order number
  - 4.2.2 Railroad's name and location of work
  - 4.2.3 Date work was performed
  - 4.2.4 Number of units of work complete
  - 4.2.5 Total amount of payment requested less 10 % retainage
  - 4.2.6 Total retainage held to date
  - 4.2.7 Supporting detail shall include by bid item, the original bid amount, percent complete, amount previously invoiced and current invoice amount.
- 4.3 Invoices submitted by the Contractor shall be specific to a single railroad property.
- 4.4 Invoices shall be sent electronically to Genesee & Wyoming Accounts Payable Department at [accountspayable@gwrr.com](mailto:accountspayable@gwrr.com).
  - 4.4.1 Electronic copies shall also be sent to the Railroad General Manager and the responsible Vice President Engineering.
  - 4.4.2 The subject line of all such emails shall include the railroad reporting marks, the Purchase Order number and a brief description of the services being billed.
- 4.5 Contractor must obtain approval of the Engineer prior to the filing of the Notice of Completion of the Project

### 5 MEASUREMENT AND PAYMENT

- 5.1 The basis for such progress billing shall be the number of units completed in that month multiplied by the unit prices contained in the Proposal or as agreed in writing by Contractor and Engineer.
  - 5.1.1 Measurement of the number of units completed shall be by methods best adapted for each item of work as described in the Contract Documents and according to generally accepted standard engineering practice.



## 190 – MEASUREMENT AND PAYMENT

- 5.1.2 Payment will be made only for actual quantities within the designated limit, as indicated in the Contract Documents.
- 5.1.3 Work not specifically spelled out as a pay item shall be included in the cost of the item for which work is being undertaken. No separate payment will be made to Contractor
- 5.2 Upon request by Engineer, Contractor shall demonstrate the Work quantities claimed in the progress billing fully meet the requirements of the Contract Documents.
- 5.3 In the event Engineer determines that billed items are not substantially complete and in conformance with the Contract Documents, excluding minor items for correction, Engineer shall remove the non-conforming quantities from the progress billing. Such items so removed may be resubmitted for payment upon their completion to the satisfaction of Engineer.
- 5.4 Engineer shall be the final judge as to the accuracy of any measurements or quantities, and the reasonableness of any approximations in lieu of accurate determinations.
- 5.5 Railroad, at its discretion, may make payment for work it finds to be substantially complete but not in full compliance with the Contract Documents. Such payments may be subject to 10% retainage.
- 5.6 Total retainage withheld by Railroad shall not exceed 10% of the Contract sum or \$300,000 unless Contractor fails to remedy defective conditions identified by Engineer. In such case, Railroad may increase the retainage commensurate with the defective conditions.
  - 5.6.1 Retainage shall be held by Railroad for forty five (45) days after Notice of Completion is filed by Contractor and accepted by Engineer.
- 5.7 Payment Terms are Net 45 Days.
- 5.8 Contractor shall warrant and guarantee that title to all Work, materials and equipment covered by the progress billing shall pass to Railroad free and clear of all liens, claims, security interests or encumbrances.

END OF SECTION

### REVISION HISTORY

The following is the revision history for this standard:

7/17/2015 – Update required invoice detail.

4/29/2013 – Initial Issue



# GENERAL CONDITIONS

## 195 – CLOSEOUT

### 1 GENERAL

- 1.1 These General Conditions are adopted by Railroad and are supplemental and complimentary to the requirements of the Agreement issued by Railroad to Contractor for the purpose of performing construction and maintenance of Railroad's infrastructure as specified in the Contract Documents. They apply to Contractor, its employees, agents, invitees and subcontractors.

### 2 MATERIALS

- 2.1 This section not used.

### 3 SUBMITTALS

- 3.1 Upon completion of the Work, and prior to final payment, Contractor shall return to Engineer one electronic set of As-Built Drawings and Specifications clearly marked with any changes made during execution of the work. If necessary, supplemental drawings may also be submitted. Any supplemental items shall be referenced on Plans and/or Specifications
- 3.2 Prior to final Payment, Contractor shall furnish to Railroad the Warranty of Work after Final Payment attached hereto as Appendix A.
- 3.3 Prior to final Payment, Contractor shall furnish to Railroad the Final Waiver of Lien attached hereto as Appendix B.

### 4 EXECUTION

- 4.1 Before the Work is finally accepted, Contractor shall remove from Railroad's property all rubbish, excess material, contractor's tools and equipment and other property not the property of Railroad.
- 4.2 Contractor shall restore to a reasonably smooth condition, safe for walking, all adjacent areas disturbed during the project.
- 4.3 If Contractor fails to clean up the worksite area upon completion of the project, the Engineer may do so and the cost thereof shall be deducted from the final payment to Contractor.
- 4.4 Final payment for the Work shall be contingent upon final inspection of the completed work and correction of any findings.

### 5 MEASUREMENT AND PAYMENT (2015)

- 5.1 Project closeout is incidental to the work and shall not be measured for payment.

END OF SECTION

### REVISION HISTORY

The following is the revision history for this standard:

7/17/2015 – Reaffirmation

4/29/2013 – Initial Issue



# 195 – CLOSEOUT APPENDIX A – WARRANTY OF WORK

## WARRANTY OF WORK AFTER FINAL PAYMENT

\_\_\_\_\_, as Contractor, does hereby warrant all Work and materials supplied under this Agreement to be in full and complete accord with the Contract Documents and Agreement between Railroad and Contractor; that all Work and materials are free from any and all defects and imperfections and fully suitable for railroad operations.

Contractor agrees that should any defect develop or appear that is not the result of improper use, Contractor shall promptly, upon demand, fully correct, substitute, repair and make good any such defective Work or material without any cost to Railroad and will save Railroad harmless from any claim, demand, loss or damage by reason of any breach of this warranty.

The period of this warranty shall commence on the \_\_\_\_ day of \_\_\_\_\_, 20\_\_, the date on which Engineer certifies that all Agreement Work is complete.

This warranty shall continue to be in full force and effect for the period of one year, except for those items for which a longer period of warranty is specifically stated in the Contract Documents. Warranties for Work stated in the Contract Documents shall continue in full force and effect for the respective periods expressly stated.

IN WITNESS WHEREOF, the undersigned has signed and sealed this instrument this \_\_\_\_ day of \_\_\_\_\_, 20\_\_.

ATTEST:

Contractor: \_\_\_\_\_

By: \_\_\_\_\_

By: \_\_\_\_\_

Name: \_\_\_\_\_

Name: \_\_\_\_\_

Title: \_\_\_\_\_

Title: \_\_\_\_\_



# 195 – CLOSEOUT APPENDIX B – WAIVER OF LIEN

## FINAL WAIVER OF LIEN

STATE OF \_\_\_\_\_)

COUNTY OF \_\_\_\_\_) SS

TO WHOM IT MAY CONCERN:

WHEREAS the undersigned has been employed by \_\_\_\_\_  
(Railroad) to furnish \_\_\_\_\_ for the  
premises known as \_\_\_\_\_ over \_\_\_\_\_, near  
\_\_\_\_\_, \_\_\_\_\_ of which Railroad is the owner.

The undersigned, for and in consideration of \_\_\_\_\_ Dollars (\$\_\_\_\_\_), and other  
good and valuable considerations, the receipt whereof is hereby acknowledged, do(es) hereby waive and release  
any and all lien or claim of, or right to, lien, under the statutes of the State of Illinois, relating to mechanics'  
liens, with respect to and on said above-described premises, and the improvements thereon, and on the material,  
fixtures, apparatus or machinery furnished, and on the moneys, funds or other considerations due or to become  
due from the owner, on account of labor, services, material, fixtures, apparatus or machinery heretofore  
furnished, or which may be furnished at any time hereafter, by the undersigned for the above-described  
premises.

Given under my hand signed and sealed this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_.

(SEAL)

ATTEST:

Contractor: \_\_\_\_\_

By: \_\_\_\_\_

By: \_\_\_\_\_

Name: \_\_\_\_\_

Name: \_\_\_\_\_

Title: \_\_\_\_\_

Title: \_\_\_\_\_

NOTE: All waivers must be for the full amount paid. If waiver is for a corporation, corporate name should be used, corporate seal affixed and title of officer signing waiver should be set forth; if waiver is for a partnership, the partnership name should be used, partner should sign and designate himself as partner.



# GENERAL CONDITIONS

## 198 – GENERAL CONDITIONS SUBMITTAL LIST

### 1 GENERAL

- 1.1 These General Conditions are adopted by Railroad and are supplemental and complimentary to the requirements of the Agreement issued by Railroad to Contractor for the purpose of performing construction and maintenance of Railroad's infrastructure as specified in the Contract Documents. They apply to Contractor, its employees, agents, invitees and subcontractors.

### 2 MATERIALS

- 2.1 This section not used.

### 3 SUBMITTALS (2015)

- 3.1 The following table summarizes the submittals required by the 100 series of the Genesee and Wyoming Standard Construction Specifications:

Specification	Section	Requirement	Frequency
120 – Execution	3.1	Name and contact information of Superintendent	Beginning of Work
120 – Execution	3.2	Proposed plan and schedule	Beginning of Work
120 – Execution	3.2.1	Updates to the plan and schedule	With pay applications
120 – Execution	3.3	Names of Subcontractors not in proposal	Beginning of Work
124 – Control of Materials	3.1	Solid and hazardous waste collection, storage and disposal plan	Beginning of Work
124 – Control of Materials	3.2	Documentation of all released material	Prior to final billing
128 – Temporary Construction	3.1	Site plan of laydown and temporary facilities	Beginning of Work
128 – Temporary Construction	3.2	Request for temporary crossings	Beginning of Work
128 – Temporary Construction	3.3	Permitting agency acceptance of cleanup of temporary in-water construction	Prior to final billing
130 – Delay of Trains	3.1	Proposed plan for extended track outage	30 Days prior to outage
170 – Safety	3.1	Emergency plan	Beginning of Work
170 – Safety	3.3	Proof of Roadway Worker Safety Training	Beginning of Work
170 – Safety	3.4	Lead abatement plan	Beginning of Work
180 – Protection of the Environment	3.1	Environmental protection plan	Beginning of Work
180 – Protection of the Environment	3.2	Documentation of proper disposal of special and hazardous waste	Prior to final billing
190 – Measurement and Payment	3.1	Electronic progress billing	Monthly
194 – Closeout	3.1	As-built drawings	Prior to final billing
194 – Closeout	3.2	Warranty of Work	Prior to final billing
194 – Closeout	3.3	Final Waiver of Lien	Prior to final billing

### 4 EXECUTION

This section not used.



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## 198 – GENERAL CONDITIONS SUBMITTAL LIST

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### 5 MEASUREMENT AND PAYMENT

5.1 This section not used.

END OF SECTION

### REVISION HISTORY

The following is the revision history for this standard:

7/17/2015 – Reaffirmation

4/29/2013 – Initial Issue





# STANDARD CONSTRUCTION SPECIFICATIONS

## 505 – STRUCTURES GENERAL

### 1 GENERAL

#### 1.1 SCOPE

- 1.1.1 These Structures General Specifications are adopted by Railroad and are supplemental and complimentary to the requirements of the Contract issued by Railroad to Contractor for the purpose of performing construction and maintenance of Railroad's Structure(s) as specified in the Contract Documents. They apply to Contractor, its employees, agents, invitees and subcontractors.
- 1.1.2 General definitions germane to the Contract Documents are contained in the General Conditions. Definitions germane to individual Work tasks are contained in the Standard Construction Specifications for the Work.

#### 1.2 PLANS AND SPECIFICATIONS

- 1.2.1 All Work performed and materials furnished under this Agreement shall be in accordance with the Contract Documents.
- 1.2.2 The latest edition in effect at Agreement execution of the following industry standard specifications are incorporated into these Specifications by reference and shall govern the Work as if written out in full:
  - 1.2.2.1 American Concrete Institute (ACI) Specification 318 - Building Code Requirements for Structural Concrete.
  - 1.2.2.2 American Institute of Steel Construction (AISC) Steel Construction Manual.
  - 1.2.2.3 American Wood Protection Association (APWA) Book of Standards.
  - 1.2.2.4 American Railway Engineering and Maintenance of Way Association Manual for Railway Engineering (AREMA Manual).
  - 1.2.2.5 ASTM International specifications germane to the Work.
  - 1.2.2.6 Society for Protective Coatings (SSPC) Painting Manual Volume 2 (SSPC Painting Manual).
- 1.2.3 The latest edition in effect at Agreement execution of the Department of Transportation specifications, for the state in which the work is performed, are incorporated into these Specifications by reference and shall govern the Work as if written out in full:
  - 1.2.3.1 Standard Specifications for Road and Bridge Construction (or equivalent specifications).
- 1.2.4 Generally accepted industry standard practice and manufacturer recommendations not inconsistent with the Contract Documents and the above rules and specifications are incorporated into these General Conditions by reference.
- 1.2.5 Contractor is advised to familiarize himself with the following sections of the AREMA Manual:
  - 1.2.5.1 Chapter 1 – Roadway and Ballast:
    - Part 1 – Roadbed
    - Part 3 – Natural Waterways
    - Part 4 – Culverts
    - Part 8 – Tunnels



1.2.5.2 Chapter 7 – Timber structures

Part 1 – Material Specifications for Lumber, Piles, Glue Laminated Timber and Fasteners

Part 2 - Design of Wood Railway Bridges and Trestles for Railway Loading

Part 3 – Construction, Maintenance and Inspection of Timber Structures

1.2.5.3 Chapter 8 – Concrete Structures and Foundations:

Part 1 – Materials Tests and Construction Requirements

Part 2 – Reinforced Concrete Design

Part 3 – Spread Footing Foundations

Part 4 – Pile Foundations

Part 5 – Retaining Walls and Abutments

Part 7 – Mechanically Stabilized Embankment

Part 10 – Reinforced Concrete Culvert Pipe

Part 11 – Lining Railway Tunnels

Part 14 – Repair and Rehabilitation of Concrete Structures

Part 16 – Design and Construction of Reinforced Concrete Box Culverts

Part 17 – Prestressed Concrete

Part 23 – Pier Protection Systems at Spans Over Navigable Streams

Part 24 – Drilled Shaft Foundations

Part 29 – Waterproofing

1.2.5.4 Chapter 15 – Steel Structures

Part 1 – Design

Part 3 – Fabrication

Part 4 – Erection

Part 6 – Movable Bridges

Part 7 – Existing Bridges

Part 8 – Miscellaneous

Part 11 – Bearing Construction

1.2.5.5 Chapter 28 – Clearances

1.2.6 Contractor shall submit to Engineer evidence of ownership for the AREMA Manual Chapters listed. Such copies shall be no more than two years old at the date of Agreement execution for the Work.

1.2.7 In the event of conflict between the Specifications and the above references and standard practices, these Specifications shall govern.



## 505 – STRUCTURES GENERAL

- 1.2.8 Contractor shall maintain copies of the reference specifications available at the site for use by Contractor's supervision and craft employees.

### 1.3 CONTRACTOR RESPONSIBILITY

- 1.3.1 Contractor shall provide all necessary material, equipment and labor to perform the Work.
- 1.3.2 Contractor is solely responsible for the quality of construction and the workmanship of the finished Work.
- 1.3.3 Contractor shall handle and store all material in accordance with the requirements of the Contract Documents.
- 1.3.4 Contractor shall handle and store all materials and construction debris in such a manner as to prevent pollution, especially within waters in and around the construction site.
- 1.3.5 Contractor shall be responsible for carrying out all project horizontal and vertical control.
- 1.3.6 Contractor shall keep the project site in a neat, safe and orderly condition.
- 1.3.7 Contractor shall prevent construction materials or debris from accumulating in such a manner as to block drainage or present a footing hazard.
- 1.3.8 Contractor is to complete all work to a level of detail and in a manner satisfactory to the Contract Documents and Engineer.

## 2 MATERIALS

- 2.1 Contractor is encouraged to find innovative materials for the execution of the work that will meet or exceed the quality of construction envisioned by the Contract Documents but at a reduced schedule or overall cost.
- 2.2 Any alternative materials proposed by contractor shall be submitted to Engineer for evaluation and approval prior to the start of work.
  - 2.2.1 Contractor shall include with this submittal all pertinent technical data along with the justification for the proposed change.

## 3 SUBMITTALS

- 3.1 Contractor shall submit to Engineer all information required by the Contract Documents at the timing and level of detail specified.
  - 3.1.1 Where two or more sections require related information, Contractor is encouraged to make one submittal provided he clearly indicates the submittal requirements being met.
- 3.2 No work may commence on any task until Engineer has approved the required submittals.
  - 3.2.1 Engineer's approval of the submitted information in no way shall relieve Contractor of responsibility for constructability, erectability, fabrication or fit in the field.
  - 3.2.2 Final approval of the submitted information by Engineer shall be subject to satisfactory performance in the field.
- 3.3 A Submittal Summary may be included in the Contract Documents for Contractor's reference. The absence of a submittal from the Submittal Summary does not relieve the contractor of his obligation to make a required submittal.
- 3.4 On a daily basis, Contractor shall document the work on the Daily Production Report contained in Appendix A of this section or an equivalent form approved by engineer.
  - 3.4.1 When the daily production involves more than one structure, Contractor shall complete a separate Daily Production Report for each structure worked.



## 505 – STRUCTURES GENERAL

3.4.2 Completed reports are to be submitted at least weekly to Railroad for its use in validating contractor pay requests.

3.5 Upon completion of the work, Contractor shall prepare as-built information to the level of detail called for in the Contract Documents and approved by Engineer.

3.5.1 At the minimum, this shall include scanned copies of all daily production reports segregated by structure.

### 4 EXECUTION

4.1 Contractor is encouraged to find innovative means and methods for the execution of the work that will meet or exceed the quality of construction envisioned by the Contract Documents but at a reduced schedule or overall cost.

4.2 Any alternative means and methods proposed by contractor shall be submitted to Engineer for evaluation and approval prior to the start of work.

4.2.1 Contractor shall include with this submittal all pertinent technical data along with the justification for the proposed change.

### 5 MEASUREMENT AND PAYMENT

5.1 This section not used.

END OF SECTION

### REVISION HISTORY

The following is the revision history for this standard:

4/29/2013 – Initial Issue



# 505 – STRUCTURES GENERAL

## APPENDIX A – DAILY PRODUCTION REPORT

RAILROAD: \_\_\_\_\_

DATE: \_\_\_\_\_

### GENERAL:

SUBDIVISION: \_\_\_\_\_

CONTRACTOR: \_\_\_\_\_

BRIDGE: \_\_\_\_\_

SUPERVISOR: \_\_\_\_\_

SECTION: \_\_\_\_\_

WATCHMAN: \_\_\_\_\_

STATION/ST: \_\_\_\_\_

INSPECTOR: \_\_\_\_\_

### SAFETY:

WEATHER: \_\_\_\_\_

PPE REQUIRED: \_\_\_\_\_ FALL PROTECTION: \_\_\_\_\_

RESCUE PLAN: \_\_\_\_\_

TRACK SAFETY: \_\_\_\_\_ EMP IN CHARGE: \_\_\_\_\_

PERMITS: \_\_\_\_\_ ONE CALL: \_\_\_\_\_

JOB BRIEFING: TIME: \_\_\_\_\_ NO. ATTENDED: \_\_\_\_\_

TOPICS: \_\_\_\_\_

INCIDENTS: \_\_\_\_\_

### PRODUCTION:

START TIME: \_\_\_\_\_ END TIME: \_\_\_\_\_

TRACK TIME: PLANNED: \_\_\_\_\_ ACTUAL: \_\_\_\_\_

DELAYS: \_\_\_\_\_ REASON: \_\_\_\_\_

EQUIP USED: \_\_\_\_\_

WORK: \_\_\_\_\_

PUNCHLIST: \_\_\_\_\_

HOUSEKEEPING: DEBRIS: \_\_\_\_\_ TRASH: \_\_\_\_\_

SIGNED: CONTRACTOR: \_\_\_\_\_ RAILROAD: \_\_\_\_\_

Page \_\_\_\_ of \_\_\_\_



# STANDARD CONSTRUCTION SPECIFICATIONS

## 510 – STRUCTURE EXCAVATION AND BACKFILL

### 1 GENERAL

- 1.1 These Structural Construction Specifications are adopted by Railroad and are supplemental and complimentary to the requirements of the Contract issued by Railroad to Contractor for the purpose of performing construction and maintenance of Railroad's Structure(s) as specified in the Contract Documents. They apply to Contractor, its employees, agents, invitees and subcontractors.
- 1.2 Contractor is responsible for performing all Structure excavation and backfill in compliance with the applicable state, federal, local and Occupational Safety and Health Administration (OSHA) regulations.
- 1.3 Protective Shoring shall consist of providing protection for railroad track or other areas designated on the plans due to an adjacent excavation in accordance with these Specifications, the requirements of Part 20 – Flexible Sheet Pile Bulkheads of Chapter 8 – Concrete Structures and Foundations of the American Railway Engineering and Maintenance of Way Association (AREMA) Manual for Railway Engineering (Manual), and the details shown on the Plans.
- 1.4 Cofferdams shall consist of providing protection for structural excavation and construction in wet conditions as designated on the plans.
- 1.5 Structure excavation shall consist of excavation of all materials, of whatever nature, necessary for the construction of foundations for all structures, other than drilled shaft foundations or pipe culverts, in accordance with the Plans.
- 1.6 Structure excavation includes wasting or disposal of excavated material in such a manner it will not affect the carrying capacity of any drainage or be unsightly. Contaminated material shall be properly disposed of in accordance with all environmental laws.
- 1.7 Structure backfill shall consist of furnishing, placing and compacting backfill material around structures to the lines designated on the Plans.
- 1.8 Pervious backfill shall consist of furnishing and placing pervious backfill material behind bridge abutments, wingwalls, and retaining walls in accordance with details shown on the Plans.

### 2 MATERIALS

- 2.1 Protective Shoring materials shall be in accordance with Contractor's drawings approved by Engineer.
- 2.2 Structure Backfill shall be made using materials indicated in the Plans or as approved by Engineer, and may be obtained from excavation or other sources. Backfill material shall noncohesive and free draining and be free from stones, frozen lumps, wood or other extraneous material that interferes with compaction.
- 2.3 Pervious Backfill Material shall consist of crushed rock or crushed gravel, or combinations thereof and shall conform to the following grading requirements:

Sieve Sizes	Percentage Passing
1-1/2 inch	100
1 inch	90-100
3/4 inch	40-85
1/2 inch	10-40
3/8 inch	0-15
No. 4	0-5

## 3 SUBMITTALS

- 3.1 When required by the Plans or Special Conditions, Contractor shall submit to Engineer the name of the proposed soils and compaction testing firm.
- 3.2 Prior to the start of work, Contractor shall submit to engineer for approval detailed plans and design calculation for protection and support of excavations. Such plans shall be stamped by a licensed professional or structural engineer in the state where the work is to be done. Installation or construction of excavation protection or support elements, including cofferdams, shall not begin without the prior approval of Engineer. This approval shall not relieve Contractor of responsibility for the protective shoring.
- 3.3 Prior to the start of work, Contractor shall submit to Engineer for approval the proposed source of the backfill material and its properties.
- 3.4 Where specified in the Plans or Special Conditions, Contractor shall submit to Engineer all required backfill materials testing and certifications.
- 3.5 Where specified in the Plans or Special Conditions, Contractor shall submit to Engineer all required backfill compaction testing results.

## 4 EXECUTION

- 4.1 Contractor is responsible for designing, providing, installing, maintaining, and removing the protective shoring when specified on the plans or by Engineer. Installation or excavation shall not begin without the prior approval of Engineer.
  - 4.1.1 Protective shoring shall be constructed of engineered structural components.
  - 4.1.2 Design of protective shoring shall consider Cooper E 80 live load surcharge for excavations adjacent to railroad tracks in accordance with the requirements Part 20 – Flexible Sheet Pile Bulkheads of Chapter 8 – Concrete Structures and Foundations of the AREMA Manual.
  - 4.1.3 A safety factor of one and one half (1.5) shall be used in the design of temporary protective shoring. A safety factor of two (2.0) shall be used in the design of permanent protective shoring.
  - 4.1.4 Figure 13-1 shows the limit lines where protective shoring is required.
  - 4.1.5 Protective shoring shall not be removed without Engineer's approval.

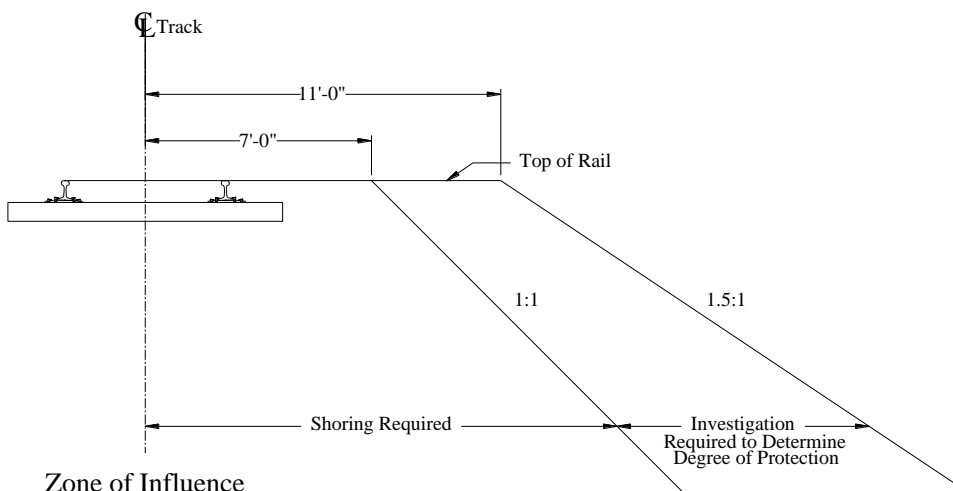


Figure 4-1 Shoring Requirements





## 510 – STRUCTURE EXCAVATION AND BACKFILL

- 4.1 Contractor is responsible for designing, providing, installing, maintaining, and removing cofferdams when specified on the plans or by Engineer. Installation and dewatering not begin without the prior approval of Engineer.
  - 4.1.1 Cofferdams shall be constructed of engineered structural components and shall be carried well below the bottom of the footings and be well braced and as watertight as practicable.
  - 4.1.2 The interior dimensions of cofferdams shall be such as to give sufficient clearance for the construction and exterior inspection of forms and to permit pumping outside of the forms.
  - 4.1.3 Cofferdams shall be constructed so as to protect newly placed concrete from erosion. Struts or bracing shall not be placed in such a way as to extend into the foundation element.
  - 4.1.4 The natural stream bed adjacent to the structure and outside of the cofferdam shall not be disturbed without the approval of Engineer.
  - 4.1.5 Unless otherwise specified, and with Engineer's approval, Cofferdams shall be entirely removed after completion of the foundation and the concrete has achieved at least 75% of its 28 day strength. Care shall be taken to avoid damage to the finished concrete.
- 4.2 Excavation shall conform to the lines and grades shown on the plans, or as directed by Engineer. Excavation shall include removal of all materials encountered, regardless of their nature.
  - 4.2.1 Contractor is responsible for designing, providing, installing, and removing protective sheeting, shoring, cofferdams, or other elements required in order to provide stable and dry excavations for all structures.
  - 4.2.2 Protection and shoring of excavations shall, as a minimum, be as required by applicable standards and regulations, including 29CFR Part 1926, Subpart P - Excavations, Trenching, and Shoring of the Occupational Safety and Health Administration Standards and Interpretations in the US and SOR/86-304 Section 3.12 – Excavations of the Canada Occupational Health and Safety Regulations.
  - 4.2.3 The elevation of the bottom of footings shown in the Plans shall be considered as approximate. Engineer, at his discretion, may order such changes in dimension or elevation of footings as necessary to secure a satisfactory foundation.
  - 4.2.4 Excavated material shall be classified as "Structure Excavation Common" or "Structure Excavation Rock."
  - 4.2.5 "Structure Excavation Common" shall include all material and foundation materials that can be excavated with a dozer blade, any size backhoe, ripping with a D-7 or smaller dozer, impact breaker less than 6,000 ft.-lb. or directly by a wheel loader. Unless other classifications are specified in the invitation to bid, "Structure Excavation Common" shall include all materials.
  - 4.2.6 "Structure Excavation Rock" shall include material requiring the use of heavy mechanical breakage (D-8 or larger dozer ripping with a single shank ripper blade and/or 6,000 ft.-lb. or greater impact breaker) or blasting.
  - 4.2.7 If during excavation Contractor encounters material that may be classified as rock excavation, such material shall be uncovered and Engineer notified so that Engineer can classify the material. Rock excavation shall be governed by the requirements of Engineer. Blasting shall only be allowed if authorized in advance by Engineer.
  - 4.2.8 Excavated material not suitable for backfill, or excess excavated material shall be legally disposed of by Contractor at a location and in a manner directed or approved by Engineer.



## 510 – STRUCTURE EXCAVATION AND BACKFILL

- 4.2.9 Except where rock or unsuitable materials are encountered the last of the excavation shall be performed by hand to a smooth surface to ensure a foundation of undisturbed earth.
- 4.2.10 Where rock is encountered, it shall not be allowed to project into the lines of the structure.
- 4.2.11 Where rock exists under a portion of a footing which is otherwise supported by an earth foundation, the rock shall first be excavated to a depth of twelve (12) inches below the underside of the footing and be replaced with gravel or other fine material.
- 4.2.12 Over-excavation shall not be allowed without specific instructions from Engineer.
- 4.3 Structure Backfill shall consist of placing and compacting the necessary fill within the limits specified in the plans.
  - 4.3.1 All bracing, forms, and rubbish shall be removed prior to placing the backfill. Unless sheeting and shoring is to remain in place, it shall be removed in such a manner to prevent loosening unexcavated material.
  - 4.3.2 Backfill shall not be placed until the structure has been approved for backfilling by Engineer.
    - 4.3.2.1 Where specified on the plans, backfill shall not be placed against concrete walls or piers until the concrete has been waterproofed.
  - 4.3.3 Backfill material shall be placed in uniform horizontal layers not exceeding six (6) inches in thickness before compaction. The backfill shall be brought up uniformly on all sides of the structure. The backfill shall be compacted to the density shown in the Contract Documents or to a minimum of 98% of the maximum dry density determined in accordance with the Standard Proctor compaction test (ASTM D698) and a moisture content within 2% of Optimum.
  - 4.3.4 Backfill material shall not have rocks larger than 3 inches placed within 18 inches of the concrete columns, piers, wing walls, retaining walls or abutments.
- 4.4 Pervious backfill material shall be placed behind bridge abutments, wingwalls and retaining walls to the lines, grades and elevations shown on the plans or as directed by Engineer.
  - 4.4.1 Pervious backfill material shall be placed in layers along with and by the same methods specified for Structure Backfill above.
  - 4.4.2 Pervious backfill material at any one location shall be approximately the same grading, and at locations where the material would otherwise be exposed to erosion shall be covered with at least a 12 inch layer of earthy material approved by Engineer.
- 4.5 Where required in the Plans or Special Conditions, soils and compaction testing shall be performed by an independent testing agency not affiliated with Contractor.

### 5 MEASUREMENT AND PAYMENT

- 5.1 Structure Excavation, Protective Shoring, Structure Backfill and Pervious Material are incidental to foundation construction and shall not be measured for payment.

END OF SECTION

### REVISION HISTORY

The following is the revision history for this standard:

4/30/2013 – Initial Issue



# STANDARD CONSTRUCTION SPECIFICATIONS

## 520 – PILE FOUNDATIONS

### 1 GENERAL

- 1.1 These Structural Construction Specifications are adopted by Railroad and are supplemental and complimentary to the requirements of the Contract issued by Railroad to Contractor for the purpose of performing construction and maintenance of Railroad's Structure as specified in the Contract Documents.
- 1.2 They apply to Contractor, its employees, agents, invitees and subcontractors.
- 1.3 These specifications shall govern the furnishing, driving, building up and cutting off of timber, concrete and steel piles in accordance with the lines, grades, and locations shown on the plans or as directed by Engineer.
- 1.4 Contractor is responsible for performing all pile operations in compliance with the current state, federal, local, FRA and OSHA regulations (including the equivalent Canadian regulations), specifically with respect to fall protection.
- 1.5 When shown on the plans or when directed by Engineer, test piles shall be driven to determine the necessary lengths of piles to be ordered for the work.
  - 1.5.1 The number and location of test piles to be driven shall be as shown on the plans or as established by Engineer; in general, at least two test piles shall be driven at each structure.
- 1.6 Unless otherwise directed by Engineer, the embankment at bridge ends shall be constructed to grade and thoroughly compacted to the full amount required by the Contract Documents prior to the driving of piling in the embankment area.
- 1.7 Foundation piling shall not be driven until the excavation is complete.

### 2 MATERIALS

- 2.1 Timber Piles:
  - 2.1.1 Timber piles shall be First Class in accordance with the requirement of Section 1.9 – Specifications for Timber Pile of Chapter 7 – Timber Structures of the AREMA Manual for first-class piles with a minimum tip circumference of 25 inches.
    - 2.1.1.1 The butt and tip circumference shall meet the requirements of Tables 7-1-2 and 7-1-3 of the AREMA Manual.
    - 2.1.1.2 The ratio of “out of round” maximum to minimum diameter at the butt or the tip of any pile shall not exceed 1.2.
    - 2.1.1.3 All circumference measurements must be taken under the bark.
    - 2.1.1.4 The circumference at the butt may not exceed the circumference at 3 feet from the butt by more than 8 inches.
    - 2.1.1.5 A straight line from the center of the butt to the center of the tip of the pile shall lie entirely within the body of the pile.
    - 2.1.1.6 Piles shall be free from short crooks that deviate more than 2 ½ inches from straightness in any 5 foot length.
    - 2.1.1.7 Piles shall be cut above the ground swell and have continuous and reasonably uniform taper from butt to tip.
  - 2.1.2 Piles may be of any species which will satisfactorily withstand driving and support the superimposed loads and shall be of sound wood, free from defects which may impair their strength or durability as piles such as decay, red heart, marine borer attack, or insect attack..



## 520 – PILE FOUNDATIONS

- 2.1.2.1 Cedar and cypress piles may have a pipe or stump rot hole not more than 1 ½ inches in diameter.
- 2.1.2.2 Cypress piles may have peck aggregating not more than the limitation for holes.
- 2.1.2.3 Piles having sound turpentine scars shall not have damage from insects.
- 2.1.2.4 Sound knots shall be no larger than one sixth the circumference of the pile located where the knot occurs. Cluster knots shall be considered as a single knot. The sum of knot diameters in any 1 foot length of pile shall not exceed one third of the circumference at the point where they occur.
- 2.1.2.5 Unsound knots shall not exceed half the permitted size of a sound knot, provided that the unsoundness extends to not more than a 1 ½ inch depth, and that the adjacent areas of the trunk are not affected.
- 2.1.2.6 Piles shall be free from holes or damage caused by decay, marine borers, or insects.
- 2.1.2.7 Piles shall be free from holes larger than ½ inch in average diameter. Holes less than ½ inch in average diameter shall be permitted provided that the sum of average diameters of all holes in any square foot of pile surface does not exceed 1 ½ inch, and the depth of any hole does not extend to more than 1 ½ inch.
- 2.1.2.8 Piles shall be free of splits longer than the butt diameter.
- 2.1.2.9 The length of any shake or combination of shakes, measured along the curve of the annual ring, shall not exceed one-third of the pile's butt circumference.
- 2.1.3 Piles specified in the Plans to have high heartwood content shall exhibit a heartwood diameter at the butt not less than eight-tenths of the diameter of the pile.
- 2.1.4 Piles for use with preservative treatment shall have sufficient sapwood to meet minimum penetration requirements.
- 2.1.5 Softwood piles specified in the Plans to have close grain shall show at least six annual rings per inch, over the outer three inches of the butt end cross section. Douglas-fir and pine averaging from 5 to 6 annual rings per inch shall be accepted as the equivalent of close grain if having one-third or more summerwood.
- 2.1.6 Butts and tips of piles shall be sawed square with the axis of the piles and shall not be out of square by more 1/10 inch per inch of diameter. All knots and limbs shall be trimmed flush with the surface of the pile.
- 2.1.7 Piles shall be clean peeled with at least 80 percent of the inner bark removed. No strip of remaining inner bark shall be larger than 1 by 6 inches. The sapwood of piles shall not be unnecessarily scarred or injured in the process of peeling.
- 2.1.8 Spiral grain of shall not exceed 180 degrees of twist when measured over any 20 foot section of the pile.
- 2.1.9 Piles shall be Creosote treated in accordance with Section 3.7 Specifications for Treatment of Chapter 30 – Ties of the AREMA Manual.
  - 2.1.9.1 Creosote Coal Tar solution shall meet the requirements of American Wood Protection Association (AWPA) Standard P2 - Standard for Creosote Solutions.
  - 2.1.9.2 Piles shall be treated in accordance with AWPA Standard C3 - Piles - Preservative Treatment by Pressure Process.



- 2.1.9.3 The minimum preservative retention shall be 12 pounds per cubic foot using the Empty Cell process in accordance with AWP Standard C1 - All Timber Products - Preservative Treatment by Pressure Processes.
- 2.1.10 Points of piles shall be trimmed to form a truncated pyramid 4 inches to 6 inches square at the end and with length of trimming not to exceed twice the tip diameter of the pile.
  - 2.1.10.1 If shown on the plans or directed by Engineer, timber piles shall be equipped with a cast steel reinforced driving shoe in accordance with details shown on the plans. Pile points shall be carefully trimmed to fit the shoe and obtain full and uniform bearing, and to avoid displacement of the shoe or damage to the pile or shoe.
- 2.1.11 Where the heads of piles tend to split when being driven, they shall be tightly wrapped with wire rope, banding, or other effective means to prevent splitting.
- 2.1.12 The heads of piles shall be protected while being driven with a driving cap (bonnet) of approved design. The cap shall be shaped to fit over the head of the pile to provide lateral support and to uniformly distribute the hammer blow. Pile heads shall be trimmed to fit snugly into the cap.
- 2.1.13 Piles shall be handled with hemp or synthetic fiber slings or wire rope encased in rubber hose whenever possible, taking care to avoid dropping, bruising, breaking or penetrating the outer fibers.
- 2.2 Steel Piles:
  - 2.2.1 Steel bearing piles shall be of the section shown on the plans and shall be structural steel, containing no less than 0.2% copper, conforming to ASTM Designation A36. Piles shall not be painted before driving.
    - 2.2.1.1 If shown on the plans or directed by Engineer, steel bearing piles shall be equipped with a cast steel reinforced driving tip in accordance with details shown on the plans. The tips shall be installed in accordance with the manufacturer's recommendations.
  - 2.2.2 Steel sheet piles shall be of the section and length shown on the plans and shall conform to ASTM Designation A328 unless otherwise shown on the plans.
  - 2.2.3 Steel pipe piles shall be of the outside diameter and wall thickness shown on the plans and shall conform to ASTM Designation A252, Grade 2 unless other material is specified on the plans.
    - 2.2.3.1 Pipe pile shall be driven with closed ends as shown in the plans. Either flat plates or driving tips shall be employed as shown in the plans.
      - 2.2.3.1.1 Flat plate ends shall be of 3/4 inch thick ASTM A36 steel plate. The plate shall have the same outside diameter as the pile and be groove welded to the pile on the tip end.
      - 2.2.3.1.2 Conical steel reinforced driving tips shall be installed in accordance with the manufacturer's recommendations as shown on the Plans.
    - 2.2.3.2 All concrete materials and reinforcing steel and their preparation and placement, used in filling steel pipe piles, shall be in accordance with Section 530 Cast In Place Concrete Construction. All concrete shall have a minimum compressive strength equal to that shown on the plans.
  - 2.2.4 Piles shall not be painted before driving.



- 2.2.5 Piles to be stored shall be placed on skids above ground and a sufficient number used to prevent visible deflection in the stored piles. Piles shall be kept clean and fully drained at all times. The method of handling shall be such that no damage will result to the piles.
- 2.3 Concrete Piles:
  - 2.3.1 Precast concrete piles shall be of the type, size and length shown on the plans.
    - 2.3.1.1 All concrete materials and steel reinforcing and their preparation and placement shall be in accordance with Section 534 Precast Concrete Construction. All concrete shall have a minimum compressive strength equal to that shown on the plans.
  - 2.3.2 Prestressed concrete piles shall meet the requirements, and shall be of the type, size, and length shown on the plans, manufactured in accordance with Section 534 Precast Concrete Construction.
  - 2.3.3 Defects and Breakage: Piles cracked in the process of curing, handling or driving, which in the opinion of Engineer can be satisfactorily repaired, shall be repaired at Contractor's expense and under the direction of Engineer. If repair is not possible in the opinion of Engineer, the piles shall be replaced at Contractor's expense.
  - 2.3.4 Piles shall be stored above ground on adequate blocking located within 1 foot of the pick-up points marked on the pile that will prevent undue stresses in the piles. When piles are only partially supported during hauling, the overhang shall not exceed the lengths permitted for pick-up. If piles are stacked for storage, blocking for all layers shall be in the same vertical plane.
  - 2.3.5 Piles shall be handled in a manner to minimize the danger of fracture by impact or undue bending stresses. Unless otherwise provided, piles shall be handled by means of a suitable bridle or sling attached to the pile at the pick-up points marked on the pile. Use of rubberized cables is also acceptable. The use of chain slings shall not be permitted.

### 3 SUBMITTALS

- 3.1 Prior to the start of construction Contractor shall submit a pile driving plan for approval by Engineer.
- 3.2 This plan shall provide detailed information on Contractor's proposed means and methods and shall include the following minimum information:
  - 3.2.1 Contractor's proposed means and methods including weights of pile hammer, power plant, leads, pile cushion, cap block and helmet.
  - 3.2.2 Name and experience of personnel in responsible charge of the pile driving.
  - 3.2.3 Roster of proposed equipment.
  - 3.2.4 Means of access for the pile driving equipment to the foundation locations.
  - 3.2.5 Details of test pile installation and interpretation of results.
  - 3.2.6 Method for splicing piles if needed.
  - 3.2.7 Procedures for accommodating existing power lines, fiber optic and other buried utilities on the project site.
- 3.3 Prior to construction, Contractor shall prepare, and submit to Engineer, a comprehensive plan of the risks to the adjacent structures and Contractor's proposed monitoring and mitigation efforts.
  - 3.3.1 Any temporary measures required to protect existing structures shall be designed by a Professional Engineer employed by Contractor and registered in the State where the work is performed.





- 3.4 Contractor shall submit material certifications for all piles supplied for the Work.
- 3.5 Upon completion of load tests, Contractor shall submit to Engineer a load test report including, but not limited to, a description of the pile driving equipment, driving records for each test pile, analysis of the test data, and recommended allowable design loads based on the load test results. This report shall be prepared by or under the direct supervision of a registered professional or structural engineer experienced in pile load testing and load test analysis. In Addition, a "Test Pile Record Form" shall be submitted to Engineer.
- 3.6 Upon completion of driving, Contractor shall submit to Engineer a complete and accurate record of each driven pile. The record shall indicate the pile location, driven length, embedded length, final elevations of tip and top, pile weight, butt and tip diameter, quantity and strength of concrete used in each pile, number of splices and locations, blows required for each foot of penetration throughout the entire length of the pile and for the final 6 inches of penetration, and the total driving time. In Addition, a "Pile Driving Summary Form" shall be submitted to Engineer.

#### 4 EXECUTION

- 4.1 Piles shall be driven with the heaviest hammer that, in the judgment of the engineer, can be used to secure maximum penetration without appreciable damage to the pile.
- 4.2 Hammers may be driven by steam, air, or diesel power as approved by Engineer.
- 4.3 The minimum weight of the hammer's ram shall be 3,000 pounds. The maximum weight of the ram shall not exceed 7000 lb. unless approved by Engineer.
- 4.4 The minimum acceptable hammer energy for use with various pile types is as follows:

<u>Pile Type</u>	<u>Minimum Energy (ft-lbs)</u>
Timber, less than 60 ft long	8,000
Timber, more than 60 ft long	13,000
Steel Bearing and Steel Pipe	30,000
Concrete	15,000 (but not less than 1.5 ft-lb per pound of pile).
Steel Sheet	As necessary to drive piles to required depth without damage

- 4.5 Steel piles may be driven with vibratory hammers under conditions approved by Engineer.
- 4.6 The use of drop hammers shall not be permitted.
- 4.7 The hammer shall be operated at all times at pressures and speeds recommended by the manufacturer. If steam or air hammers are used, boiler or air compressor capacity shall be adequate to maintain full rated pressure throughout the driving period of any pile. The boiler or air compressor shall be equipped with an accurate pressure gauge at all times.
- 4.8 Pile drivers shall be equipped with leads which are constructed in such a manner as to afford freedom of movement of the hammer and to provide adequate support of the pile during driving. The longitudinal axis of the leads and hammer shall coincide with the longitudinal axis of the pile.
- 4.8.1 Except where piles are driven through water, the leads shall be long enough so that a follower will not be necessary.
- 4.8.2 Where a follower is required for driving piles underwater, one pile in each group of ten shall be long enough to permit driving without a follower. This pile shall be used as a test pile for proper correlation of the follower-driven piles bearing capacity.
- 4.9 After driving is completed, the piles shall be cut off as shown on the plans and at the elevation approved by Engineer.





### 4.10 Driving Tolerances:

- 4.10.1 Piles for bent construction shall be driven with a degree of accuracy that will permit framing into bents with a minimum of pulling or jacking. Under ordinary conditions, timber piles, after driving and before framing, shall not vary from the vertical or from the required batter by more than 1/4 inch per foot of pile above finished ground. Other types of piles shall not vary from the vertical or from the required batter by more than 1/8 inch per foot of pile above finished ground, except that under ordinary conditions, the maximum deviation of the top of the pile from the plan location shall be 2 inches in the direction of the structure centerline and 4 inches in the direction along the centerline of the bent.
- 4.10.2 Foundation piles shall be driven to the vertical or batter line shown on the plans and the top of the completed pile shall not be more than 4 inches in any direction from the position shown on the plans. The center of gravity of the completed pile group shall not vary by more than 3 inches from the center of gravity determined from plan location.

### 4.11 Protection of Pile Heads:

- 4.11.1 A steel driving head suitable for the type and size of piles being driven shall be used. Steel bearing piles and steel sheet piles shall be driven with a driving head compatible with the specific pile shape driven.
- 4.11.2 For concrete piles, a cushion block shall be provided between the driving head and the top of the pile. Wood cushion blocks, wire rope mat, belting, or other suitable material shall be used, subject to the approval of Engineer, to prevent damage to the pile. Cushion blocks shall be changed as necessary to maintain an effective cushion.

### 4.12 Pile Damage and Misalignment:

- 4.12.1 Care shall be exercised to avoid damage to piles from overdriving.
- 4.12.2 Any pile that is damaged to the extent that, in the opinion of Engineer, it will not perform its design function; any pile that is driven off location or alignment beyond the allowable tolerances; or any timber pile that is driven below cut-off elevation shall be pulled, if possible, or cut off below ground line and another pile driven as close as possible to the proper location.
- 4.12.3 Splicing of timber piles shall not be permitted.

### 4.13 Pile Penetration:

- 4.13.1 All piles shall be driven to a penetration satisfactory to Engineer. The length of the piles shown on the plans is the length which is estimated to give the minimum required penetration and bearing, and is for estimating purposes only.
- 4.13.2 Actual pile lengths and penetration required shall be established by Engineer on the basis of the test pile data. These lengths and elevation of pile tips shall supersede requirements shown on the plans.
- 4.13.3 Unless otherwise shown on the plans or directed in writing by Engineer for cases where piles penetrate into competent rock, foundation piles shall be driven to a penetration of a minimum 10 feet below bottom of footing, and other piles to a penetration of at least 15 feet below natural or finished ground line, whichever is lower.
- 4.13.4 Piles in streambeds or on the banks of streams, where marked erosion is expected, shall be driven to such penetration as Engineer deems necessary for protection against scour.



- 4.13.5 When the specified penetration cannot be obtained without overdriving the piles, Contractor shall provide either pilot holes or jetting equipment or a combination of both, as directed by Engineer.
- 4.14 Jetting:
- 4.14.1 For jetting operations, sufficient power shall be provided to operate the hammer and to supply water volume sufficient to freely erode the material adjacent to the pile.
- 4.14.2 Jetting shall be stopped a minimum of 2 feet above the desired tip elevation and the final penetration shall be obtained by driving without jetting.
- 4.14.3 In silty soils it is possible that jetting may loosen the soil around piles already driven. If such a condition is considered possible, piles shall be redriven after all jetting within 25 feet has been completed.
- 4.15 Pilot Holes
- 4.15.1 If piles cannot be driven to the required penetration and the material is not suitable for jetting, Engineer may permit pilot holes to be drilled to facilitate driving. Engineer shall approve the diameter and depth of the drilled hole. Ordinarily, the following drill diameters will be satisfactory:
- 12 inches for timber piles
  - 4 inches less than the diagonal of square piles
  - 2 inches less than the diagonal of octagonal piles
  - 1 inch less than the diameter of round piles
- 4.15.2 Where pilot holes are required in granular material which cannot be sealed off by ordinary "mudding" drilling methods, a casing pipe of sufficient diameter shall be placed around the boring device. The casing shall be of sufficient length to extend through the loose materials and shall be held in position until the pile is placed and ready for driving.
- 4.15.3 If the hard material extends below the desired penetration, the drilling shall be stopped 1 foot above that level and the pile driven the remaining distance if it is possible to do so without damaging the pile.
- 4.15.4 If the pile does not completely fill the pilot hole, the space between the pile and the wall of the hole shall be filled with dry granular material prior to driving as approved by Engineer.
- 4.16 Shooting Pilot Holes:
- 4.16.1 The use of explosives for drilling of pilot holes shall not be permitted.
- 4.17 Bearing Capacity:
- 4.17.1 All piles shall be driven to the ultimate bearing capacity specified on the plans, in the special provisions, or by Engineer. The bearing values shall be determined using the wave equation method or the following formula as directed by Engineer:
- $$R_u = \frac{12eE}{s + c} \times \frac{W + n^2P}{W + P}$$
- Where:
- $R_u$  = Ultimate dynamic pile resistance (pounds)
  - $e$  = Hammer efficiency = 0.9
  - $E$  = Hammer energy per blow =  $Wh$  for single acting steam or air hammer or open cylinder Diesel hammer.



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s = Penetration of pile per hammer blow (inches)

c = Average temporary compression (inches). The value of c shall be determined from test pile rebound graphs or as approved by Engineer.

W = Weight of striking parts of hammer (pounds)

h = Hammer ram stroke (feet) average during 1 inch of pile penetration

n = Coefficient of restitution = 0.7

P = Weight being driven (pounds) includes pile and pile follower, anvil, drive cap and adapter as applicable

4.17.2 When measuring penetration per blow to determine if adequate bearing capacity has been obtained, the hammer shall be running freely and at the speed specified by the manufacturer for full rated energy output.

4.17.3 If, for some unavoidable reason, driving must be interrupted before final penetration is reached, the penetration per blow to determine bearing capacity shall not be measured until 12 inches of penetration or refusal has been obtained after driving has been resumed.

### 4.18 Pile Driving Near Fresh Concrete

4.18.1 Piles shall not be driven within 150 feet of concrete that was placed within the previous 24 hours.

4.18.2 If piles are driven within 150 feet of concrete that has not attained its specified 28-day strength, the following distances, based on the concrete strength and pile hammer rated energy, shall be maintained between the concrete and the nearest pile.

% of 28 Day Strength	Hammer Energy (ft-lb)		
	<40k	40k-60k	>60k
20	60 feet	70 feet	85 feet
40	35 feet	45 feet	50 feet
60	25 feet	25 feet	30 feet
80	10 feet	15 feet	15 feet

### 4.19 Test Piles:

4.19.1 The furnished length of test piles shall be a minimum of 10 feet longer than the estimated length of the permanent piles shown on the plans or as directed by Engineer.

4.19.2 Wherever possible, test piles shall be driven in a location such that they can become part of the permanent structure. If not so used, test piles shall be cut off or extracted as directed by Engineer. Extraction of test piles shall be considered incidental to the test pile item, and no separate compensation shall be made for this work.

4.19.3 Ground elevations shall be brought to finished grade wherever possible prior to driving test piles so that the test piles will be comparable to the piles used in the permanent structure.

4.19.4 Equipment used for driving test piles shall be adequate for handling the lengths provided without splicing. The hammer used shall be the same make and model as that to be used in driving the permanent piles.

4.19.5 Driving of a test pile shall continue until a penetration and bearing capacity is obtained which is satisfactory to Engineer. Typically, test piles shall be driven to not less than 125% of the ultimate pile capacity required for permanent piles in the structure.



### 4.20 Timber Piles:

#### 4.20.1 Preparation:

- 4.20.1.1 When the furnished length is much longer than the required length, Engineer may permit shortening the tip end before driving so as to have the desired diameter at the cut-off.
- 4.20.1.2 Pile tips shall be cut perpendicular to the axis of the pile.
- 4.20.1.3 The piles for bents shall be matched as much as possible in diameter to facilitate framing and bracing.

#### 4.20.2 Cut-offs:

- 4.20.2.1 Piles which are to be encased in concrete shall be cut-off square to the elevation shown on the plan or established by Engineer. The pile heads shall then be swabbed with preservative in accordance with Part 3 – Construction, Maintenance and Inspection of Timber Structures of Chapter 7 – Ties of the AREMA Manual.
- 4.20.2.2 Piles which are to support steel or timber caps shall be brought into final position and held while cut-off is made. Any chains or jacks used in positioning the piles shall be arranged so that the surface of the pile below cut-off is not damaged. Cut-off shall be made to a true plane and to the exact elevation shown on the plans or established by Engineer so that the cap will bear on the entire cross section of each pile.
- 4.20.2.3 Piles shall show a solid head at the plane of the cut off.
- 4.20.2.4 No shims shall be permitted between the pile and the cap.
- 4.20.2.5 Useable cut-off portions of piles and shall be hauled to and stockpiled at a location designated by Engineer.
- 4.20.2.6 Unusable cut-off portions of piles shall be disposed of by Contractor in accordance with all applicable environmental laws and regulations.

#### 4.20.3 Framing:

- 4.20.3.1 After the cut-off has been made, the tops of treated piles shall be saturated with hot preservative, followed by two coats of hot sealing compound. The sealing compound shall be a mixture of creosote coal-tar pitch, mixed to about the consistency of Vaseline, and brushed thoroughly into the wood.
- 4.20.3.2 The treated pile cut-off may be covered with plastic cement used with or without a fabric layer and topped with a ½ inch neoprene pad. The use of roofing material or sheet metal to cover the cut-off has is not acceptable.
- 4.20.3.3 Caps shall be placed while the piles are held in correct position. Where drift bolts are used for making connections, the caps and tops of piles shall be bored the same diameter as the drift bolt and to a depth of 3 inches less than its length.
- 4.20.3.4 Piles shall not be trimmed or cut to facilitate the framing of sway or longitudinal bracing. Where necessary, filler blocks shall be used between the pile and brace to establish the bracing in a true plane.
- 4.20.3.5 Holes for bolts shall be bored the same diameter as the bolt.
- 4.20.3.6 Holes for drive spikes shall be 1/8 inch less than the nominal diameter of the spike.



- 4.20.3.7 When holes are bored in treated piles, caps or bracing in the field, the entire hole shall be pressure treated or swabbed with hot preservative and sealing compound just before the bolt is placed.
- 4.20.3.8 Bolts shall be cleaned of rust and scale, and dipped in hot sealing compound before placing.
- 4.20.3.9 All unused holes shall be plugged at each end with tight fitting treated wooden plugs.
- 4.20.4 Treatment of Damaged Surfaces:
  - 4.20.4.1 Any pile surface below cut-off that has been scuffed, torn or otherwise disturbed shall be treated with a liberal quantity of hot preservative followed by two applications of hot sealing compound.
- 4.21 Steel Bearing and Steel Sheet Piles:
  - 4.21.1 Splices and Build-ups:
    - 4.21.1.1 The length of steel bearing piles and steel sheet piles shown on the plans or ordered by Engineer may be built up in sections either before or during driving operations.
    - 4.21.1.2 The sections, unless otherwise shown on the plans, shall be of identical cross-section.
    - 4.21.1.3 Pile splices shall be made by full penetration butt welding of the entire cross-section or as otherwise shown on the plans.
    - 4.21.1.4 All welding shall be in accordance with ANSI/AASHTO/AWS D1.5 Bridge Welding Code.
    - 4.21.1.5 Care shall be taken to properly align the sections connected so that the axis of the pile will be straight.
    - 4.21.1.6 Pile splices above a point 15 feet below finished ground line shall be reinforced as shown on the plans, unless otherwise directed by Engineer.
    - 4.21.1.7 Field splices shall be avoided for pile lengths under 60 feet.
  - 4.21.2 Cut-Offs:
    - 4.21.2.1 Piles shall be cut off, with a cutting torch, or by other acceptable methods, to the elevation shown on the plans or established by Engineer.
    - 4.21.2.2 Where caps are required, piles shall be brought into final position and held while cut off is made. The end surface of the piles shall be made as smooth as practicable with maximum gap of 1/8 inch between pile and pile cap.
- 4.22 Steel Pipe Piles:
  - 4.22.1 Splices and Build-ups:
    - 4.22.1.1 The length of a steel pipe pile may be built up in sections either before or during the driving operation.
    - 4.22.1.2 The minimum length of a section measured between welded splices shall be 5 feet, and between drive splices shall be 30 feet.
    - 4.22.1.3 Only one welded splice and no drive splices shall be permitted in that portion of the pile exposed above ground line or normal water line.



- 4.22.1.4 Drive splices shall be 15 feet below the ground line, unless directed by Engineer.
- 4.22.1.5 Care shall be taken to properly align the sections to be spliced to insure a straight axis. The sections shall be spliced together in accordance with details shown on the plans.
- 4.22.1.6 All welding shall be in accordance with the ANSI/AASHTO/AWS D1.5 Bridge Welding Code.
- 4.22.2 Cut-Offs:
  - 4.22.2.1 Piles shall be cut off, with a cutting torch, or by other acceptable methods, to the elevation shown on the plans or established by Engineer.
  - 4.22.2.2 Where caps are required, piles shall be brought into final position and held while cut off is made and the end surface of the piles shall be made as smooth as practicable with maximum gap of 1/8 inch between pile and cap.
- 4.22.3 Placement of Concrete:
  - 4.22.3.1 After all driving, splicing, and positioning of pile is completed, the pile shall be free from buckles, splits, distortions, water or other foreign matter.
  - 4.22.3.2 Contractor shall provide equipment, lighting, and facilities necessary for the proper inspection of the piles.
  - 4.22.3.3 Any damaged, improperly driven, or otherwise defective pile shall be removed and replaced at Contractor's expense.
  - 4.22.3.4 The tops of piles shall be kept covered after driving until the concrete is placed.
  - 4.22.3.5 No concrete shall be placed until Engineer has inspected the completed pile and reinforcing steel, when required, and given his approval to proceed.
  - 4.22.3.6 No concrete shall be placed in the piles in any unit until the driving of all piles in that unit has been completed. A unit is defined as a pier, bent or abutment.
  - 4.22.3.7 Concrete shall be placed in a continuous operation taking care to prevent segregation. Special placing devices shall be used if necessary.
- 4.23 Precast and Prestressed Concrete Piles:
  - 4.23.1 Build-ups:
    - 4.23.1.1 Build-ups shall be made in accordance with the details shown on the plans or provided by Engineer.
    - 4.23.1.2 The concrete used for the build-up shall be of the same quality as that used originally in the pile.
    - 4.23.1.3 Just prior to placing the concrete, the top of the pile shall be coated with an epoxy bonding compound approved by Engineer.
    - 4.23.1.4 When additional driving of precast non-prestressed piles is required, the built-up portion shall obtain a compressive strength equal to the design compressive strength of the original pile prior to redriving.
  - 4.23.2 Cut-Offs:



- 4.23.2.1 Concrete at the end of a pile terminating in cast-in-place concrete shall be cut back the required amount leaving the reinforcing steel or prestressing steel exposed.
- 4.23.2.2 The final cut of the concrete shall be normal to the axis of the pile.
- 4.23.2.3 Any damage to the pile below the plan cut-off elevation shall be remedied by further cut-back and built-up.

### 5 MEASUREMENT AND PAYMENT

#### 5.1 Measurement:

- 5.1.1 Piles driven of the various kinds, sizes, types, and weights shall be measured to the nearest 1/10 lineal foot of net length of pile in place after all cut-offs and build-ups have been made.
  - 5.1.1.1 Steel sheet piles shall be measured by the square foot of acceptable pile in place.
  - 5.1.1.2 That portion of piles driven below the elevation at which the minimum penetration and bearing requirements were first obtained shall not be measured for payment.
- 5.1.2 Timber Piles broken during driving shall not be measured for payment.
- 5.1.3 Concrete Piles:
  - 5.1.3.1 Two feet shall be added to the length of concrete piles, measured for payment in accordance with the above, for each authorized build-up made, other than those made necessary by improper casting, handling or driving.
- 5.1.4 Test piles:
  - 5.1.4.1 Test piles that do not become a part of the permanent structure shall be measured by the lineal foot of pile in the leads and driven in accordance with the Contract Documents and approved by Engineer.
  - 5.1.4.2 Test piles that become a part of the permanent structure, shall be measured by the lineal foot of acceptable pile in place after all cut-offs and build-ups have been made in accordance with the provisions of Paragraph 5.1 covering the various kinds of piles.
- 5.1.5 Cut-off portions of piles shall not be measured for payment.
- 5.1.6 Pile splices are considered incidental to pile driving and shall not be measured for payment.
- 5.1.7 Reinforced Pile Tips are considered incidental to pile driving and shall not be measured for payment.
- 5.1.8 Pilot holes are considered incidental to pile driving and shall not be measured for payment.
- 5.1.9 Jetting is considered incidental to pile driving and shall not be measured for payment.

#### 5.2 Payment:

- 5.2.1 Piles driven shall be paid for at the contract unit price per lineal foot or square foot, as measured in accordance with Paragraph 5.1.





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- 5.2.1.1 This price shall include full compensation for furnishing all labor, materials, tools, equipment, jetting, pilot holes, splicing, points and incidentals necessary to drive and cut-off the piles and complete the work.
- 5.2.1.2 Contractor shall accept the contingencies of driving greater or lesser length of piles or other changes of features in construction which this may involve, all without modification of the unit price fixed by the contract.
- 5.2.2 The contract price per lineal foot of acceptable timber pile shall also include full compensation for preparing the piles, disposing of the pile heads, treating the pile tops, and the treating of damaged surfaces, splits, and checks.

END OF SECTION

### REVISION HISTORY

The following is the revision history for this standard:

5/2/2013 – Initial Issue



# 520 – PILE FOUNDATIONS

## APPENDIX A – PILE DRIVING RECORDS

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### 1 GENERAL

- 1.1 Contractor shall document all test and production pile driving on the following forms.
- 1.2 Upon approval by Engineer, Contractor may use his standard form provided it contains the essential elements of information contained in the attached.



Railroad: \_\_\_\_\_ Subdivision: \_\_\_\_\_ Bridge: \_\_\_\_\_

Bent/Pier/Abut No.: \_\_\_\_\_ Row No.: \_\_\_\_\_ Pile No.: \_\_\_\_\_ Pile Type: \_\_\_\_\_

Hammer Model: \_\_\_\_\_ Energy Rating: \_\_\_\_\_ (ft-lbs) Ram Weight: \_\_\_\_\_ lbs.

Cushion Material(s) – Types & Thicknesses: \_\_\_\_\_

Total Pile Length (w/ Follower): \_\_\_\_\_ ft. Date/Time Start: \_\_\_\_\_ Date/Time End: \_\_\_\_\_

Distance R/L to T/T: \_\_\_\_\_ ft. Above or Below Distance T/T to G/L: \_\_\_\_\_ ft.

Distance T/T To P/T At End Of Driving: \_\_\_\_\_ ft. Distance T/T To Splice At End Of Driving: \_\_\_\_\_ ft.

[illegible]

Issued: 2 May 2013





Railroad: \_\_\_\_\_ Subdivision: \_\_\_\_\_ Bridge: \_\_\_\_\_  
 Hammer Model: \_\_\_\_\_ Energy Rating: \_\_\_\_\_ (ft-lbs) Ram Weight: \_\_\_\_\_ lbs.  
 Cushion Material(s) – Types & Thicknesses: \_\_\_\_\_

[illegible]

Issued: 2 May 2013



# STANDARD CONSTRUCTION SPECIFICATIONS

## 530 – PORTLAND CEMENT CONCRETE GENERAL

### 1 GENERAL

- 1.1 These Portland Cement Concrete General Specifications are adopted by Railroad and are supplemental and complimentary to the requirements of the Contract issued by Railroad to Contractor for the purpose of performing construction and maintenance of Railroad's Structure(s) as specified in the Scope of Work and the Contract Documents. They apply to Contractor, its employees, agents, invitees and subcontractors.
- 1.2 Portland cement concrete (concrete) shall consist of mix designs, materials and production in accordance with these Specifications, the requirements of Part 1 – Materials, Tests and Construction Requirements of Chapter 8 – Concrete Structures and Foundations of the American Railway Engineering and Maintenance of Way Association (AREMA) Manual for Railway Engineering (Manual), and the details shown on the Plans.
- 1.3 Contractor is responsible for performing all concrete production in compliance with local, state, and federal laws, Railroad safety and operating rules, and Federal Railroad Administration regulations pertaining to workplace safety.

### 2 MATERIALS

- 2.1 Portland cement concrete shall conform to the requirements of Part 1 – Materials, Tests and Construction Requirements of Chapter 8 – Concrete Structures and Foundations of the AREMA Manual.
- 2.2 Unless otherwise specified in the Plans, concrete shall be proportioned, mixed, and transported by the methods herein prescribed.
- 2.3 Unless otherwise specified in the plans, Cement shall conform to the requirements of ASTM C150 Type IIA. The cement shall have an alkali content of 0.6% or less expressed by  $\text{Na}_2\text{O}$  plus 0.658  $\text{K}_2\text{O}$ .
  - 2.3.1 If high early strength is required, the Cement shall conform to the requirements of ASTM C150 Type IIIA.
- 2.4 Unless otherwise specified in the Plans, other cementitious materials shall not be used.
- 2.5 Unless otherwise specified in the Plans, aggregates shall conform to the requirements of ASTM C33 Standard Specification for Concrete Aggregates.
  - 2.5.1 Representative samples shall be selected and sent to the laboratory for testing in accordance with ASTM C33 as follows:
    - 2.5.1.1 Surface Moisture in Fine Aggregate: ASTM C70
    - 2.5.1.2 Specific Gravity and Absorption of Coarse Aggregate: ASTM C127
    - 2.5.1.3 Specific Gravity and Absorption of Fine Aggregate: ASTM C128
    - 2.5.1.4 Standard Sand: ASTM C778
  - 2.5.2 Aggregate subjected to five cycles of ASTM C88 Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate shall show a loss weighed in accordance with the grading procedures, not greater than the percentages found in Table 8-1-4 of Chapter 8 – Concrete Structures and Foundations of the AREMA Manual
  - 2.5.3 Aggregates may not be used until the samples have been tested by the laboratory and approved by the Engineer.
- 2.6 Unless otherwise specified in the Plans, fine aggregate shall consist of natural sand. Lightweight fine aggregate shall not be used.



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- 2.6.1 Fine aggregate, except as provided in ASTM C33, shall be graded within the limits found in Table 8-1-5 of Chapter 8 – Concrete Structures and Foundations of the AREMA Manual.
- 2.6.2 The minimum percentages shown above for material passing the No. 50 and No. 100 sieves may be reduced to 5 and 0, respectively, if the aggregate is to be used in air-entrained concrete containing more than 420 lb of cement per cubic yard.
- 2.6.3 The fine aggregate shall have not more than 45% retained between any two consecutive sieves of those shown in Table 8-1-5 of Chapter 8 – Concrete Structures and Foundations of the AREMA Manual and its fineness modulus shall be not less than 2.3 nor more than 3.1.
- 2.6.4 Fine aggregate shall be of such quality that when made into a mortar and subjected to the mortar strength test prescribed in ASTM C87, the mortar shall develop a compressive strength not less than that developed by a mortar prepared in the same manner with the same cementitious materials and graded standard sand having a fineness modulus of  $2.40 \pm 0.10$ . The graded sand shall conform to the requirements of ASTM C778.
- 2.6.5 The amount of deleterious substances in fine aggregate shall not exceed the limits found in Table 8-1-6 of Chapter 8 – Concrete Structures and Foundations of the AREMA Manual.
- 2.7 Unless otherwise specified in the Plans, coarse aggregate shall consist of crushed stone or gravel meeting the requirements of ASTM C33.
  - 2.7.1 The maximum size of aggregate shall be not larger than one-fifth of the narrowest dimension between forms of the member for which concrete is used, nor larger than one-half of the minimum clear space between reinforcing bars.
  - 2.7.2 The amount of deleterious substances in coarse aggregate shall not exceed the limits found in ASTM C33.
  - 2.7.3 Coarse aggregate to be used in concrete when subjected to test for resistance to abrasion in accordance with ASTM C535 or ASTM C131 and shall show a loss of weight not more than 40%:
- 2.8 Unless otherwise specified in the Plans, water used in mixing and curing concrete including free water on aggregates, shall be potable and free from any pronounced taste, odor, or color that would indicate the presence of substances that may be deleterious to concrete or reinforcement. If there is any question regarding compliance with these requirements, mortar strength tests shall be required.
  - 2.8.1 Mortar test cubes with the proposed mixing water shall have 7 day and 28 day strengths equal to at least 90% of strengths of similar specimens made with water known to be acceptable. Strength test comparison shall be made on mortar, identical except for the mixing water, prepared and tested in accordance with ASTM Method of Test C109.
- 2.9 Unless otherwise specified in the Plans, concrete admixtures, except air-entraining agents, used to alter the normal properties of concrete for densifying, dispersing, retarding, accelerating, plasticizing, coloring, or waterproofing, shall be used only upon express written permission of Engineer.
- 2.10 Unless otherwise specified in the plans, the minimum compressive strength at 28 days shall be as follows:
  - 2.10.1 4,000 psi for foundation components such as drilled shafts, piers, abutments and caps.
  - 2.10.2 3,000 psi for shotcrete.



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- 2.11 Unless otherwise specified in the Plans, concrete slump shall not exceed three inches. At least one slump test shall be made for each truckload of concrete delivered to the project for inclusion in the work. A record of the amount of slump shall be made and furnished to Engineer.
  - 2.11.1 Concrete intended for pumping may have higher slump upon approval by the Engineer. The proposed slump shall be included with the mix design information.
- 2.12 Contractor is solely responsible for delivering all material to the project site.
- 2.13 Contractor shall be responsible for ensuring that all material meets the requirements as identified in the applicable paragraphs of the Contract Documents.
- 2.14 All materials of any kind rejected by the Engineer shall be immediately removed from the site and any work affected by the defective material shall be remedied by the Contractor at his own expense and to the satisfaction of the Engineer.
- 2.15 Final acceptance of the material shall be based upon satisfactory performance in the field.

### 3 SUBMITTALS

- 3.1 At least 14 days prior to the start of work, Contractor shall submit his proposed concrete mix designs to Engineer for approval.
  - 3.1.1 The specific number of mix designs submitted shall match the types of concrete planned for the foundations, retaining walls, backwalls, wingwalls, shotcrete, etc.
  - 3.1.2 For those mix designs that are already in common use on other railroad or highway projects, Contractor shall include with the mix design a certification from an independent laboratory that the mix designs meet or exceed the requirements of this Specification and Part 1 – Materials, Tests and Construction of Chapter 8 – Concrete Structures and Foundations of the AREMA Manual.
  - 3.1.3 For new mix designs, Contractor shall submit to Engineer the results of the qualification testing required below.
- 3.2 If not already identified during the bidding process, Contractor shall submit his proposed concrete supplier to Engineer for approval.
  - 3.2.1 If Contractor obtains concrete from multiple sources then all suppliers must be identified.
- 3.3 If not already identified during the bidding process, Contractor shall submit his proposed independent testing laboratory to Engineer for approval.
- 3.4 Contractor shall submit his plan for maintaining concrete quality from batching at the plant through discharge from the truck. At the minimum this plan should consider
  - 3.4.1 Type of truck mixer.
  - 3.4.2 Water metering and control.
  - 3.4.3 Number and monitoring of mixing revolutions and speed
  - 3.4.4 Timing of the entire batching process from initial charging of dry materials, through addition of water and ultimate discharge of concrete on the site.
  - 3.4.5 The equipment and methods used in discharging the mixer drum and placing the concrete to ensure no segregation occurs.
  - 3.4.6 Documentation for the individual batches and a means of identifying test cylinders to their parent materials in the finished pour.
- 3.5 Prior to the start of construction, Contractor shall submit to Engineer mill affidavits and certifications, chemical and physical test reports for all concrete materials.





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- 3.6 Upon completion of the Work, Contractor shall submit to Engineer a complete and accurate record of all concrete testing.

### 4 EXECUTION

- 4.1 Portland cement concrete shall conform to the requirements of Part 1 – Materials, Tests and Construction Requirements of Chapter 8 – Concrete Structures and Foundations of the AREMA Manual.
- 4.1.1 The proportioning of materials shall be based on the requirements for a plastic and workable mix suited to the conditions of placement containing not more than the specified amount of water, including the free water contained in the aggregate. The maximum specified amount of water shall be the smaller of 46% or the quantity shown in Table 8-1-9 of Chapter 8 – Concrete Structures and Foundations of the AREMA Manual for the type of structure and the condition of exposure to which it will be subjected.
- 4.1.2 The volume of entrained air in concrete shall be within the limits shown in Table 8-1-10 of Chapter 8 – Concrete Structures and Foundations of the AREMA Manual as determined by ASTM C138, ASTM C173 or ASTM C231.
- 4.1.3 The ingredients shall be thoroughly mixed and brought to a proper consistency.
- 4.2 For proposed mix designs that do not have a history of satisfactory service in railroad bridge projects, Contractor shall furnish a two cubic yard (2 CY) batch of each type of concrete, delivered to the project site by the selected concrete supplier, for the sole purpose of making test specimens.
- 4.2.1 The slump shall be measured and a minimum of eight (8) standard test cylinders shall be made from each batch and be delivered to the independent laboratory for testing at 3, 7, 14, and 28 days. A report of the cylinder tests shall be delivered to Engineer at contractor's expense.
- 4.2.2 No cast-in-place concrete shall be placed in the permanent structure until satisfactory compressive strength for the mix design has been documented through test results.
- 4.3 During construction, the slump shall be measured and a minimum of four (4) standard test cylinders shall be made from each batch of concrete, regardless of type, and be delivered to the independent laboratory for testing at 7 and 28 days.
- 4.3.1 Contractor shall submit the results of all 7-day and 28-day test results to Engineer.
- 4.3.2 Any concrete placed in the permanent structure for which test cylinders indicate substandard compressive strength shall be removed and replaced at Contractor's expense.
- 4.3.3 Substandard shall mean anything less than the minimum compressive strength at 28 days as specified above for the intended end use.
- 4.3.4 No reductions or tolerances will be recognized, regardless of American Concrete Institute (ACI) or other Association Standards for acceptance.
- 4.3.5 Contractor shall be solely responsible for providing all equipment, labor, materials and transportation associated with obtaining test cylinders and performing associated testing.

### 5 MEASUREMENT AND PAYMENT

- 5.1 Portland cement concrete is incidental to the Cast in Place or Precast Concrete Construction performed and shall not be measured for payment.

END OF SECTION



### REVISION HISTORY

The following is the revision history for this standard:

5/1/2013 – Initial Issue



# STANDARD CONSTRUCTION SPECIFICATIONS

## 531 – CAST IN PLACE CONCRETE CONSTRUCTION

### 1 GENERAL

- 1.1 These Cast in Place Concrete Construction Specifications are adopted by Railroad and are supplemental and complimentary to the requirements of the Contract issued by Railroad to Contractor for the purpose of performing construction and maintenance of Railroad's Structure(s) as specified in the Scope of Work and the Contract Documents. They apply to Contractor, its employees, agents, invitees and subcontractors.
- 1.2 Cast in Place Concrete construction shall consist of Portland cement concrete formed, reinforced, placed and maintained in accordance with these Specifications, the requirements of Part 1 – Materials, Tests and Construction Requirements, Part 2 – Reinforced Concrete Design, Part 5 – Retaining Walls Abutments and Piers, and Part 14 – Repair and Rehabilitation of Concrete Structures of Chapter 8 – Concrete Structures and Foundations of the American Railway Engineering and Maintenance of Way Association (AREMA) Manual for Railway Engineering (Manual), and the details shown on the Plans.
- 1.3 Contractor is responsible for performing all concrete construction operations in compliance with local, state, and federal laws, Railroad safety and operating rules, and Federal Railroad Administration regulations pertaining to workplace safety.
- 1.4 With regard to the Work, Contractor is encouraged to provide value engineering that considers best practices. Any proposed changes to the work shall be prepared with sufficient detail and cost analysis that Engineer can make an informed decision on Contractor's proposed change.
- 1.5 Concrete components are numbered in the direction of increasing mileposts and from left to right when facing the direction of increasing mileposts.

### 2 MATERIALS

- 2.1 Portland cement concrete shall be of a mix design conforming to the requirements of Standard Specification 530 – Portland Cement Concrete General and the requirements of Part 1 – Materials, Tests and Construction of Chapter 8 – Concrete Structures and Foundations of the AREMA Manual as approved by Engineer.
- 2.2 Unless otherwise specified in the plans, the minimum compressive strength at 28 days for cast in place concrete shall be at least 4,000 psi.
- 2.3 Unless otherwise specified in the Plans, concrete slump shall not exceed three inches. At least one slump test shall be made for each truckload of concrete delivered to the project for inclusion in the work. A record of the amount of slump shall be made and furnished to Engineer.
  - 2.3.1 Concrete intended for pumping may have higher slump upon approval of Engineer. The proposed slump shall be included with the mix design information.
- 2.4 Unless otherwise specified in the Plans, reinforcing steel shall be deformed Billet Steel Bars in accordance with the requirements of ASTM A615 Grade 60 or Deformed Steel Wire not smaller than size W4 in accordance with the requirements of ASTM A496.
  - 2.4.1 Plain bars and plain wire may be used for spirals or tendons, or for dowels at expansion or contraction joints.
  - 2.4.2 Reinforcement with rust, mill scale, or a combination of both, shall be considered as satisfactory, provided the minimum dimensions, including height of deformations, and weight of a hand wire-brushed test specimen do not exceed the applicable ASTM requirements.
- 2.5 When specified in the Plans, epoxy-coated steel reinforcing bars shall meet the requirements of ASTM A775.



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- 2.5.1 Equipment for handling epoxy-coated reinforcing bars shall have protected contact areas. Bundles of coated bars shall be lifted in a manner that prevents bar-to-bar abrasion from sags in the bundles. Coated bars or bundles of coated bars shall not be dropped or dragged. Coated bars shall be stored on protective cribbing.
- 2.5.2 All damaged coating shall be repaired with patching material conforming to ASTM A775. Repair shall be done in accordance with the material manufacturer's recommendations. The maximum amount of damage areas shall not exceed 2% of the surface area of each linear foot of the bar.
- 2.5.3 When epoxy-coated reinforcing bars are cut, the ends of the bars shall be coated with the same material that is used for the repair of damaged coating.
- 2.5.4 All parts of mechanical splices used on coated bars shall be coated with the same material used for repair of damaged coating on the spliced material. Remove coating for two inches back from the mechanical splice to bright metal before repair.
- 2.5.5 Plants applying fusion-bonded epoxy coatings to reinforcing bars shall maintain certification by the Concrete Reinforcing Steel Institute.
- 2.6 Contractor is solely responsible for delivering all material to the project site.
- 2.7 All material shall be stored and handled to avoid damage or unnecessary disfiguring.
  - 2.7.1 Material, either plain or fabricated, shall be stored properly above the ground upon platforms, skids, or other supports. It shall be kept free from dirt, grease and other foreign matter, and shall be protected as far as practicable from corrosion.
  - 2.7.2 Materials stored at the site shall be kept in a neat manner at proper clearance to operated tracks.
  - 2.7.3 Hardware received at the job site shall be protected from corrosion by storing under cover or by a protective coating.
  - 2.7.4 Care shall be exercised to prevent fires in material held in storage. The ground underneath and in the vicinity of stored material should be kept clear of all weeds, rubbish and combustible material.
- 2.8 Contractor shall be responsible for ensuring that all material meets the requirements as identified in the applicable paragraphs of the Contract Documents.
- 2.9 All materials of any kind rejected by the Engineer shall be immediately removed from the site and any work affected by the defective material shall be remedied by the Contractor at his own expense and to the satisfaction of the Engineer.
- 2.10 Final acceptance of the material shall be based upon satisfactory performance in the field.

### 3 SUBMITTALS

- 3.1 If not already identified during the bidding process, Contractor shall submit his proposed reinforcing fabricator to Engineer for approval.
- 3.2 Prior to the start of work, Contractor shall submit a complete set of shop drawings for bent reinforcing steel for review by Engineer. This shall be submitted at least fourteen (14) days prior to start of the scheduled bending.
- 3.3 Prior to the start of work Contractor shall submit a concrete construction plan for approval by Engineer. This plan shall provide detailed information on Contractor's proposed means and methods and shall include the following minimum information:
  - 3.3.1 Contractor's proposed means and methods.



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- 3.3.2 Form and falsework designs and calculations.
- 3.3.3 Name and experience of personnel in responsible charge of the concrete construction.
- 3.3.4 Roster of proposed equipment.
- 3.3.5 Means of access for the personnel, equipment and material to the work location.
- 3.3.6 Method of placement of reinforcing steel, vibrating concrete, finishing concrete, appropriate curing technique and handling of concrete and reinforcing steel.
- 3.3.7 Procedures for accommodating existing utilities on the project site.
- 3.4 Where forms and falsework support the structure during construction, Contractor shall submit to Engineer for approval the applicable designs and calculations.
- 3.5 Prior to the start of work, Contractor shall submit to Engineer mill affidavits and certifications, chemical and physical test reports for all concrete materials.
- 3.6 Prior to the start of work, Contractor shall submit to Engineer mill affidavits and certifications, chemical and physical test reports for all reinforcing materials.
- 3.7 Upon completion of the Work, Contractor shall submit to Engineer a complete and accurate record of the work performed.
- 3.8 Upon completion of the Work, Contractor shall submit to Engineer a complete and accurate record of all slump, 7-day, and 28-day test results to Engineer.

### 4 EXECUTION

- 4.1 Workmanship shall be of the best quality performed by competent railroad bridge construction workers. All forming shall be true and exact. No movement of forms shall be permitted once concrete has been placed in forms.
- 4.2 The Work must be planned and performed by the Contractor in such a manner as to continually maintain the structure in a condition that it is safe for 10 MPH train traffic at the end of each work window.
- 4.3 Contractor shall be responsible for the design of all formwork, shoring, falsework and centering required to complete the Work.
  - 4.3.1 Structural design of formwork and falsework shall be performed in accordance with ACI 347R, Guide to Formwork for Concrete, or other generally accepted standards, subject to the approval of the Engineer.
  - 4.3.2 Where the forms and falsework support the structure during construction such forms and falsework shall be designed by a licensed engineer.
  - 4.3.3 Falsework shall allow for and correct anticipated settlements so that the finished members conform to the desired line and grade.
- 4.4 Fabrication of reinforcing steel shall be in accordance with Chapter 7 of the Current CRSI Manual of Standard Practice.
  - 4.4.1 Reinforcement shall be prefabricated to the dimensions shown on the plans.
  - 4.4.2 Unless otherwise specified in the Plans, bending detail dimensions are out to out of bars.
  - 4.4.3 Reinforcement shall be bent cold around a pin in a manner that will not damage the material. Bars with kinks or bends not shown on the plans shall be rejected.



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- 4.4.4 Unless otherwise specified in the Plans, the inside diameter of bends shall be not less than: six (6) bar diameters for #3 through #8 bars; eight (8) bar diameters for #9, #10 and #11 bars; and ten (10) bar diameters for #14 and #18 bars.
- 4.4.5 Unless otherwise specified in the Plans, the tolerance in fabricated lengths of bars shall be  $\pm 1$  inch for bar sizes #11 and under and  $\pm 2$  inches for bar sizes #14 and #18; the tolerance in out-to-out dimensions of hooks shall be  $\pm \frac{1}{2}$  inch; the tolerance in out-to-out dimensions of stirrups and ties shall be  $\pm 1$  inch and the maximum angular deviation on 90 degree hooks or bends shall be 0.5 inches per foot (1 in 24).
- 4.4.6 When epoxy-coated reinforcing bars are cut in the field, the ends of the bars shall be coated with the same material that is used for the repair of damaged coating.
  - 4.4.6.1 Flame-cutting of epoxy-coated reinforcing bars shall not be permitted.
- 4.5 Unless otherwise specified in the Plans, welding of reinforcement is not permitted and all reinforcing shall be tied into proper position.
  - 4.5.1 Tie wire shall be 16½ gage or heavier, black-annealed.
  - 4.5.2 Where welding is authorized, it shall conform to “Structural Welding Code–Reinforcing Steel” (ANSI/AWS D1.4) of the American Welding Society. Type and location of welded splices and other required welding of reinforcing bars shall be indicated on the Plans.
  - 4.5.3 Welders of reinforcing bars shall maintain certification by the American Welding Society.
- 4.6 Reinforcement shall be accurately placed, adequately supported and secured against displacement before concrete is placed.
  - 4.6.1 The supervisor responsible for placing reinforcing bars shall maintain certification by the American Concrete Institute as a Concrete Transportation Construction Inspector.
  - 4.6.2 Unless otherwise specified in the Plans, reinforcement shall be placed within the tolerances given in Section 1.10.4.2 – Tolerances of Chapter 8 – Concrete Structures and Foundations of the AREMA Manual.
  - 4.6.3 Reinforcing partially embedded in concrete shall not be field bent.
  - 4.6.4 Unless otherwise specified in the Plans, the minimum concrete cover on reinforcing steel shall be three (3) inches.
  - 4.6.5 Holes drilled into existing concrete for dowel bars shall be drilled on a slight downward angle to retain epoxy adhesive. Holes shall be properly air blasted clean of all debris to allow for good adhesion between epoxy and concrete surface.
- 4.7 Forms shall be constructed mortar-tight and be of wood, steel, or other suitable material. Forms shall be of a type, size, shape, quality and strength that will produce true, smooth lines and surfaces conforming to the lines and dimensions shown on the Plans.
  - 4.7.1 The supervisor responsible for construction of formwork should be certified by the American Concrete Institute Inspector Certification Program as a Concrete Transportation Construction Inspector. The Contractor may appoint a similarly qualified and experienced individual with the approval of the Engineer.
  - 4.7.2 Metal forms, where used, shall be kept free of rust, grease and other foreign matter which will discolor the concrete.
  - 4.7.3 Joints in forms shall be horizontal or vertical, and suitable devices shall be used to hold adjacent edges together in accurate alignment.
  - 4.7.4 All fasteners in contact with concrete shall be countersunk.



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- 4.7.5 All forms shall be constructed and maintained so as to prevent warping and the opening of joints.
- 4.7.6 All forms shall be constructed so that they may be readily removed without damaging the concrete.
- 4.7.7 Where bolts and/or rods are used for internal form ties they shall be so arranged that, when the forms are removed, no metal shall be within 1-1/2 inches of any surface. The cavities shall be filled with cement mortar or epoxy grout and the surfaces left in a sound condition, even and uniform in color with respect to the original surface.
- 4.7.8 Unless otherwise specified in the Plans, suitable moldings or bevels shall be placed in the angles of forms to round or bevel the edges of the concrete, including abutting edges of expansion joints.
- 4.7.9 Any material once used in forms shall be thoroughly cleaned and re-oiled before erection in a new location. All rough surfaces shall be smoothed and repairs made to the satisfaction of the Engineer.
- 4.7.10 Prior to placing reinforcement, the inside surfaces of forms shall be coated with a ready-to-use, nonstaining form release agent. A thin film shall be applied to all surfaces that will be in contact with the fresh concrete.
- 4.7.11 Temporary openings shall be provided at the base of the column and wall forms, and at other locations where necessary to facilitate cleaning and inspection immediately before depositing concrete.
- 4.7.12 Forms for thin sections of considerable height shall be provided with openings or other devices which permit the concrete to be placed in a manner to avoid accumulation of hardened concrete on the forms or metal reinforcement.
- 4.8 Portland cement concrete shall be of a mix design conforming to the requirements of Standard Specification 530 – Portland Cement Concrete General and the requirements of Part 1 – Materials, Tests and Construction of Chapter 8 – Concrete Structures and Foundations of the AREMA Manual as approved by Engineer.
  - 4.8.1 The ingredients shall be thoroughly mixed and brought to a proper consistency.
  - 4.8.2 Concrete shall not be placed more than 90 minutes after the introduction of the mixing water, except that in hot weather or under other conditions contributing to quick stiffening of the concrete, Engineer may reduce this maximum allowable time.
  - 4.8.3 Retempering concrete by adding water or by other means shall not be permitted. Concrete that is not within the specified slump limits at time of placement shall not be used.
  - 4.8.4 When deposited, concrete shall have the following minimum temperatures but shall not be more than 90 degrees Fahrenheit: 70 degrees Fahrenheit for ambient temperatures below 30 degrees Fahrenheit; 60 degrees Fahrenheit for ambient temperatures between 30 and 45 degrees Fahrenheit; and 50 degrees Fahrenheit for ambient temperatures above 45 degrees Fahrenheit.
  - 4.8.5 For each batch of concrete placed into the structure, the slump shall be measured and a minimum of four (4) standard test cylinders collected. After curing in the same manner as the concrete in the structure, these cylinders shall be delivered to the independent laboratory for testing at 7 and 28 days.
    - 4.8.5.1 Contractor shall be solely responsible for performing all concrete testing.





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- 4.8.6 Any concrete placed in the permanent structure for which test cylinders indicate the compressive strength is below 4,000 psi shall be removed and replaced at Contractor's expense.
- 4.8.6.1 No reductions or tolerances will be recognized, regardless of American Concrete Institute (ACI) or other Association Standards for acceptance.
- 4.9 Portland cement concrete shall be placed in accordance with the requirements of Part 1 – Materials, Tests and Construction of Chapter 8 – Concrete Structures and Foundations of the AREMA Manual as approved by Engineer.
- 4.9.1 The supervisor of the concrete placing crew shall maintain certification by the American Concrete Institute as a Concrete Flatwork Finisher, or Concrete Transportation Construction Inspector.
- 4.9.2 Before concrete is placed, Contractor shall ensure reinforcement is free from mud, oil, or other non-metallic coatings that adversely affect bonding capacity.
- 4.9.3 Before concrete is placed, Contractor shall ensure all debris have been removed from the space to be occupied by the concrete and any mortar splashed upon the reinforcement and surfaces of forms shall be removed.
- 4.9.4 Where concrete is to be placed on a rock foundation any unusual conditions or excess fissures shall be treated as directed by Engineer. Water shall be removed from the space to be occupied by the concrete before concrete is deposited.
- 4.9.5 Where concrete is to be placed in contact with existing concrete, the surface of the existing concrete shall be mechanically abraded to remove all unsound concrete and be cleaned of all contaminants such as soil and oils.
- 4.9.6 Before beginning placement of concrete, hardened concrete and loose foreign materials shall be removed from the inner surfaces of the mixing and conveying equipment.
- 4.9.7 Concrete shall be handled to the place of final deposit as rapidly as practicable by methods which will prevent the separation or loss of the ingredients. Concrete shall not have a free fall of more than 4 feet.
- 4.9.7.1 The maximum distance of delivery of concrete by pumping shall be 1000 feet horizontally and 100 feet vertically. A 90-degree bend is figured as equivalent to 40 feet of horizontal piping. A 45-degree bend is equivalent to 20 feet. A 22.5-degree bend is equivalent to 10 feet.
- 4.9.8 Concrete shall be placed in horizontal layers and each layer shall be placed and compacted before the preceding layer has taken initial set in order to prevent formation of a joint.
- 4.9.8.1 The interval between batches for a single pour shall not exceed 20 minutes unless otherwise authorized by Engineer.
- 4.9.8.2 Concrete shall be so deposited to maintain, until the completion of the unit, a plastic surface approximately horizontal.
- 4.9.8.3 In placing concrete for an arch ring, the work shall be carried out symmetrically with respect to the center line, and the working faces of the completed courses shall be on approximately radial planes.
- 4.9.8.4 Construction joints other than shown on the Plans will not be permitted.
- 4.9.9 Concrete shall be thoroughly compacted during and immediately after depositing by vibrating the concrete internally using mechanical vibrating equipment capable of transmitting vibration to the concrete in frequencies of not less than 3500 impulses per



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minute and of sufficient intensity to consolidate the concrete into place without separation of the ingredients.

- 4.9.9.1 The internal vibrators shall be applied at points uniformly spaced, not farther apart than the radius over which the vibration is visibly effective, and shall be applied close enough to the forms effectively to vibrate the surface concrete.
- 4.9.9.2 The vibrating element shall be inserted in the concrete mass a sufficient depth to vibrate the bottom of each layer effectively, in as nearly a vertical position as practicable. It shall be withdrawn completely from the concrete before being advanced to the next point of application.
- 4.9.10 In order to allow for shrinkage or settlement, at least 2 hours shall elapse after placing concrete in walls, columns or stems of deep T-beams before depositing concrete in girders, beams or slabs supported thereon.
- 4.9.11 Concrete in girders, slabs and shallow T-beam construction shall be placed in one continuous operation for each span. Concrete shall be deposited uniformly for the full length of the span and brought up evenly in horizontal layers.
- 4.9.12 No concrete shall be placed in the superstructure until the pier forms have been stripped sufficiently to determine the character of the concrete in the piers, and the load of the superstructure shall not be allowed to come upon abutments, piers and column bents until they have been in place at least 7 days.
- 4.10 Where the space to be filled with concrete contains fresh water which cannot be readily removed, Engineer may approve depositing concrete under water using the tremie method in accordance with the following.
  - 4.10.1 The methods, equipment and materials proposed to be used, shall be submitted first to the Engineer for approval before the work is started.
  - 4.10.2 The methods used shall be such as will prevent the washing out of the cement from the concrete mixture, minimize the segregation of materials and the formation of laitance, and prevent the flow of water through or over the new concrete until it has fully hardened.
  - 4.10.3 Concrete shall not be placed in water having a temperature below 35 degrees F.
  - 4.10.4 The materials, preparations and methods to be used in making concrete to be deposited under water shall modified as follows:
    - 4.10.4.1 Not less than 610 lb of cement per cubic yard of concrete shall be used.
    - 4.10.4.2 Aggregate for this work shall be of exceptionally good quality, strong and durable with a maximum size of 2 inches.
    - 4.10.4.3 The coarse aggregate shall be well graded in such proportions that the weight of the coarse aggregate shall be not less than 1.25 or more than 2.0 times that of the fine aggregate.
    - 4.10.4.4 The cement and aggregates shall be mixed for a period of 2 minutes with sufficient water to produce a concrete having a slump of not less than 6 inches or more than 8 inches.
  - 4.10.5 Caissons, cofferdams or forms shall be sufficiently tight to prevent loss of mortar or flow of water through the space in which the concrete is to be deposited. Pumping will not be permitted while concrete is being deposited, nor until a minimum of 24 hours has elapsed.



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- 4.10.6 Subject to the approval of Engineer, before starting to deposit concrete under water, the condition of the bottom shall be examined by a competent diver.
  - 4.10.6.1 The surface of the bottom shall be cleared of silt and loose material and be leveled as directed by the Engineer.
- 4.10.7 Concrete shall be deposited continuously until it is brought up to the required elevation. While depositing, the top surface shall be kept as nearly level as possible, and the formation of laitance planes avoided.
- 4.10.8 The top section of the tremie shall be a hopper large enough to hold one entire batch of the mix or the entire contents of the transporting bucket, when one is used. The tremie pipe shall be not less than 8 inches in diameter and shall allow a free flow of concrete. The lower end of the pipe shall be equipped with a check valve.
- 4.10.9 After the start of placing the concrete, and until all concrete is placed, the lower end of the tremie pipe shall be below the top surface of the plastic concrete. The tremie shall be slowly raised to cause a uniform flow of the concrete, but the tremie shall not be emptied so that water enters above the concrete in the pipe. If the charge in the tremie is lost while depositing, the tremie shall be raised above the concrete surface before refilling for depositing concrete.
- 4.11 Where the amount of concrete to be placed does not warrant the equipment required for tremie methods, concrete may be placed under water in sacks or bags. In such case the space shall be filled with sacks of concrete carefully placed by hand in header and stretcher formation, so that the whole mass becomes interlocked.
  - 4.11.1 Sacks used for this purpose shall be made of jute or other coarse material free from deleterious materials, and shall be filled about two-thirds full of concrete and the sack openings securely tied.
- 4.12 Unless otherwise specified in the Plans, concrete for structures in, or exposed to, sea water shall be shall be made with Type IIA Portland cement having a maximum tricalcium aluminate content of 8%.
  - 4.12.1 Concrete in sea water or exposed directly along the sea coast shall contain a minimum of 560 lb of Portland cement per cubic yard.
  - 4.12.2 The concrete shall be mixed for a period of not less than 2 minutes and the water content of the mixture shall be carefully controlled and regulated so as to produce concrete of maximum impermeability.
  - 4.12.3 Porous or weak aggregates shall not be used.
  - 4.12.4 Between levels of extreme low water and extreme high water as determined by the Engineer, sea water shall not come in direct contact with the concrete for a period of not less than 30 days. Sea water shall not be allowed to come in contact with other concrete that will be in or exposed to sea water until it is hardened for at least 4 days.
  - 4.12.5 The original surface, as the forms are removed from the concrete, shall be left undisturbed.
  - 4.12.6 Concrete shall be placed in such a manner that no construction joints shall be formed between levels of extreme low water and extreme high water as determined by the Engineer.
  - 4.12.7 Reinforcing steel or other corrodible metal shall have a cover of not less than 4 inches of concrete.



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- 4.13 The supervisor responsible for curing procedures shall maintain certification by the American Concrete Institute as a Concrete Flatwork Finisher or Concrete Transportation Construction Inspector.
- 4.13.1 Unless otherwise specified in the Plans, when there is likelihood of freezing temperatures within the specified curing period, Contractor shall provide means for maintaining all concrete surfaces at a temperature of not less than 50 degrees F for a period of not less than seven (7) days after the concrete is placed.
- 4.13.1.1 Temperature readings shall be taken and recorded over the entire curing period at intervals designated by Engineer.
- 4.13.1.2 When protection from cold is needed, all necessary materials and equipment for covering and heating the concrete must be delivered at the site of the work before concreting is started. Such coverings and heat shall be applied as the work progresses without depending upon the heat of hydration during the first 24 hours after concrete is placed. The methods of heating and protecting the concrete shall be approved by Engineer.
- 4.13.1.3 Special care shall be exercised to maintain the specified temperature continuously and uniformly in all parts of the enclosures, and to exclude cold drafts from angles, corners and from all projecting reinforcing steel. All exposed surfaces in the heated enclosure shall be kept continuously wet during the heating period unless heat is supplied in the form of live steam.
- 4.13.2 Unless otherwise specified in the Plans, when temperature of the concrete approaches 90 degrees F, it shall be wet cured for a period of not less than seven (7) days after concrete is placed.
- 4.13.2.1 Continuous wet curing is preferred and shall commence as soon as the concrete has hardened sufficiently to resist surface damage.
- 4.13.2.2 The wet curing period for all concrete which will be in contact with brine drip, sea water, salt spray, alkali or sulfate-bearing soils or waters, or similar destructive agents, shall be increased to 11 days. Salt water and corrosive waters and soils shall be kept from contact with the concrete during placement and for the curing period.
- 4.13.2.3 Curing water shall not be much cooler than the concrete to avoid temperature change stresses resulting in cracking.
- 4.13.2.4 Exposed, unformed concrete surfaces shall be protected from wind and direct sun.
- 4.13.2.5 When wood forms are left in place during the curing period they shall be kept sufficiently damp at all times to prevent openings at the joints and drying of the concrete.
- 4.14 Unless otherwise specified in the Plans, unformed surfaces shall be struck off and finished with floats and trowels or finishing machines in a manner approved by the Engineer.
- 4.14.1 Edges shall be finished with an edging tool.
- 4.14.2 Except those directly under bearing plates all horizontal surfaces shall be sloped to drain away from the structure.
- 4.14.3 The supervisor responsible for finishing unformed surfaces shall have and maintain certification by the American Concrete Institute as a Concrete Flatwork Finisher.



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- 4.15 Forms shall be removed in such a manner as to insure the complete safety of the structure. Care shall be taken to preserve formed surfaces and not to damage the corners or surfaces of the concrete. Hammering on or prying between forms and concrete shall not be permitted.
  - 4.15.1 Forms shall not be removed from the concrete before a concrete strength of 2,500 psi is reached unless a higher strength is required to support its weight and any anticipated loads upon it.
  - 4.15.2 Falsework, shoring and centering shall not be released until the concrete has attained sufficient strength to support its weight and any anticipated loads upon it, but not less than 70% of its specified compressive strength; and in no case until at least 5 days have elapsed after the concrete has been placed. In continuous structures, support shall not be released in any span until the first and second adjoining spans on each side have reached the specified strength.
  - 4.15.3 Bulkheads at construction joints shall not be removed for a period of 15 hours after casting adjacent concrete.
- 4.16 Upon completion of the work, all surplus material or material salvaged from an existing structure shall be delivered to and be neatly stacked in a location designated by the Engineer. Material not salvageable and other refuse shall be properly disposed of. The premises shall be left in a clean, neat and orderly condition.
  - 4.16.1 In no case shall any materials be left within 200 feet of the bridge, upstream of the bridge or within 15 feet of track centerline.

### **5 MEASUREMENT AND PAYMENT**

- 5.1 Measurement:
  - 5.1.1 Cast in place concrete construction shall be measured for payment on the basis of individual components formed, reinforced, constructed and accepted into the finished structure up to the estimated quantity given in the Proposal.
  - 5.1.2 Existing concrete and masonry surface preparation is considered incidental to concrete construction and shall not be measured for payment.
  - 5.1.3 Concrete and masonry debris, reinforcing and other material disposal is considered incidental to concrete construction and shall not be measured for payment.
- 5.2 Payment
  - 5.2.1 Cast in place concrete construction shall be paid for at the contract unit price for the cast in place concrete bid items and shall constitute full payment for all labor, equipment, materials and supervision necessary to construct the concrete in accordance with the Plans and Specifications.

END OF SECTION

### **REVISION HISTORY**

The following is the revision history for this standard:

5/1/2013 – Initial Issue



# STANDARD CONSTRUCTION SPECIFICATIONS

## 532 – PRESTRESSED CONCRETE CONSTRUCTION

### 1 GENERAL

- 1.1 These Prestressed Concrete Construction Specifications are adopted by Railroad and are supplemental and complimentary to the requirements of the Contract issued by Railroad to Contractor for the purpose of performing construction and maintenance of Railroad's Structure(s) as specified in the Scope of Work and the Contract Documents. They apply to Contractor, its employees, agents, invitees and subcontractors.
- 1.2 Prestressed Concrete construction shall consist of commercially available prestressed or post tensioned Portland cement concrete components formed, reinforced, prestressed or post-tensioned, placed and maintained in accordance with these Specifications, the requirements of Part 1 – Materials, Tests and Construction Requirements, Part 2 – Reinforced Concrete Design, and Part 17 – Prestressed Concrete of Chapter 8 – Concrete Structures and Foundations of the American Railway Engineering and Maintenance of Way Association (AREMA) Manual for Railway Engineering (Manual), and the details shown on the Plans.
- 1.3 Non-prestressed units that are locally precast for use in a structure shall be formed, reinforced and cast in accordance with the requirements of Standard Specification 531 – Cast in Place Concrete Construction. Placement of these units shall be in accordance with this specification.
- 1.4 Contractor is responsible for performing all prestressed concrete construction operations in compliance with local, state, and federal laws, Railroad safety and operating rules, and Federal Railroad Administration regulations pertaining to workplace safety.
- 1.5 With regard to the Work, Contractor is encouraged to provide value engineering that considers best practices. Any proposed changes to the work shall be prepared with sufficient detail and cost analysis that Engineer can make an informed decision on Contractor's proposed change.
- 1.6 Concrete components are numbered in the direction of increasing mileposts and from left to right when facing the direction of increasing mileposts.

### 2 MATERIALS

- 2.1 Portland cement concrete shall be of a mix design conforming to the requirements of Standard Specification 530 – Portland Cement Concrete General and the requirements of Part 1 – Materials, Tests and Construction of Chapter 8 – Concrete Structures and Foundations of the AREMA Manual as approved by Engineer.
- 2.2 Unless otherwise specified in the plans, the minimum compressive strength at 28 days for prestressed and post-tensioned concrete shall be at least 5,000 psi.
- 2.3 Unless otherwise specified in the Plans, reinforcing steel shall be deformed Billet Steel Bars in accordance with the requirements of ASTM A615 Grade 60, Deformed Steel Wire not smaller than size W4 in accordance with the requirements of ASTM A496 or Uncoated Seven-Wire Steel Strand in accordance with the requirements of ASTM A416.
  - 2.3.1 Reinforcement, except prestressing tendons, with rust, mill scale, or a combination of both, shall be considered as satisfactory, provided the minimum dimensions, including height of deformations, and weight of a hand wire-brushed test specimen do not exceed the applicable ASTM requirements.
  - 2.3.2 Prestressing tendons shall be clean and free of oil, excessive soaps, dirt, scale, pitting and excessive rust. A light coating of rust without pitting shall be permitted.
- 2.4 All grout for post-tensioning tendons shall comply with the provisions of the current PTI GUIDE SPECIFICATION "SPECIFICATION FOR GROUTING OF POST-TENSIONED STRUCTURES"





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prepared by the Post-Tensioning Institute Committee on Grouting Specifications and published by the Post-Tensioning Institute.

- 2.5 Rigid ducts shall have sufficient strength to maintain their correct alignment without visible wobble during placement of concrete. Rigid ducts may be fabricated with either welded or interlocked seams. Galvanizing of the welded seam will not be required.
- 2.6 Contractor is solely responsible for delivering all material to the project site.
- 2.7 All material shall be stored and handled to avoid damage or unnecessary disfiguring.
  - 2.7.1 Material shall be stored properly above the ground upon platforms, skids, or other supports. It shall be kept free from dirt, grease and other foreign matter, and shall be protected as far as practicable from corrosion.
  - 2.7.2 Materials stored at the site shall be kept in a neat manner at proper clearance to operated tracks.
  - 2.7.3 Hardware received at the job site shall be protected from corrosion by storing under cover or by a protective coating.
  - 2.7.4 Care shall be exercised to prevent fires in material held in storage. The ground underneath and in the vicinity of stored material should be kept clear of all weeds, rubbish and combustible material.
- 2.8 Contractor shall be responsible for ensuring that all material meets the requirements as identified in the applicable paragraphs of the Contract Documents.
- 2.9 All materials of any kind rejected by the Engineer shall be immediately removed from the site and any work affected by the defective material shall be remedied by the Contractor at his own expense and to the satisfaction of the Engineer.
- 2.10 Final acceptance of the material shall be based upon satisfactory performance in the field.

### 3 SUBMITTALS

- 3.1 If not already identified during the bidding process, Contractor shall submit his proposed prestressed concrete manufacturer to Engineer for approval.
- 3.2 Prior to the start of work, Contractor shall submit a complete set of shop drawings for prestressed concrete components for review by Engineer. This shall be submitted at least fourteen (14) days prior to start of the scheduled production and shall include the following requirements:
  - 3.2.1 Concrete mix design meeting the requirements of Standard Specification 530 – Portland Cement Concrete General that is tailored to the intended service environment such as cold climate or exposure to salt water.
  - 3.2.2 Spacing of tendons, ducts and minimum concrete cover to meet the requirements of Section 17.5 – Details of Prestressing Tendons and Ducts of Chapter 8 – Concrete Structures and Foundations of the AREMA Manual
  - 3.2.3 Unless otherwise specified in the Plans the location of the center of gravity of the prestressing steel shall be not more than +/- 3/16 inch from that shown in the plans.
  - 3.2.4 The planned pretension force not to exceed 175,000 psi and the method of achieving uniform pretension force.
  - 3.2.5 The method of transferring the pretensioning force to the concrete in a smooth and gradual manner but not before the concrete has reached a strength of 4,000 psi.
  - 3.2.6 The method of handling members and removal from the casting bed but not before the concrete has reached a strength of 4,500 psi.





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- 3.3 Prior to the start of work Contractor shall submit a prestressed concrete construction plan for approval by Engineer. This plan shall provide detailed information on Contractor's proposed means and methods and shall include the following minimum information:
- 3.3.1 Contractor's proposed means and methods.
  - 3.3.2 Contractor's proposed rigging plan with lifting weights.
  - 3.3.3 Name and experience of personnel in responsible charge of the prestressed concrete construction.
  - 3.3.4 Roster of proposed equipment.
  - 3.3.5 Means of access for the personnel, equipment and material to the work location.
  - 3.3.6 Method of placement and securing of prestressed components.
  - 3.3.7 Procedures for accommodating existing utilities on the project site.
- 3.4 Prior to the start of work Contractor shall submit a post-tensioning concrete construction plan for approval by Engineer. This plan shall provide detailed information on Contractor's proposed means and methods and shall include the following minimum information:
- 3.4.1 Contractor's proposed means and methods.
  - 3.4.2 Contractor's proposed rigging plan with lifting weights.
  - 3.4.3 Name and experience of personnel in responsible charge of the post-tensioned concrete construction.
  - 3.4.4 Roster of proposed equipment.
  - 3.4.5 Means of access for the personnel, equipment and material to the work location.
  - 3.4.6 Method of placement and securing of post-tensioned components.
  - 3.4.7 The planned post-tensioned method and force not to exceed 175,000 psi and the method of achieving uniform post-tension force.
  - 3.4.8 The method of grouting the post-tensioning tendons and means of achieving uniform grout density within the ducts.
  - 3.4.9 Procedures for accommodating existing utilities on the project site.
- 3.5 Where falsework supports the structure during construction, Contractor shall submit to Engineer for approval the applicable designs and calculations.
- 3.6 Prior to the start of work, Contractor shall submit to Engineer mill affidavits and certifications, chemical and physical test reports for all concrete and reinforcing materials.
- 3.7 Upon completion of the Work, Contractor shall submit to Engineer a complete and accurate record of the work performed.

## 4 EXECUTION

- 4.1 Workmanship shall be of the best quality performed by competent railroad bridge construction workers. All component placing shall be true and exact.
- 4.2 The work of fabrication of the prestressed components must meet the requirements of Part 17 – Prestressed Concrete of Chapter 8 – Concrete Structures and Foundations of the AREMA Manual.
- 4.3 The Work of construction must be planned and performed by the Contractor in such a manner as to continually maintain the structure in a condition that it is safe for 10 MPH train traffic at the end of each work window.



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- 4.4 Contractor shall be responsible for the design of all shoring, falsework and centering required to complete the Work.
  - 4.4.1 Where the falsework supports the structure during construction such forms and falsework shall be designed by a licensed engineer.
  - 4.4.2 Falsework shall allow for and correct anticipated settlements so that the finished members conform to the desired line and grade.
- 4.5 All precast members shall be hauled, stored, and shipped in a manner to avoid chipping, cracking, fractures, and excessive bending stresses. These members shall be supported on firm blocking with foundations suitable to prevent differential settlement or twisting of the units.
  - 4.5.1 Transportation of members shall not be undertaken until the full 28 day concrete strength has been achieved, or by order of Engineer.
  - 4.5.2 Members shall be handled such that the points of support and directions of the reactions with respect to the unit are approximately the same during transportation and storage as when the member is in its final position. Members damaged by improper storage or handling shall be replaced or repaired to the satisfaction of Engineer by the Fabricator at his expense.
  - 4.5.3 The ends of precast members shall not be permitted to extend a distance exceeding the depth of the member beyond any point of bearing during hauling or stockpiling.
  - 4.5.4 Precast members shall be handled with a suitable hoisting device or crane provided with a spreader sling of sufficient length to prevent horizontal forces in the member due to lifting.
  - 4.5.5 Precast, prestressed members shall be maintained in upright position at all times and shall be supported only at the ends or points of bearing. During lifting, they shall be supported only by the lifting devices provided for that purpose.
  - 4.5.6 Storing of precast, prestressed members shall be done with adequate blocking so that warpage or cracking will not occur.
  - 4.5.7 Precast, prestressed members, when stacked, shall be separated by blocking capable of supporting the members in a level position without twisting. The blocking shall be arranged in vertical planes. Stacking of precast prestressed members shall be arranged such that lifting devices will be accessible and undamaged.
  - 4.5.8 Before moving a long member, Contractor shall check it for any tendency to buckle. Each girder that may buckle shall be braced on the sides to prevent buckling. This bracing shall be attached securely to the top flanges of the girder. The lateral bracing shall be in place during all lifting or handling necessary for transportation from the fabricating plant to the job site and erection of the girder.
- 4.6 Bearing areas on concrete caps and beams or girders which are to receive epoxy materials shall be abrasive blast cleaned to remove all form oil and curing agents and shall be left in a dust free condition.
- 4.7 In erecting members, care shall be taken to keep bridge seats and tops of bearing devices free of foreign materials. Any shifting of beams shall be done while they are held free of the foundation.
- 4.8 Contractor will be required to shift or interchange members to achieve a better fit when directed by Engineer. As the members are placed in their final position, and prior to securing anchor bolts, rods, or diaphragms, the members shall be brought to full and even bearing on the bearings.
- 4.9 Precast members shall be set in the proper location using care not to damage concrete members. After members are set, Contractor shall burn off lifting loops flush with the concrete surface. The



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remaining portion of lifting loops are to be coated with paint. Patch recesses, if necessary, around lifting loops with epoxy mortar.

- 4.10 Bearings shall be set level in exact position and shall have full and even bearing upon the bridge seat areas.
- 4.11 Anchor bolts and anchor rods shall be installed as shown on the Plans.
- 4.12 Upon completion of the work, all surplus material or material salvaged from an existing structure shall be delivered to and be neatly stacked in a location designated by the Engineer. Material not salvageable and other refuse shall be properly disposed of. The premises shall be left in a clean, neat and orderly condition.
  - 4.12.1 In no case shall any materials be left within 200 feet of the bridge, upstream of the bridge or within 15 feet of track centerline.

### 5 MEASUREMENT AND PAYMENT

- 5.1 Measurement:
  - 5.1.1 Prestressed concrete construction shall be measured for payment on the basis of individual components constructed and accepted into the finished structure up to the estimated quantity given in the Proposal.
  - 5.1.2 Concrete, reinforcing and other material disposal is considered incidental to prestressed concrete construction and shall not be measured for payment.
- 5.2 Payment
  - 5.2.1 Prestressed concrete construction shall be paid for at the contract unit price for the prestressed concrete bid items and shall constitute full payment for all labor, equipment, materials and supervision necessary to construct the concrete elements in accordance with the Plans and Specifications.

END OF SECTION

### REVISION HISTORY

The following is the revision history for this standard:

5/1/2013 – Initial Issue



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# STANDARD CONSTRUCTION SPECIFICATIONS

## 533 – SHOTCRETE CONSTRUCTION

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### 1 GENERAL

- 1.1 These Shotcrete Construction (Shotcreting) Specifications are adopted by Railroad and are supplemental and complimentary to the requirements of the Contract issued by Railroad to Contractor for the purpose of performing construction and maintenance of Railroad's Structure(s) as specified in the Scope of Work and the Contract Documents. They apply to Contractor, its employees, agents, invitees and subcontractors.
- 1.2 Shotcreting shall consist of Portland cement concrete reinforced, pneumatically placed and maintained in accordance with these Specifications, the requirements of Part 1 – Materials, Tests and Construction Requirements, Part 2 – Reinforced Concrete Design, and Part 14 – Repair and Rehabilitation of Concrete Structures of Chapter 8 – Concrete Structures and Foundations of the American Railway Engineering and Maintenance of Way Association (AREMA) Manual for Railway Engineering (Manual), and the details shown on the Plans.
- 1.3 Contractor is responsible for performing all shotcrete construction operations in compliance with local, state, and federal laws, Railroad safety and operating rules, and Federal Railroad Administration regulations pertaining to workplace safety.
- 1.4 With regard to the Work, Contractor is encouraged to provide value engineering that considers best practices. Any proposed changes to the work shall be prepared with sufficient detail and cost analysis that Engineer can make an informed decision on Contractor's proposed change.
- 1.5 Structural components are numbered in the direction of increasing mileposts and from left to right when facing the direction of increasing mileposts.

### 2 MATERIALS

- 2.1 Portland cement concrete for shotcrete shall be of materials conforming to the requirements of Standard Specification 530 – Portland Cement Concrete General and the requirements of Part 1 – Materials, Tests and Construction of Chapter 8 – Concrete Structures and Foundations of the AREMA Manual as approved by Engineer.
- 2.2 Unless otherwise specified in the plans, the minimum compressive strength at 28 days for shotcrete shall be at least 3,000 psi.
- 2.3 Unless otherwise specified in the Plans, reinforcing steel shall be deformed Billet Steel Bars in accordance with the requirements of ASTM A615 Grade 60 or Deformed Steel Wire not smaller than size W4 in accordance with the requirements of ASTM A496.
  - 2.3.1 Reinforcement with rust, mill scale, or a combination of both, shall be considered as satisfactory, provided the minimum dimensions, including height of deformations, and weight of a hand wire-brushed test specimen do not exceed the applicable ASTM requirements.
- 2.4 When specified in the Plans, epoxy-coated steel reinforcing shall meet the requirements of ASTM A775.
  - 2.4.1 All damaged coating shall be repaired with patching material conforming to ASTM A775. Repair shall be done in accordance with the material manufacturer's recommendations. The maximum amount of damage areas shall not exceed 2% of the surface area of each linear foot of the bar.
  - 2.4.2 When epoxy-coated reinforcing bars are cut, the ends of the bars shall be coated with the same material that is used for the repair of damaged coating.
  - 2.4.3 Plants applying fusion-bonded epoxy coatings to reinforcing bars shall maintain certification by the Concrete Reinforcing Steel Institute.



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- 2.5 Contractor is solely responsible for delivering all material to the project site.
- 2.6 All material shall be stored and handled to avoid damage or unnecessary disfiguring.
  - 2.6.1 Material, either plain or fabricated, shall be stored properly above the ground upon platforms, skids, or other supports. It shall be kept free from dirt, grease and other foreign matter, and shall be protected from the elements.
  - 2.6.2 Materials stored at the site shall be kept in a neat manner at proper clearance to operated tracks.
  - 2.6.3 Hardware received at the job site shall be protected from corrosion by storing under cover or by a protective coating.
  - 2.6.4 Care should be exercised to prevent fires in material held in storage. The ground underneath and in the vicinity of stored material should be kept clear of all weeds, rubbish and combustible material.
- 2.7 Contractor shall be responsible for ensuring that all material meets the requirements as identified in the applicable paragraphs of the Contract Documents.
- 2.8 All materials of any kind rejected by the Engineer shall be immediately removed from the site and any work affected by the defective material shall be remedied by the Contractor at his own expense and to the satisfaction of the Engineer.
- 2.9 Final acceptance of the material shall be based upon satisfactory performance in the field.

### 3 SUBMITTALS

- 3.1 If not already identified during the bidding process, Contractor shall submit his proposed reinforcing fabricator to Engineer for approval.
- 3.2 Prior to the start of work, Contractor shall submit a complete set of shop drawings for bent reinforcing steel for review by Engineer. This shall be submitted at least fourteen (14) days prior to start of the scheduled bending.
- 3.3 Prior to the start of work Contractor shall submit a shotcrete construction plan for approval by Engineer. This plan shall provide detailed information on Contractor's proposed means and methods and shall include the following minimum information:
  - 3.3.1 Contractor's proposed means and methods.
  - 3.3.2 Name and experience of personnel in responsible charge of the shotcrete construction.
  - 3.3.3 Roster of proposed equipment.
  - 3.3.4 Means of access for the personnel, equipment and material to the work location.
  - 3.3.5 Method of placement of reinforcing steel, applying shotcrete and the appropriate curing technique.
  - 3.3.6 Procedures for accommodating existing utilities on the project site.
  - 3.3.7 Procedures for maintaining concrete quality during shotcrete operations.
- 3.4 Prior to the start of work, Contractor shall submit to Engineer mill affidavits and certifications, chemical and physical test reports for all concrete materials.
- 3.5 Prior to the start of work, Contractor shall submit to Engineer mill affidavits and certifications, chemical and physical test reports for all reinforcing materials.
- 3.6 Upon completion of the Work, Contractor shall submit to Engineer a complete and accurate record of the work performed.



## 533 – SHOTCRETE CONSTRUCTION

- 3.7 Upon completion of the Work, Contractor shall submit to Engineer a complete and accurate record of all 7-day and 28-day test results to Engineer.

### 4 EXECUTION

- 4.1 Workmanship shall be of the best quality performed by competent shotcrete applicators. All finished lines shall be reasonably true.
- 4.2 The Work must be planned and performed by the Contractor in such a manner as to continually maintain the structure in a condition that it is safe for 10 MPH train traffic at the end of each work window.
- 4.3 Fabrication of reinforcing steel shall be in accordance with Chapter 7 of the Current CRSI Manual of Standard Practice.
- 4.3.1 Reinforcement shall be prefabricated to the dimensions shown on the plans.
- 4.3.2 Unless otherwise specified in the Plans, bending detail dimensions are out to out of bars.
- 4.3.3 Reinforcement shall be bent cold around a pin in a manner that will not damage the material. Bars with kinks or bends not shown on the plans shall be rejected.
- 4.3.4 Unless otherwise specified in the Plans, the inside diameter of bends shall be not less than six (6) bar diameters for #3 through #8 bars.
- 4.3.5 Unless otherwise specified in the Plans, the tolerance in fabricated lengths of bars shall be  $\pm 1$  inch; the tolerance in out-to-out dimensions of hooks shall be  $\pm \frac{1}{2}$  inch; and the maximum angular deviation on 90 degree hooks or bends shall be 0.5 inches per foot (1 in 24).
- 4.3.6 When epoxy-coated reinforcing bars are cut in the field, the ends of the bars shall be coated with the same material that is used for the repair of damaged coating.
- 4.3.6.1 Flame-cutting of epoxy-coated reinforcing bars shall not be permitted.
- 4.4 Unless otherwise specified in the Plans, welding of reinforcement is not permitted and all reinforcing shall be tied into proper position.
- 4.4.1 Tie wire shall be 16½ gage or heavier, black-annealed.
- 4.4.2 Where welding is authorized, it shall conform to “Structural Welding Code–Reinforcing Steel” (ANSI/AWS D1.4) of the American Welding Society. Type and location of welded splices and other required welding of reinforcing bars shall be indicated on the Plans.
- 4.4.3 Welders of reinforcing bars shall maintain certification by the American Welding Society.
- 4.5 Reinforcement shall be accurately placed, adequately supported and secured against displacement before shotcrete is placed.
- 4.5.1 The supervisor responsible for placing reinforcing bars shall maintain certification by the American Concrete Institute as a Concrete Transportation Construction Inspector.
- 4.5.2 Unless otherwise specified in the Plans, reinforcement shall be placed within the tolerances given in Section 1.10.4.2 – Tolerances of Chapter 8 – Concrete Structures and Foundations of the AREMA Manual.
- 4.5.3 Reinforcing partially embedded in concrete or masonry shall not be field bent.
- 4.5.4 Unless otherwise specified in the Plans, the minimum cover on reinforcing steel shall be three (3) inches.



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- 4.5.5 Holes drilled into existing concrete and masonry for dowel bars shall be drilled on a slight downward angle to retain epoxy adhesive. Holes shall be properly air blasted clean of all debris to allow for good adhesion of the epoxy.
- 4.6 Unless otherwise specified in the Plans, Portland cement concrete for shotcrete shall be made of a mixture of Portland cement and sand in the proportion of one bag of cement for every 4 cubic feet of sand by volume. The Portland cement and sand shall conform to the requirements of RailAmerica Standard Specification 530 – Portland Cement Concrete General and the requirements of Part 1 – Materials, Tests and Construction of Chapter 8 – Concrete Structures and Foundations of the AREMA Manual as approved by Engineer.
  - 4.6.1 The ingredients shall be thoroughly mixed and brought to a proper consistency.
  - 4.6.2 For wet applications, shotcrete shall not be placed more than 90 minutes after the introduction of the mixing water.
  - 4.6.3 Shotcrete when deposited shall have the following minimum temperatures but not more than 90 degrees Fahrenheit: for ambient temperatures below 30 degrees Fahrenheit the minimum concrete temperature shall be 70 degrees Fahrenheit; for ambient temperatures between 30 and 45 degrees Fahrenheit the minimum concrete temperature shall be 60 degrees Fahrenheit; and for ambient temperatures above 45 degrees Fahrenheit the minimum concrete temperature shall be 50 degrees Fahrenheit.
  - 4.6.4 For each batch of concrete placed into the structure a minimum of four (4) standard test cylinders shall be collected. After curing in the same manner as the shotcrete in the structure, these cylinders shall be delivered to the independent laboratory for testing at 7 and 28 days.
    - 4.6.4.1 Contractor shall be solely responsible for performing all concrete testing.
  - 4.6.5 Any shotcrete placed in the permanent structure for which test cylinders indicate the compressive strength is below 3,000 psi shall be removed and replaced at Contractor's expense.
    - 4.6.5.1 No reductions or tolerances will be recognized, regardless of American Concrete Institute (ACI) or other Association Standards for acceptance.
- 4.7 Shotcrete construction shall be in accordance with ACI Standard "Guide to Shotcrete" (ACI 506) and ACI Standard "Specification for Materials, Proportioning, and Application of Shotcrete" (ACI 506.2).
  - 4.7.1 To avoid voids and reduce shrinkage cracks, shotcrete should be applied as dry as practicable. Suitable prepackaged materials may be used as approved by the engineer.
  - 4.7.2 Shrinkage reducing and/or bonding compounds are to be applied as specified by the manufacturer.
  - 4.7.3 The air pressure in the pneumatic apparatus should be maintained uniform and not less than 35 psi while placing the mixed material, with necessary increase in pressure for horizontal delivery distances of more than 100 feet or vertical distances of more than 25 feet.
  - 4.7.4 For dry mix applications, the water pressure applied through the nozzle should be not less than ten (10) psi greater than the air pressure in the shotcrete machine.
  - 4.7.5 Unless otherwise specified in the Plans, shooting strips shall be employed to ensure square corners, straight lines and a plane surface of shotcrete.





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- 4.7.6 Where shotcrete is to be placed in contact with existing masonry or concrete, the surface of the existing concrete shall be mechanically abraded to remove all unsound material and be cleaned of all contaminants.
- 4.7.7 Before shotcrete is placed, Contractor shall ensure reinforcement is free from mud, oil, or other non-metallic coatings that adversely affect bonding capacity.
- 4.7.8 Before shotcrete is placed, Contractor shall ensure all debris have been removed from the space to be occupied by the shotcrete and any mortar splashed upon the reinforcement and surfaces of forms shall be removed.
- 4.7.9 Where shotcrete is to be placed on a rock foundation any unusual conditions or excess fissures shall be treated as directed by Engineer. Water shall be removed from the space to be occupied by the shotcrete before shotcrete is deposited.
- 4.7.10 Where no separate bonding agent is used, the surface, particularly porous brick, to which shotcrete is to be applied should be thoroughly wet, without free water, to facilitate bond.
- 4.7.11 At the end of each day's work, or similar stopping periods requiring construction joints, the shotcrete should be sloped off to a thin edge. No square joints will be allowed. In shooting vertical surfaces, care must be taken in general to begin the shotcrete area at the bottom and complete at the top.
- 4.7.12 Unless otherwise specified in the Plans, a sufficient number of coats should be applied to obtain the required thickness with the thickness of each coat not greater than 1 inch.
- 4.7.13 Where a successive coat is applied on shotcrete which has set more than two hours, the surface shall be cleaned and water blasted.
- 4.7.14 Deposits of rebound from previous shooting, whether loose or cemented, shall be removed and not covered up. Should any such deposits be covered, they shall be cut out and the area reshot.
- 4.7.15 Unless otherwise specified in the Plans, the final surface of shotcrete shall be given a thin finishing or flash coat.
- 4.8 The supervisor responsible for curing procedures shall maintain certification by the American Concrete Institute as a Concrete Flatwork Finisher or Concrete Transportation Construction Inspector.
  - 4.8.1 Unless otherwise specified in the Plans, when there is likelihood of freezing temperatures within the specified curing period, Contractor shall provide means for maintaining all shotcrete surfaces at a temperature of not less than 50 degrees F for a period of not less than seven (7) days after the shotcrete is placed.
    - 4.8.1.1 Temperature readings shall be taken and recorded over the entire curing period at intervals designated by Engineer.
    - 4.8.1.2 When protection from cold is needed, all necessary materials and equipment for covering and heating the shotcrete must be delivered at the site of the work before shotcreting is started. Such coverings and heat shall be applied as the work progresses without depending upon the heat of hydration during the first 24 hours after shotcrete is placed. The methods of heating and protecting the shotcrete shall be approved by Engineer
    - 4.8.1.3 Special care shall be exercised to maintain the specified temperature continuously and uniformly in all parts of the enclosures, and to exclude cold drafts from angles, corners and from all projecting reinforcing steel. All



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exposed surfaces in the heated enclosure shall be kept continuously wet during the heating period unless heat is supplied in the form of live steam.

- 4.8.2 Unless otherwise specified in the Plans, when temperature of the shotcrete approaches 90 degrees F, it shall be wet cured for a period of not less than seven (7) days after shotcrete is placed.
  - 4.8.2.1 Continuous wet curing is preferred and shall commence as soon as the shotcrete has hardened sufficiently to resist surface damage.
  - 4.8.2.2 The wet curing period for all shotcrete which will be in contact with brine drip, sea water, salt spray, alkali or sulfate-bearing soils or waters, or similar destructive agents, shall be increased to 11 days. Salt water and corrosive waters and soils shall be kept from contact with the shotcrete during placement and for the curing period.
  - 4.8.2.3 Curing water shall not be much cooler than the shotcrete to avoid temperature change stresses resulting in cracking.
  - 4.8.2.4 Exposed shotcrete surfaces shall be protected from wind and direct sun.
- 4.9 Upon completion of the work, all surplus material or material salvaged from an existing structure shall be delivered to and be neatly stacked in a location designated by the Engineer. Material not salvageable and other refuse shall be properly disposed of. The premises shall be left in a clean, neat and orderly condition.
  - 4.9.1 In no case shall any materials be left within 200 feet of the bridge, upstream of the bridge or within 15 feet of track centerline.

### 5 MEASUREMENT AND PAYMENT

- 5.1 Measurement:
  - 5.1.1 Shotcrete construction shall be measured for payment on the basis of square feet of shotcrete reinforced and applied to the depth specified in the plans and accepted into the finished structure up to the estimated quantity given in the Proposal.
  - 5.1.2 Existing concrete and masonry surface preparation considered incidental to shotcrete construction and shall not be measured for payment.
  - 5.1.3 Concrete and masonry debris, reinforcing and other material disposal is considered incidental to shotcrete construction and shall not be measured for payment.
- 5.2 Payment
  - 5.2.1 Shotcrete construction shall be paid for at the contract unit price for the shotcrete bid items and shall constitute full payment for all labor, equipment, materials and supervision necessary to construct the shotcrete in accordance with the Plans and Specifications.

END OF SECTION

### REVISION HISTORY

The following is the revision history for this standard:

5/2/2013 – Initial Issue



# STANDARD CONSTRUCTION SPECIFICATIONS

## 534 – TUCKPOINT REPAIRS

### 1 GENERAL

- 1.1 These Tuckpoint Repair (Tuckpointing) Specifications are adopted by Railroad and are supplemental and complimentary to the requirements of the Contract issued by Railroad to Contractor for the purpose of performing construction and maintenance of Railroad's Structure(s) as specified in the Scope of Work and the Contract Documents. They apply to Contractor, its employees, agents, invitees and subcontractors.
- 1.2 Tuckpointing shall consist of Portland cement mortar placed and maintained in the joints of stone masonry foundations in accordance with these Specifications, the requirements of Part 1 – Materials, Tests and Construction Requirements and Part 14 – Repair and Rehabilitation of Concrete Structures of Chapter 8 – Concrete Structures and Foundations of the American Railway Engineering and Maintenance of Way Association (AREMA) Manual for Railway Engineering (Manual), and the details shown on the Plans.
- 1.3 Contractor is responsible for performing all tuckpointing in compliance with local, state, and federal laws, Railroad safety and operating rules, and Federal Railroad Administration regulations pertaining to workplace safety.
- 1.4 Masonry components are numbered in the direction of increasing mileposts and from left to right when facing the direction of increasing mileposts.

### 2 MATERIALS

- 2.1 Mortar mix design shall conform to the requirements of Part 1 – Materials, Tests and Construction of Chapter 8 – Concrete Structures and Foundations of the AREMA Manual as approved by Engineer.
- 2.2 Unless otherwise specified in the plans, the minimum compressive strength at 28 days for mortar shall be at least 3,000 psi as determined by ASTM C87.
- 2.3 Mortar shall consist of one part cement to three parts sand with sufficient water to produce a workable mixture.
- 2.4 Unless otherwise specified in the plans, cement shall conform to the requirements of ASTM C150 Type I.
- 2.5 Unless otherwise specified in the Plans, sand shall be fine mason sand with a fineness modulus of not more than 2.0.
- 2.6 Unless otherwise specified in the Plans, other cementitious materials shall not be used.
- 2.7 Unless otherwise specified in the Plans, water used in mixing and curing mortar shall be potable and free from any pronounced taste, odor, or color that would indicate the presence of substances that may be deleterious.
- 2.8 Unless otherwise specified in the Plans, concrete admixtures shall be used only upon express written permission of Engineer.
- 2.9 Contractor is solely responsible for delivering all material to the project site.
- 2.10 All material shall be stored and handled to avoid damage.
  - 2.10.1 Material shall be stored properly above the ground upon platforms, skids, or other supports. It shall be kept free from contamination and shall be protected from the elements.
  - 2.10.2 Materials stored at the site shall be kept in a neat manner at proper clearance to operated tracks.



- 2.10.3 Care should be exercised to prevent fires in material held in storage. The ground underneath and in the vicinity of stored material should be kept clear of all weeds, rubbish and combustible material.
- 2.11 Contractor shall be responsible for ensuring that all material meets the requirements as identified in the applicable paragraphs of the Contract Documents.
- 2.12 All materials of any kind rejected by the Engineer shall be immediately removed from the site and any work affected by the defective material shall be remedied by the Contractor at his own expense and to the satisfaction of the Engineer.
- 2.13 Final acceptance of the material shall be based upon satisfactory performance in the field.

### 3 SUBMITTALS

- 3.1 Prior to the start of work Contractor shall submit a tuckpointing plan for approval by Engineer. This plan shall provide detailed information on Contractor's proposed means and methods and shall include the following minimum information:
  - 3.1.1 Contractor's proposed means and methods.
  - 3.1.2 A map of the foundation joints that need to be repaired.
  - 3.1.3 The mix design for the mortar.
  - 3.1.4 Name and experience of personnel in responsible charge of the tuckpointing.
  - 3.1.5 Roster of proposed equipment.
  - 3.1.6 Means of access for the personnel, equipment and material to the work location.
  - 3.1.7 Means of ensuring mortar quality.
- 3.2 Upon completion of the Work, Contractor shall submit to Engineer a complete and accurate map of the masonry joints repaired.
- 3.3 Upon completion of the Work, Contractor shall submit to Engineer a complete and accurate record of all mortar test results to Engineer.

### 4 EXECUTION

- 4.1 Workmanship shall be of the best quality performed by competent railroad bridge construction workers.
- 4.2 The Work must be planned and performed by the Contractor in such a manner as to continually maintain the bridge in condition that it is safe for 10 MPH train traffic at the end of each work window.
- 4.3 For the masonry joints to be repaired Contractor shall remove all deteriorated mortar, dirt and loose particles from the joint and blast clean with water or oil free air.
- 4.4 Mortar shall be thoroughly mixed and brought to a proper consistency.
  - 4.4.1 Mortar shall not be placed more than 90 minutes after the introduction of the mixing water, except that in hot weather or under other conditions contributing to quick stiffening of the concrete, Engineer may reduce this maximum allowable time.
  - 4.4.2 Retempering mortar by adding water or by other means shall not be permitted.
  - 4.4.3 Any mortar placed in the permanent structure for which test cubes indicate substandard compressive strength shall be removed and replaced at Contractor's expense.
  - 4.4.4 Contractor shall be solely responsible for providing all equipment, labor, materials and transportation associated with obtaining test cylinders and performing associated testing.



- 4.5 After cleaning, masonry joints to be repaired shall be wet thoroughly to prevent absorption of water from the mortar.
- 4.6 To the extent possible, the mortar shall be packed into the joint. All excess material shall be removed and the joint tooled to a neat workmanlike appearance.
- 4.7 Unless otherwise specified in the Plans, when there is likelihood of freezing temperatures within the specified curing period, Contractor shall provide means for maintaining all tuckpointed joints at a temperature of not less than 50 degrees F for a period of not less than seven (7) days after the joints are repaired.
- 4.8 Unless otherwise specified in the Plans, when temperature of the masonry approaches 90 degrees F, the tuckpointing shall be wet cured for a period of not less than seven (7) days after the joints are repaired.
- 4.9 Upon completion of the work, all surplus material shall be delivered to and be neatly stacked in a location designated by the Engineer. Material not salvageable and other refuse shall be properly disposed of. The premises shall be left in a clean, neat and orderly condition.
  - 4.9.1 In no case shall any materials be left within 200 feet of the bridge, upstream of the bridge or within 15 feet of track centerline.

### 5 MEASUREMENT AND PAYMENT

- 5.1 Measurement:
  - 5.1.1 Tuckpointing shall be measured for payment on the basis of lineal feet of masonry joints repaired and accepted into the finished structure up to the estimated quantity given in the Proposal.
  - 5.1.2 Old mortar and other material disposal is considered incidental to tuckpointing and shall not be measured for payment.
- 5.2 Payment
  - 5.2.1 Tuckpointing shall be paid for at the contract unit price for the tuckpoint repair bid items and shall constitute full payment for all labor, equipment, materials and supervision necessary to effect the tuckpoint repairs in accordance with the Plans and Specifications.

END OF SECTION

### REVISION HISTORY

The following is the revision history for this standard:

4/29/2013 – Initial Issue



# STANDARD CONSTRUCTION SPECIFICATIONS

## 535 – INTERNAL STRUCTURAL REPAIR

### 1 GENERAL

- 1.1 These Internal Structural Repair Specifications are adopted by Railroad and are supplemental and complimentary to the requirements of the Contract issued by Railroad to Contractor for the purpose of performing construction and maintenance of Railroad's Structure(s) as specified in the Scope of Work and the Contract Documents. They apply to Contractor, its employees, agents, invitees and subcontractors.
- 1.2 Internal structural repairs shall consist of filling internal voids and/or restoring the cracked stone, masonry and concrete sections to meet original strength with Portland cement grouts or epoxies and reinforcement cored, reinforced, pumped and maintained in accordance with these Specifications, the requirements of Part 14 – Repair and Rehabilitation of Concrete Structures of Chapter 8 – Concrete Structures and Foundations of the American Railway Engineering and Maintenance of Way Association (AREMA) Manual for Railway Engineering (Manual), and the details shown on the Plans.
- 1.3 Contractor is responsible for performing all internal structural repair operations in compliance with local, state, and federal laws, Railroad safety and operating rules, and Transport Canada / Federal Railroad Administration regulations pertaining to workplace safety.
- 1.4 Stone, masonry and concrete components are numbered in the direction of increasing mileposts and from left to right when facing the direction of increasing mileposts.

### 2 MATERIALS

- 2.1 Unless otherwise specified in the Plans, Portland cement grout for stone masonry pressure grouting shall consist of one part of cement, one-half part of sand. The amount of sand to be used in the grouting mixture shall be determined by starting the grouting operation with neat cement grout and adding sand in gradually increasing proportions until the optimum ratio of sand to cement has been reached which will give a free flowing grout.
- 2.2 Unless otherwise specified in the Plans, Portland cement grout for concrete the pressure grouting should consist of neat cement grout only.
- 2.3 Unless otherwise specified in the Plans, reinforcing steel for pin and grout repairs shall be #8 deformed Billet Steel Bars in accordance with the requirements of ASTM A615 Grade 60.
  - 2.3.1 When specified in the Plans, epoxy-coated steel reinforcing bars shall meet the requirements of ASTM A775.
  - 2.3.2 All damaged coating due to bending, straightening, handling, shipping, and placing shall be repaired with patching material conforming to ASTM A775. Repair shall be done in accordance with the material manufacturer's recommendations. The maximum amount of damage areas shall not exceed 2% of the surface area of each linear foot of the bar.
  - 2.3.3 Plants applying fusion-bonded epoxy coatings to reinforcing bars shall maintain certification by the Concrete Reinforcing Steel Institute.
- 2.4 Unless otherwise specified in the Plans, epoxy for injection repair of concrete cracks shall be Sikadur 35 Hi-Mod LV epoxy or equivalent material meeting the following minimum requirements.
  - 2.4.1 Epoxy injection material should meet requirements of ASTM C881, Type IV, Grade 1, Class A, B or C.
  - 2.4.2 Injected epoxies should be wet bonding agents.
- 2.5 Unless otherwise specified in the Plans, epoxy gel for sealing cracks shall be Sikadur 31 Hi-Mod gel or equivalent material meeting the following minimum requirements.



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- 2.5.1 Epoxy crack surface sealant gel (paste type) should meet the requirements of ASTM C881, Type 1, Grade 3, Class A, B or C.
- 2.6 Epoxy injection equipment should be the automatic mixing and dispensing type. The equipment should include positive displacement pumps inline pressure gauges, pressure gauges on the mixed materials at the point of injection, and positive connection to the injection ports. The unit should be capable of delivering 125 psi dynamic fluid pressure at the point of injection at a minimum flow rate of 2 gpm. The equipment should indicate when the supply of one component has been exhausted to prevent injection of only a single component.
- 2.7 Contractor is solely responsible for delivering all material to the project site.
- 2.8 All material shall be stored and handled to avoid damage or unnecessary disfiguring.
  - 2.8.1 Materials stored at the site shall be kept in a neat manner at proper clearance to operated tracks.
  - 2.8.2 Portland cement and epoxies received at the job site shall be protected from the elements by storing under cover or within an enclosure.
  - 2.8.3 Care should be exercised to prevent fires in material held in storage. The ground underneath and in the vicinity of stored material should be kept clear of all weeds, rubbish and combustible material.
- 2.9 Contractor shall be responsible for ensuring that all material meets the requirements as identified in the applicable paragraphs of the Contract Documents.
- 2.10 All materials of any kind rejected by the Engineer shall be immediately removed from the site and any work affected by the defective material shall be remedied by the Contractor at his own expense and to the satisfaction of the Engineer.
- 2.11 Final acceptance of the material shall be based upon satisfactory performance in the field.

### 3 SUBMITTALS

- 3.1 Prior to the start of work Contractor shall submit an internal structural repair plan for approval by Engineer. This plan shall provide detailed information on the location and lengths of pins, grout and epoxy materials as well as Contractor's proposed means and methods and shall include the following minimum information:
  - 3.1.1 Plan and elevation views of the structure to be repaired with dimensioned pin locations and orientations.
  - 3.1.2 Contractor's proposed materials.
  - 3.1.3 Contractor's proposed means and methods.
  - 3.1.4 Name and experience of personnel in responsible charge of the pin and grout repairs.
  - 3.1.5 Roster of proposed equipment.
  - 3.1.6 Means of access for the personnel, equipment and material to the work location.
  - 3.1.7 Method of coring holes, placement of reinforcing steel and pumping of grout or epoxy and means of preventing leakage of grout or epoxy.
  - 3.1.8 Procedures for accommodating existing utilities on the project site.
- 3.2 Prior to the start of work, Contractor shall submit to Engineer mill affidavits and certifications, chemical and physical test reports for all grout, epoxy and reinforcing materials.
- 3.3 Upon completion of the Work, Contractor shall submit to Engineer a complete and accurate record of the work performed.





### 4 EXECUTION

- 4.1 Workmanship shall be of the best quality performed by competent railroad bridge construction workers.
- 4.2 The Work must be planned and performed by the Contractor in such a manner as to continually maintain the bridge in condition that it is safe for 10 MPH train traffic at the end of each work window.
- 4.3 Before the grouting operation is started, all defective materials should be removed and the entire surface should be thoroughly inspected for points of leakage and indications of voids. Inserts for grouting should be so located and set that the pressure grout will reach all voids and paths of leakage.
- 4.4 Unless otherwise specified in the plans, all defective exposed joints and cracks in the structure should be chipped out, then thoroughly cleaned of all foreign materials by means of high pressure air or water. The joints, cracks and disintegrated areas should be restored to the original surface with hand pointing or shotcrete.
- 4.5 Unless otherwise specified, when pinning and grouting masonry structures, two (2) inch grout holes shall be drilled at regular intervals, staggered to include approximately twelve (12) square feet of surface area per hole or at such other locations as may be specified.
  - 4.5.1 Unless specified to fill suspected voids behind the masonry, before drilling grout holes in stone, test drillings should be made completely through the masonry to determine the thickness of the masonry. From the test drillings, the proper depth of grout holes should be determined in order that grout holes are not drilled completely through the masonry.
  - 4.5.2 In cases of arch rings, the holes should be drilled diagonally to intercept the longitudinal joints (parallel to the barrel) and staggered at such intervals as to include approximately twelve (12) square feet of surface area per hole.
  - 4.5.3 Holes should be drilled to such a depth, and in such manner, as necessary to intercept joints and internal voids, to completely consolidate the structure.
  - 4.5.4 Holes which have been drilled completely through the structure should not be used for pressure grouting and these holes must be completely plugged before grouting begins.
  - 4.5.5 On structures of one stone thickness, the grout holes should be drilled in such a manner as to intercept the horizontal and vertical joints where possible. Holes in the courses of masonry below ground line should be drilled diagonally downward at various angles to the natural foundation below the masonry, so that the bottom courses and any underlying cavities, including cavities in or under timber grillages, should be completely filled.
- 4.6 Unless otherwise specified, when pinning and grouting concrete structures, one and one half (1 ½) inch grout holes shall be drilled at regular intervals, staggered to include approximately twelve (12) square feet of surface area per hole or at such other locations as may be specified.
  - 4.6.1 Grout holes shall be drilled to a depth and spacing as necessary to provide maximum dissemination of the pressure grout throughout the repair areas.
- 4.7 Prior to grouting, holes and interior voids shall be cleaned to the extent possible with water or air. If water is used, holes must be then air cleaned to remove standing water.
  - 4.7.1 Prior to the application of pressure grout, the pins should be set in the holes and grout inserts applied.
  - 4.7.2 The grout should be pressure induced into the internal voids and joints of the structure to fill them completely.
  - 4.7.3 Excessive pressure should be avoided to prevent damage to the structure.





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- 4.7.4 Grouting should be started at the lowest row of holes and at the hole nearest the center line of structure.
- 4.7.5 If grout appears in adjacent holes at the same elevation, these holes should be temporarily plugged and grouting continued in the original hole until grout appears at the next adjacent hole at the same elevation or at the next line of holes above the one being grouted. When this condition occurs, grouting of the original hole should be discontinued and the grout line moved to the last hole at the current elevation at which grout appeared, and the same procedure followed until all holes in the current line have been grouted, at which time grouting should proceed in a like manner along the next line of holes above, etc., until the entire structure has been completely filled.
- 4.7.6 During the course of all grouting operations, extreme care should be given to observing the surrounding ground, track subgrade, ballast and the stream bed for the breaking out of grout, and when such breaking out occurs, the grout line should be moved to some other part of structure. Grouting may be resumed in the original location after the elapse of 24 hours.
- 4.7.7 In grouting foundations, pressure grout should be applied to the various holes in rotation. The above program should be followed until the grout is brought up into the masonry.
- 4.7.8 When grouting foundations founded on rock, care should be taken to watch for movement of the track structure caused by the lifting of all or a portion of the structure.
- 4.8 Unless otherwise specified, when injecting epoxy to repair concrete cracks ranging in width from 0.003 inch to 0.25 inch, the missing, injection and curing procedures shall be in accordance with the epoxy manufacturer's recommendations.
  - 4.8.1 The area surrounding the crack should be cleaned of efflorescence, deteriorated concrete and other contaminants that may be detrimental to adhesion of the epoxy gel. If unsound or deteriorated concrete is located adjacent to the crack, the unsound or deteriorated concrete should be removed prior to the injection.
  - 4.8.2 Cracks should be flushed with water under pressure to remove debris and other contaminants then flushed with air to remove any excess water.
  - 4.8.3 Injection ports shall be installed as needed to accomplish full penetration of the injection resin and the spacing of the injection ports determined by the size of the crack and the depth of the concrete substrate.
  - 4.8.4 Injection ports shall be designed for the intended use and be acceptable to the epoxy manufacturer.
  - 4.8.5 Injection ports should have the capability of being positively capped and sealed following the injection work.
  - 4.8.6 Surface Mounted Injection Ports shall be centered over the crack and secured in place using the epoxy gel. The exposed crack between the injection ports and other areas as required to prevent leaking of the resins shall be sealed with epoxy gel.
  - 4.8.7 Drilled in injection ports shall be centered over the crack and inserted one half (1/2) inch into holes drilled a minimum of five eighths ( $\frac{5}{8}$ ) inch deep. The ports shall be secured in place using the epoxy gel with the exposed crack between the injection ports sealed with epoxy gel.
  - 4.8.8 If the crack extends through the member, and is accessible, install telltale injection ports on the opposite side and seal all exposed areas of the crack. Generally, the spacing of the telltale injection ports should be between 12 inches and 24 inches.



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- 4.8.9 After adequate curing of injection epoxy, all ports and the epoxy gel should be ground smooth to eliminate any sharp edges or protrusions. No epoxy materials or injection ports should extend beyond the surface of the existing concrete.
- 4.9 Upon completion of the work all surplus material or material salvaged from an existing structure shall be delivered to and be neatly stacked in a location designated by the Engineer. Material not salvageable and other refuse shall be properly disposed of. The premises shall be left in a clean, neat and orderly condition.

### 5 MEASUREMENT AND PAYMENT

- 5.1 Measurement:
  - 5.1.1 Pin and grout repairs shall be measured for payment on the basis of number of pins installed and accepted into the finished structure up to the estimated quantity given in the Proposal.
  - 5.1.2 Epoxy injection for crack repairs shall be measured for payment on the basis of number of feet of crack injected and accepted into the finished structure up to the estimated quantity given in the Proposal.
  - 5.1.3 Concrete, reinforcing and other material disposal is considered incidental to concrete construction and shall not be measured for payment.
- 5.2 Payment
  - 5.2.1 Internal structural repairs shall be paid for at the contract unit prices for the pin and grout or the epoxy injection repair bid items and shall constitute full payment for all labor, equipment, materials and supervision necessary to construct the effect the repairs in accordance with the Plans and Specifications.

END OF SECTION

### REVISION HISTORY

The following is the revision history for this standard:

5/2/2013 – Initial Issue



# STANDARD CONSTRUCTION SPECIFICATIONS

## 540 – TIMBER CONSTRUCTION

### 1 GENERAL

- 1.1 These Timber Construction Specifications are adopted by Railroad and are supplemental and complimentary to the requirements of the Contract issued by Railroad to Contractor for the purpose of performing construction and maintenance of Railroad's Structure(s) as specified in the Scope of Work and the Contract Documents. They apply to Contractor, its employees, agents, invitees and subcontractors.
- 1.2 Timber construction shall consist of timber foundations and superstructures constructed in accordance with these Specifications, the requirements of Part 3 – Construction Maintenance and Inspection of Timber Structures of Chapter 7 – Timber Structures of the AREMA Manual, and the details shown on the Plans.
- 1.3 Contractor is responsible for performing all timber construction operations in compliance with local, state, and federal laws, Railroad safety and operating rules, and Transport Canada / Federal Railroad Administration regulations pertaining to workplace safety.
- 1.4 Structural components are numbered in the direction of increasing mileposts and from left to right when facing the direction of increasing mileposts.

### 2 MATERIALS

- 2.1 Wood piles and associated hardware conform to the requirements of Part 1 - Material Specifications for Lumber, Piles, Glued Laminated Timber and Fasteners of Chapter 7 – Timber Structures of the AREMA Manual in accordance with the requirements of section 520 – Pile Foundations of these construction specifications.
- 2.2 Bridge ties and associated hardware such tie spacers, guard rails and walkways as shall conform to the requirements of Part 1 - Material Specifications for Lumber, Piles, Glued Laminated Timber and Fasteners of Chapter 7 – Timber Structures of the AREMA Manual in accordance with the requirements of section 560 – Bridge Deck Construction of these construction specifications.
- 2.3 Structural lumber shall be stress-grade and shall conform to the requirements of Part 1 - Material Specifications for Lumber, Piles, Glued Laminated Timber and Fasteners of Chapter 7 – Timber Structures of the AREMA Manual.
  - 2.3.1 The following species of wood, listed in order of preference, are acceptable for use in timber construction provided the timbers meet the grade requirements shown in accordance with the grading agency rules appropriate for the species of wood.
    - 2.3.1.1 Dense Select Structural Douglas Fir - Larch
    - 2.3.1.2 Dense Select Structural Southern Pine
  - 2.3.2 Solid sawn structural timbers shall comply with the requirements for "Select Car Stock-Select Dimension or Common Dimension" as described on pages 78 to 80 of the 1960 Rules of the National Hardwood Lumber Association, with the following additional requirements:
    - 2.3.2.1 Timber shall be free from any defects that may impair their strength or durability such as decay, rot, large splits, large shakes, slanting grain, large or numerous holes, or knots.
    - 2.3.2.2 Timber shall be straight, well hewed or sawed, cut square at the ends, have bottom and top parallel and the bark entirely removed.
    - 2.3.2.3 The general slope of grain on any face, ignoring local deviations, shall not be more than 1 in 8.



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- 2.3.2.4 Knots in narrow faces or at the edges of wide faces at any point in the length of the piece shall be limited to sizes of 1 inch in pieces 2 or 3 inches thick, 2 inches in pieces 4 or 5 inches thick, 3 inches in pieces 6 or 7 inches thick, 3 ½ inches in pieces 8 to 10 inches thick, and 4 ¼ inches in pieces 12 inches or thicker.
- 2.3.2.5 End shakes or season checks in the center half of the width shall not exceed two-fifths the thickness of the timber in size. End splits in the center of the width shall be limited to an average length not exceeding the thickness of the timber. A combination of maximum shakes, checks, or splits in either end of any piece shall not be permitted.
- 2.3.3 Glue Laminated (Glulam) structural timbers shall comply with the requirements of American National Standard ANSI A190.1 and shall meet the requirements of stress group 24F-1.8E (DF or SP) or better.
  - 2.3.3.1 Glulam members intended for bending may have balanced layup combinations of Douglas Fir and Southern Pine.
  - 2.3.3.2 Glulam members intended for axial compression shall be supplied with all laminations of a single grade of either Douglas Fir or Southern Pine.
  - 2.3.3.3 Glulam members may be comprised of alternate sources of lumber provided the species criteria are maintained in the layup grade requirements.
  - 2.3.3.4 Adhesives must be in conformance with specifications included in ANSI A190.1 for wet-use.
  - 2.3.3.5 Multiple-piece laminations to be used for pile cap applications shall be edge-glued.
  - 2.3.3.6 Fabrication, trimming and boring of glulam members should be performed prior to the preservative treating process.
  - 2.3.3.7 Glulam material supplied for the Work shall at least meet the finish requirements for Industrial Appearance classification. Members shall be surfaced on their top and bottom sides. Loose knot holes appearing on the wide face of the laminations exposed to view shall be filled.
- 2.4 Preservative Treating:
  - 2.4.1 All timber shall be Creosote treated in accordance with Section 3.7 Specifications for Treatment of Chapter 30 – Ties of the AREMA Manual.
    - 2.4.1.1 Creosote Coal Tar solution shall meet the requirements of American Wood Protection Association (AWPA) Standard P2 - Standard for Creosote Solutions.
    - 2.4.1.2 Piles shall be treated in accordance with AWPA Standard C3 - Piles - Preservative Treatment by Pressure Process.
    - 2.4.1.3 Solid sawn timbers shall be treated in accordance with AWPA Standard C2 - Lumber, Timber, Bridge Ties and Mine Ties - Preservative Treatment by Pressure Processes.
    - 2.4.1.4 Glulam timbers shall be treated in accordance with AWPA Standard C28 - Standard for Preservative Treatment of Structural Glued Laminated Members and Lamination Before Gluing of Southern Pine, Coastal Douglas Fir, Hem-Fir and Western Hemlock by Pressure Processes.



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- 2.4.1.5 The minimum preservative retention shall be 12 pounds per cubic foot using the Empty Cell process in accordance with AWP Standard C1 - All Timber Products - Preservative Treatment by Pressure Processes.
- 2.4.2 To the extent possible, all shaping, dapping and drilling of timbers shall be accomplished prior to treating.
- 2.4.3 If it is necessary to cut into treated wood, the freshly cut surfaces (including holes) shall be further protected by a thorough application of three coats of preservative to the freshly cut surface in accordance with the requirements of AWP Standard M4 – Standard for the Care of Preservative Treated Wood Products.
- 2.5 Where portions of the structure consist of structural steel, reinforced concrete or masonry, the current AREMA specifications relating to structures of these materials shall apply, with the allowance for impact provided for in those specifications.
- 2.6 Stringers shall be as specified in the plans with the following minimum requirements:
  - 2.6.1 Stringers shall be new with minimum exterior dimensions of 8 inches by 16 inches and shall match the existing stringer dimensions as closely as possible.
  - 2.6.2 Stringers shall be selected to provide:
    - 2.6.2.1 Depth, preferably, not less than one-twelfth of the span.
    - 2.6.2.2 Width, not less than one-third of the depth.
- 2.7 Posts shall be as specified in the plans with the following minimum requirements:
  - 2.7.1 Round posts shall be new from first class piles with a minimum diameter of 12 inches and shall match the diameter of the existing pile as closely as possible.
  - 2.7.2 Square posts shall be new with minimum exterior dimensions of 12 inches by 12 inches.
- 2.8 Caps shall be as specified in the plans with the following minimum requirements:
  - 2.8.1 Timber caps shall be new with minimum exterior dimensions of 14 inches by 14 inches and shall match the existing cap dimensions as closely as possible.
  - 2.8.2 Caps shall have a minimum length of 14 feet and shall match the length of the existing caps as closely as possible.
  - 2.8.3 Concrete caps shall be new commercial of the shelf caps manufactured by a firm specializing in precast concrete railroad bridge components. Contractor shall provide Engineer with a catalog cut of the proposed cap for approval.
- 2.9 Subcaps shall be as specified in the plans with the following minimum requirements:
  - 2.9.1 Timber subcaps shall be new with minimum exterior width of 12 inches and shall match the existing subcap dimensions as closely as possible.
  - 2.9.2 Subcaps shall have a minimum length of 14 feet and shall match the length of the existing caps as closely as possible.
- 2.10 Sills and Corbells shall be as specified in the plans with the following minimum requirements:
  - 2.10.1 Timber sills and corbels shall be new with minimum exterior dimensions of 12 inches by 12 inches and shall match the existing component dimensions as closely as possible.
- 2.11 Shims greater than 2" in thickness shall be new, hardwood with a minimum width of 12 inches and the depth required. The length shall be sufficient to provide proper bearing for the supported item without the use of adjacent stacks of shims.



- 2.12 Shims less than 2" in thickness shall be new, marine grade plywood with a minimum width of 12 inches. The length shall be sufficient to provide proper bearing for the supported item without the use of adjacent stacks of shims.
- 2.13 Bracing shall be as specified in the plans with the following minimum requirements:
  - 2.13.1 Diagonal and sash bracing shall have minimum exterior dimensions of 4 inches by 16 inches and shall match the existing bracing dimensions as closely as possible.
  - 2.13.2 Girt bracing shall have minimum exterior dimensions of 6 inches by 8 inches and shall match the existing bracing dimensions as closely as possible.
- 2.14 Ballast deck planking shall be as specified in the plans with the following minimum requirements:
  - 2.14.1 Timber ballast deck planking shall be new with minimum exterior dimensions of 4 inches by 12 inches and shall match the existing planking dimensions as closely as possible.
- 2.15 Ballast retainers shall be as specified in the plans with the following minimum requirements:
  - 2.15.1 Timber ballast retainers shall be new with minimum exterior dimensions of 8 inches by 14 inches and shall match the existing ballast retainer dimensions as closely as possible.
- 2.16 Unless otherwise specified in the plans, fasteners shall meet the following minimum requirements:
  - 2.16.1 Nails, spikes and drift bolts shall be made of rolled steel, square or round, as called for on the plans. Where special heads are not specified, the manufacturer's standard heads will be acceptable. Nails used for fastening timbers shall be of a type having grooved, barbed or otherwise deformed shanks for greater holding power.
  - 2.16.2 Through bolts shall be made of  $\frac{3}{4}$  inch A307 rolled steel with U.S. standard square or hexagon heads and nuts to match, unless otherwise specified on the plans. The use of threaded bar in lieu of bolts is to be avoided.
  - 2.16.3 Cast washers, such as Lewis Bolt and Nut Company's WSHMI or equivalent, shall be made of malleable or cast iron. The outside diameter shall not be less than  $3\frac{1}{2}$  times the diameter of the bolt on which it is used. The diameter of the hole shall be  $\frac{1}{8}$  inch larger than the diameter of the bolt.
  - 2.16.4 Plate washers, such as Lewis Bolt and Nut Company's WFF4H or equivalent, shall be made of rolled steel. The outside diameter shall be not less than  $3\frac{1}{2}$  times the diameter of the bolt on which it is used. The diameter of the hole shall be  $\frac{1}{8}$  inch larger than the diameter of the bolt.
  - 2.16.5 Dome Head Drive Spikes, such as Lewis Bolt and Nut Company's SDH4N or equivalent, Washer Head Drive Spikes, such as Lewis Bolt and Nut Company's SWH2M or equivalent, and steel drive dowels and spikes with spirally grooved shanks shall be made of  $\frac{3}{4}$  inch rolled steel. Heads for lag screws shall be U.S. standard unless otherwise specified.
  - 2.16.6 Drift pins shall be of made of  $\frac{3}{4}$  inch rolled steel of the length and shape specified on the plans.
  - 2.16.7 Special castings, including such parts as gib plates, angle blocks, etc., shall be made of cast or malleable iron. They shall be true to pattern, free from wind, without injurious defects and of the size and shape specified on the plans.
  - 2.16.8 Metal Joint Connectors such as spiked grids, cast shear plates and claw plates shall be made of malleable iron and shall be of the size and design specified on plan.



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- 2.16.9 Metal joint connectors such as split rings, toothed rings, bull dog types, pressed shear plates and clamping plates shall be made of rolled steel and shall be of the size and design specified on plan.
- 2.16.10 Brace plates and washer plates or similar items shall be made of rolled steel to the size and details specified on the plan.
- 2.16.11 Malleable iron castings shall conform to current ASTM Specifications, designation A 47, Grade 35018, with minimum yield point of 35,000 psi.
- 2.16.12 Cast iron shall conform to ASTM Specifications, designation A48, Class No. 30.
- 2.16.13 Rolled steel plates, bars and shapes shall conform to ASTM Specifications, designation A36.
- 2.16.14 Cast steel shall conform to ASTM Specifications, designation A27, Grade 65-35, full annealed with minimum yield point of 33,000 psi.
- 2.17 Contractor is solely responsible for delivering all material to the project site.
- 2.18 Storage and Handling:
  - 2.18.1 All material should be handled to avoid structural damage or unnecessary disfiguring.
  - 2.18.2 Timber treated with preservatives should be handled with extreme care in unloading and assembling to avoid damage to the timber which would expose untreated wood. These materials shall be preferably handled with rope slings. Sharp-pointed bars, peavies, hooks, tongs or similar tools shall not be used, except as approved by the Engineer.
  - 2.18.3 Timber should be stored on evenly spaced blocks to minimize ground contact and to prevent warping or permanent-set.
  - 2.18.4 Materials should be stored at the site in a neat manner at proper clearance to operated tracks.
  - 2.18.5 Hardware received at the job site should be protected from corrosion by storing under cover or by a protective coating.
  - 2.18.6 Care should be exercised to prevent fires in material held in storage. The ground underneath and in the vicinity of piling and lumber should be kept clear of all weeds, rubbish and combustible material.
  - 2.18.7 Treated lumber should be close-stacked in a manner that will prevent long timbers or preframed material from sagging or becoming crooked.
  - 2.18.8 Piling should be stacked in a manner to prevent excessive bending.
- 2.19 Contractor shall be responsible for ensuring that all material meets the requirements as identified in the applicable paragraphs of the Contract Documents.
- 2.20 Final acceptance of the material shall be based upon satisfactory performance in the field.

### 3 SUBMITTALS

- 3.1 Prior to the start of work, Contractor shall submit a timber procurement plan for approval by Engineer. This plan shall provided detailed information on Contractor's proposed material for the works and shall include:
  - 3.1.1 The species and grade of timber proposed.
  - 3.1.2 Details of the proposed treating of the material.





- 3.2 Prior to the start of construction Contractor shall submit a timber construction plan for approval by Engineer. This plan shall provide detailed information on Contractor's proposed means and methods and shall include the following minimum information:
  - 3.2.1 Contractor's proposed means and methods.
  - 3.2.2 Name and experience of personnel in responsible charge of the timber construction.
  - 3.2.3 Roster of proposed equipment.
  - 3.2.4 Means of access for the personnel, equipment and material to the work location.
  - 3.2.5 Method of restoring preservative treatment for any wood exposed during the work. This includes saw cuts for fitting timber, holes bored to accommodate fasteners, and wood fibers damaged in handling and installation.
  - 3.2.6 Procedures for accommodating existing power lines, fiber optic and other buried utilities on the project site.
- 3.3 Upon completion of timber construction, Contractor shall submit to Engineer a complete and accurate record of the work performed.
  - 3.3.1 Where the work involves more than one structure, Contractor shall submit to Engineer a spreadsheet detailing the work performed by structure.

#### 4 EXECUTION

- 4.1 Workmanship shall be of the best quality performed by competent bridge carpenters. All framing shall be true and exact. No blocking or shimming will be permitted, except as provided herein.
- 4.2 The Work must be planned and performed by the Contractor in such a manner as to continually maintain the bridge in condition that it is safe for 10 MPH train traffic at the end of each work window.
- 4.3 Upon completion of the work, all surplus material or material salvaged from an existing structure shall be delivered to and be neatly stacked in a location designated by the Engineer. Material not salvageable and other refuse shall be properly disposed of. The premises shall be left in a clean, neat and orderly condition.
  - 4.3.1 In no case shall any materials be left within 200 feet of the bridge or within 10 feet of track centerline.
- 4.4 Pile Driving:
  - 4.4.1 Piles shall be driven, cut off and framed in accordance with the requirement of Section 520 – Pile Foundations of these construction specifications.
- 4.5 Timber Deck Renewal:
  - 4.5.1 Timber bridge decks and associated construction shall be installed in accordance with the requirements of Section 560 – Bridge Deck Construction of these construction specifications.
- 4.6 Standard Plans:
  - 4.6.1 The Work of timber component replacement shall be in accordance with the following standard plans found in Chapter 7 of the AREMA Manual:
    - 4.6.1.1 7-3-9 - Floor Plan for Open-Deck Trestles
    - 4.6.1.2 7-3-10 Floor Plan for Ballasted-Deck Trestles
    - 4.6.1.3 7-3-11 Bulkheads and Miscellaneous Details





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- 4.6.1.4 7-3-12 Cap Stringer Fastening and Pile Top Protection
- 4.6.1.5 7-3-13 Bent Details for Open-Deck Pile Trestles
- 4.6.1.6 7-3-14 Bent Details for Ballasted-Deck Pile Trestles
- 4.6.1.7 7-3-15 Longitudinal Bracing
- 4.6.1.8 7-3-16 Details of Footings for Framed Bents
- 4.6.1.9 7-3-17 Multiple-Story Trestle Bents (6 Post Bent)
- 4.6.1.10 7-3-18 Multiple-Story Trestle Bents (5 Post Bent)
- 4.6.2 Where the existing construction is more conservative in design and function than these standard plans, the work of timber component replacement shall replicate the existing construction.
- 4.7 Framing of Timber:
  - 4.7.1 All cutting, framing, and boring of timbers to be treated, shall be done before treatment unless otherwise shown on the plans or specifically permitted by the Engineer.
  - 4.7.2 All cuts or abrasions made in or suffered by treated lumber shall be carefully trimmed and then field treated by the application of three saturating coats of hot creosote oil. All holes bored in treated material shall be field treated with hot creosote oil under pressure, using an approved type of bolt hole treater, in such a manner that the entire surface of the hole receives thorough penetration. All countersunk recesses for bolts which would form pockets to retain water shall be treated as for cuts and then filled with a suitable mastic after the bolt is placed.
  - 4.7.3 Trestles on curves shall be built to follow the curve. Bents shall be placed on radial lines and spaced to maintain standard panel lengths under the outside stringer.
    - 4.7.3.1 The superelevation of the outer rail shall be as specified by the Engineer.
    - 4.7.3.2 For open deck structures, the specified superelevation shall be achieved by cutting off the pile and installing the cap at the specified superelevation.
    - 4.7.3.3 For ballast deck structures with less than two inches of superelevation, the bents may be cut level with the elevation taken up in the ballast section.
  - 4.7.4 Sills shall have a true and even bearing on foundation piles, timber grillages, mats or pedestals. All earth shall be removed from around sills so that there will be free air circulation around them.
  - 4.7.5 Posts in framed bents shall be sawed to proper length (vertical or batter) and shall have an even bearing on caps and sills.
  - 4.7.6 Caps shall be sized to a uniform depth and placed to a uniform and even bearing on piles or posts.
  - 4.7.7 Sash and sway bracing, tower bracing and girts shall bear firmly against the piles or timber to which secured. When necessary, filler shall be placed to avoid bending the bracing more than 1 inch out of line when the bracing bolts or other fastenings are drawn up tight. Built-up fillers will not be permitted and each filler shall be a single piece of creosoted lumber of like kind to that in the brace with a width of not less than 6 inches and a length of not less than 12 inches.
  - 4.7.8 Bents shall not be out-of-plumb by more than 1 inch in 4 feet in the direction of the track.
    - 4.7.8.1 Out of plumb bents shall be straightened, as much as possible, with additional bracing added as needed, and all bolts tightened.



- 4.7.9 Stringers shall be sized to provide a uniform depth and even bearing at supports. They shall be assembled in the structure according to plans.
- 4.7.10 Ties shall be sized and spaced in accordance with the plans.
- 4.7.11 Guard timbers shall be framed in accordance with the plans and laid to line and uniform top surface.
- 4.7.12 Deck plank and ballast retainers on ballasted deck trestles shall be placed in accordance with the plans. Drainage shall be provided for in the manner specified.
- 4.7.13 Bulkheads at the ends of trestles shall be of sufficient height and width to retain properly the shoulders of embankments and to provide a berm sufficient to prevent loss of embankment from beneath the bulkhead. When necessary, special anchorage, such as bulkhead piles or dead-men buried in the embankment, shall be provided to support the bulkhead.
- 4.7.14 Refuge platforms, water barrels platforms, footwalks, motor car set-off or other special platforms shall be in accordance with the plans.
- 4.8 Connections:
  - 4.8.1 All fastenings, including bolts, dowels, lag screws, timber connectors and other type fastenings shall be placed in accordance with the plans, drawn up securely, and on completion of the structure shall be retightened.
    - 4.8.1.1 All bolts, drift pins, screws, and nuts removed from structures must be replaced with the appropriate size hardware.
    - 4.8.1.2 Serviceable hardware may be reused in component replacement.
    - 4.8.1.3 New construction shall utilize only new hardware.
    - 4.8.1.4 All bolts shall only have one washer at each end of the bolt.
    - 4.8.1.5 Bolts shall be tightened until the washer begins to sink into the timber and the bolts shall be trimmed to be within 2" of the surface.
    - 4.8.1.6 Drift pins shall be driven flush.
  - 4.8.2 Unless otherwise shown on the plans, holes for dowels and drift bolts shall be bored 1/8 inch smaller than the nominal diameter of the dowel or bolt used; holes shall not be bored deeper than the length of the dowel or bolt.
  - 4.8.3 Holes for machine bolts and rods other than dowels and drift bolts shall be bored the same size as the nominal diameter of the bolt or rod used.
  - 4.8.4 Holes for lag screws shall be bored with a bit not larger than the body of the screw at the base of the thread.
  - 4.8.5 Screw-type fastenings shall be screwed into place for the entire length of the fastening. Driving with a maul or other tool will not be permitted.
  - 4.8.6 Timber connectors shall be of the types specified on the plans. Split-ring and shear-plate connectors shall be installed in pre-cut grooves of the dimensions shown on the plans or as recommended by the manufacturer. Toothed-ring and spike-grid connectors, and clamping plates, shall be forced into the contact surfaces of the timbers joined by means of proper pressure tools; all connectors of these types at any joint shall be embedded simultaneously and uniformly.
  - 4.8.7 All holes shall be treated after drilling.
  - 4.8.8 Drift pins and bolts shall be liberally coated with preservative prior to installation.



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- 4.8.9 All unused holes shall be plugged with treated hardwood dowels that will fit snugly and be flush to the hole surface.
- 4.8.10 Existing bolts within the panels adjacent to the component replacement shall be tightened upon completion of the component replacement.
- 4.9 Posting Piles:
  - 4.9.1 Piles are to be posted in such a manner as to maintain or improve upon the existing line and surface of the bridge, eliminating the use of shims.
  - 4.9.2 Piles to be posted shall be excavated and cut down to the point where there are no voids visible in the cross section of the pile.
  - 4.9.3 Post shall be selected to closely match the diameter of the pile at cut off to ensure water is not able to collect on the top of the pile
  - 4.9.4 Post shall be cut to achieve good and complete bearing between piles and cap without shims.
    - 4.9.4.1 The pile shall be squarely cut perpendicular to the pile axis.
    - 4.9.4.2 The post shall be squarely cut at its base perpendicular to its axis. At the top, the post shall be cut to match the existing batter of the pile to the cap.
  - 4.9.5 All cuts, pile tops and ends of posts shall be field treated with three coats of hot creosote oil or other proprietary preservative approved by Engineer.
  - 4.9.6 With full bearing, all posts shall be connected to the cap using  $\frac{3}{4}$  by 22 inch drift pins toe nailed upward through the pile into the cap with 10 inches of penetration into the cap. Holes for drift pins shall be pre-drilled to the diameter and depth of the drift pin and shall be field treated.
  - 4.9.7 With full bearing, all posts shall be connected to the pile cutoff with at least two  $\frac{3}{4}$  by 22 inch drift pins toe nailed upward through the pile into the post.
  - 4.9.8 The joint between post and pile shall be wrapped with tape to seal the joint and any voids filled with epoxy as shown in figure 7-2-8 of the AREMA Manual.
  - 4.9.9 Bents with posted piles shall have all bracing installed as shown in figure 7-3-13 and 7-3-14 of the AREMA Manual. Bracing members shall be sound and tightly fastened. Additional bracing shall be installed as necessary to ensure that the ends of the posts cannot move out of position.
  - 4.9.10 Where there is danger of the post being dislodged from the pile by ice or debris in streams, or other site hazards, additional bracing shall be applied. All bracing connections shall be tight and solid.
  - 4.9.11 Adequate connectivity shall be provided between all components when double caps and corbels are installed.
- 4.10 Cap Changeout:
  - 4.10.1 Caps and subcaps are to be removed and installed in such a manner as to maintain or improve upon the existing line and surface of the bridge, eliminating the use of shims.
  - 4.10.2 Bracing may be removed if it conflicts with the replacement of the cap. Any bracing so removed shall be reinstalled upon completion of the cap replacement. Care should be taken in the removal of existing bracing so that the bracing can be reused. Bracing that is damaged by Contractor shall be replaced by Contractor at no cost to Railroad.



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- 4.10.3 Piling shall be cut to achieve good and complete bearing between piles and cap without shims. Pile cuts shall take into account the removal of shims, replacement of subcaps, and the need for good stringer chord bearing.
  - 4.10.3.1 All cuts and pile tops shall be field treated with three coats of hot creosote oil or other proprietary preservative approved by Engineer.
- 4.10.4 The work of cap replacement shall attain level elevation of the deck surface and improve the track alignment. Cross level tolerance shall be held to within 1/8 inch.
- 4.10.5 With full bearing, all piles shall be connected to the cap using  $\frac{3}{4}$  by 22 inch drift pins toe nailed upward through the pile into the cap with 10 inches of penetration into the cap. Holes for drift pins shall be pre-drilled to the diameter and depth of the drift pin and shall be field treated.
- 4.10.6 The bent may need to be plumbed so that the cap is positioned and centered under stringer parting lines. Stringers shall be connected to the cap by either the Vertical Angle Type or Strap Type cap-stringer fastening shown in Figure 7-3-12 of the AREMA Manual.
- 4.11 Stringer Replacement:
  - 4.11.1 Stringers shall be removed and installed in such a manner as to maintain or improve upon the existing line and surface of the structure eliminating the use of shims.
    - 4.11.1.1 Where required, shimming of stringers to provide proper surface and cross level should be performed using a single hardwood or plywood shim under each chord or stringer. No more than two shims may be stacked to achieve the desired thickness.
  - 4.11.2 The work of stringer replacement shall attain level elevation of the deck surface and improve the track alignment. Cross level tolerance shall be held to within 1/8 inch.
  - 4.11.3 Stringer replacement shall be performed without damaging existing stringers.
  - 4.11.4 If the stringer is continuous over two spans, the entire stringer over both spans shall be replaced.
  - 4.11.5 All cuts shall be field treated with three coats of hot creosote oil or other proprietary preservative approved by Engineer.
  - 4.11.6 Upon installation, chorded stringers shall be packed tightly to each other.
  - 4.11.7 Stringer chords in open deck bridges shall be centered to within one inch of the centerline of each rail or be consistent with the existing chord location.
  - 4.11.8 Parting lines for each stringer shall be centered to within two inches of the centerline of the cap.
  - 4.11.9 For corded stringers, two new  $\frac{3}{4}$  inch diameter packing bolts shall be placed near the cap at the end of each stringer chord span.
    - 4.11.9.1 The bottom packing bolt shall be located 3 inches from the bottom of the stringer and 21 inches out from the edge of the cap.
    - 4.11.9.2 The top packing bolt shall be located 3 inches from the top of the stringer and 6 inches out from the edge of the cap.
    - 4.11.9.3 Both packing bolts shall be located at least 3 inches from existing packing bolt holes.
    - 4.11.9.4 Holes shall be drilled in a horizontal plane and perpendicular to the stringer chord.



- 4.11.9.5 Packing bolts shall be tightened until the washer begins compressing the stringer.
- 4.11.10 Chorded stringers shall be connected to the cap by two  $\frac{3}{4}$  drift pins, of sufficient length to provide 10 inches of penetration into the cap, located at each cap to chord interface, preferably in the center of the continuous stringers. Holes for drift pins shall be pre-drilled to the diameter and depth of the drift pin and shall be field treated.
- 4.12 Bracing:
  - 4.12.1 When either new bracing is installed or old bracing reused, the braces shall be placed so as to connect to the cap and all piles above the groundline as shown in figure 7-3-13 and 7-3-14 of the AREMA Manual.
  - 4.12.2 Bracing shall be position such that it is flush with the cap and any required trimming is performed on the lower end of the brace. All field cuts are to be treated.
  - 4.12.3 Bracing shall bear firmly against all piles. Piling shall not be cut to ensure firm bearing of bracing. Where necessary, a filler shim shall be placed to avoid bending the brace more than one (1) inch out of line when bolts are drawn tight.
  - 4.12.4 All existing and new bracing shall be bolted up tight to all intersecting piles and cap. All holes bored in bracing and piling shall be field treated.
- 4.13 Other Considerations:
  - 4.13.1 Field modifications of members such as notching, tapering or drilling not shown on the design or shop drawings shall be avoided and never done without a thorough understanding of their effects on the structural integrity of the members involved. This understanding shall include knowledge of how affected members are expected to perform in the design application.
  - 4.13.2 Notching of bending members shall be avoided whenever possible, especially on the tension faces, for both simple span and continuous span applications.
  - 4.13.3 Horizontal holes drilled through width of bending members should be limited to locations away from shear and moment critical zones.
  - 4.13.4 Field-drilled horizontal holes shall not be used as attachment points for brackets or other load bearing hardware unless specifically designated in the Plans.
  - 4.13.5 Any horizontal holes required for support of significant weight, must be located above the neutral axis.
  - 4.13.6 Vertical holes drilled through the depth of a member should be limited to locations away from shear and moment critical zones.

## 5 MEASUREMENT AND PAYMENT

- 5.1 Measurement:
  - 5.1.1 Timber trestle construction shall be measured for payment on the basis of lineal foot of trestle constructed and accepted in to the finished structure up to the estimated quantity given in the Proposal.
  - 5.1.2 Individual component replacement such as piles posted, caps installed, bracing replaced, bents framed and stringers replaced shall be measured for payment on the basis of individual units installed and accepted into the finished structure up to the estimated quantity given in the Proposal.
  - 5.1.3 Installation of hardware is considered incidental to timber construction and shall not be measured for payment.



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### 5.2 Payment

- 5.2.1 Timber trestle construction shall be paid for at the contract unit price for the bid item Trestle Construction and shall constitute full payment for all labor, equipment, materials and supervision necessary to construct the trestle in accordance with the Plans and Specifications.
- 5.2.2 Individual component replacement shall be paid for at the contract unit price for the component bid item and shall constitute full payment for all labor, equipment, materials and supervision necessary to replace the component in accordance with the Plans and Specifications.

END OF SECTION

### REVISION HISTORY

The following is the revision history for this standard:

5/2/2013 – Initial Issue



# STANDARD CONSTRUCTION SPECIFICATIONS

## 550 – STEEL CONSTRUCTION

### 1 GENERAL

- 1.1 These Steel Construction Specifications are adopted by Railroad and are supplemental and complimentary to the requirements of the Contract issued by Railroad to Contractor for the purpose of performing construction and maintenance of Railroad's Structure(s) as specified in the Scope of Work and the Contract Documents. They apply to Contractor, its employees, agents, invitees and subcontractors.
- 1.2 Steel construction shall consist of structural steel erected and maintained in accordance with these Specifications, the requirements of Part 1 – Design, Part 3 – Fabrication, Part 4 Erection, and Part 11 Bearing Construction of Chapter 15 – Steel Structures of the American Railway Engineering and Maintenance of Way Association (AREMA) Manual for Railway Engineering (Manual), and the details shown on the Plans.
- 1.3 Contractor is responsible for performing all bridge steel construction operations in compliance with local, state, and federal laws, Railroad safety and operating rules, and Federal Railroad Administration regulations pertaining to workplace safety.
- 1.4 With regard to the Work, Contractor is encouraged to provide value engineering that considers best practices. Any proposed changes to the work shall be prepared with sufficient detail and cost analysis that Engineer can make an informed decision on Contractor's proposed change.
- 1.5 Structural steel components are numbered in the direction of increasing mileposts and from left to right when facing the direction of increasing mileposts.

### 2 MATERIALS

- 2.1 Structural Steel components shall conform to the requirements of Part 1 – Design and Part 3 – Fabrication of Chapter 15 – Steel Structures of the AREMA Manual.
- 2.2 Unless otherwise specified in the plans, all structural steel shall conform to the requirements of ASTM A709, Grade 50W Weathering Steel where  $F_y = 50,000$  psi minimum and  $F_u = 70,000$  psi minimum.
  - 2.2.1 Where this material is to be used for other than Fracture Critical Members, the impact test requirements of Table 15-1-2 of Chapter 15 – Steel Structures of the AREMA Manual shall be met.
  - 2.2.2 Charpy V-notch (CVN) toughness requirements for Fracture Critical Members shall be in accordance with Table 15-1-14. Components requiring these toughness requirements shall be designated on the design drawings and/or in the specifications.
  - 2.2.3 Testing shall be performed for a minimum service temperature corresponding to zone 2.
  - 2.2.4 For bridge construction, the material shall not be rimmed or capped steel.
  - 2.2.5 Nondestructive testing of the fracture critical members is to be performed by an independent testing company approved by Engineer and contracted for and by the fabricator.
  - 2.2.6 Copies of test reports are to be furnished to Engineer.
- 2.3 Unless otherwise noted in the plans, all nonstructural steel such as for handrail and walkway components and framing shall conform to the requirements of ASTM A36.
  - 2.3.1  $F_y = 36,000$  psi min.
  - 2.3.2  $F_u = 58,000$  psi min.
  - 2.3.3 Unless otherwise noted in the plans, all non-structural steel shall be galvanized.





- 2.3.3.1 Steel shall be pickled per Society for Protective Coatings (SSPC) Standard Practice No. 8 and Hot-Dipped Galvanized per ASTM A123. The coating weight shall be not less than 2.3 ounces per square foot.
- 2.4 Structural bolts shall be 7/8" diameter ASTM A325 Type 3 bolts provided with one ASTM F436 Type 3 hardened circular washer and one ASTM A563-C3 hex heavy nut.
- 2.5 Countersunk structural connections shall be 7/8" diameter ASTM A449 Type 3 bolts provided with one ASTM F436 Type 3 hardened circular washer and one ASTM A563-C3 hex heavy nut.
- 2.6 All non-structural bolts shall be zinc plated ASTM A307 bolts with hardened circular washer and Nylon Insert Lock Hex Nut such as Lewis Bolt and Nut Company's NFHN or equivalent.
- 2.7 Contractor is solely responsible for delivering all material to the project site.
- 2.8 All material shall be stored and handled to avoid structural damage or unnecessary disfiguring.
  - 2.8.1 Material, either plain or fabricated, shall be stored properly above the ground upon platforms, skids, or other supports. It shall be kept free from dirt, grease and other foreign matter, and shall be protected as far as practicable from corrosion.
  - 2.8.2 Long members, such as columns, chords and girders, shall be supported on blocking placed close enough together to prevent injury from deflection.
  - 2.8.3 Materials stored at the site shall be kept in a neat manner at proper clearance to operated tracks.
  - 2.8.4 Hardware received at the job site shall be protected from corrosion by storing under cover or by a protective coating.
  - 2.8.5 Care should be exercised to prevent fires in material held in storage. The ground underneath and in the vicinity of stored material should be kept clear of all weeds, rubbish and combustible material.
- 2.9 Contractor shall be responsible for ensuring that all material meets the requirements as identified in the applicable paragraphs of the Contract Documents.
- 2.10 Final acceptance of the material shall be based upon satisfactory performance in the field.

### 3 SUBMITTALS

- 3.1 Prior to the start of steel fabrication, Contractor shall submit to Engineer the name, qualifications and references of the proposed certified structural steel fabricator.
  - 3.1.1 Structural steel fabricators shall be certified under the American Institute of Steel Construction (AISC) Quality Certification Program CBR – Major Steel Bridges.
  - 3.1.2 Structural steel fabricators of Fracture Critical Members shall be certified under the AISC Quality Certification Program, with a Fracture Critical Endorsement (F). The fabricator shall also meet the additional requirements for Fracture Critical Members specified in Section 1.14 – Fracture Critical Members of Chapter 15 – Steel Structures of the AREMA Manual.
- 3.2 Prior to the start of steel fabrication, Contractor shall submit to Engineer mill affidavits and certifications, chemical and physical test reports, and Charpy test results when required, for all structural steel.
- 3.3 Prior to the start of steel fabrication, Contractor shall submit to Engineer proof that all welders and welding operators are currently qualified in accordance with the requirements of AWS D1.5 Bridge Welding Code to perform the type of work required and have at least one year's experience.



- 3.4 Prior to the start of steel fabrication, Contractor shall submit to Engineer proof that the bolt assemblies meet the rotational-capacity test for ASTM A325 high strength bolts described in Section 3.2.14 of Chapter 15 – Steel Structures of the AREMA Manual for each rotational-capacity lot. Such documentation shall include the Mill Test Reports and the Manufacturer Certified Test Reports and the Distributer Certified Test Reports described in the section.
- 3.5 At least 14 days prior to the start of steel fabrication, Contractor shall submit to Engineer for approval a complete set of shop drawings, prepared by a qualified steel detailer, for all fabricated steel.
  - 3.5.1 Contractor shall verify dimensions and bridge layout prior to preparation of Shop Drawings.
  - 3.5.2 The Shop Drawing shall indicate all connections, lengths, locations of field and shop splices, attachments, erection and fabrication plans, and types of steel used.
  - 3.5.3 Contractor shall review all Shop Drawings and verify all dimensions and procedures prior to submittal to Engineer.
  - 3.5.4 Any discrepancies or other items for correction identified by Engineer shall be corrected and the Shop Drawings resubmitted.
  - 3.5.5 Fabrication shall not commence until the Shop Drawings are approved by Engineer.
  - 3.5.6 Engineer's approval of the Shop Drawings in no way shall relieve Contractor of responsibility for erectability, fabrication and fit in the field.
- 3.6 Prior to the start of steel erection Contractor shall submit to engineer the results of all non-destructive examination of welding during fabrication.
- 3.7 Prior to start of steel erection, Contractor shall submit to engineer for approval his procedures for field cutting and drilling of steel. This plan shall include existing steel members as well as new steel components.
- 3.8 Prior to the start of steel erection, Contractor shall submit to Engineer for approval a steel construction plan. This plan shall provide detailed information on Contractor's proposed means and methods and shall include the following minimum information:
  - 3.8.1 Contractor's proposed means and methods.
  - 3.8.2 Name and experience of personnel in responsible charge of the steel construction.
  - 3.8.3 Roster of proposed equipment.
  - 3.8.4 Means of access for the personnel, equipment and material to the work location.
  - 3.8.5 Means of accommodating wind and other loads during erection.
  - 3.8.6 Procedures for accommodating existing power lines, fiber optic and other utilities on the project site.
  - 3.8.7 Details of proposed quality assurance to include alignment and assembly verification.
- 3.9 Prior to the start of work, Contractor shall submit to Engineer for approval any modifications to the existing structure to accommodate the work. This includes such items as falsework, additional bracing for jacking and any other construction, temporary or otherwise, necessary to accommodate the work. Details for such modifications shall be designed by a competent Railroad Bridge Engineer familiar with the type of work proposed.
- 3.10 Prior to start of work, Contractor shall submit catalog cuts of all commercial off the shelf components and hardware for approval by Engineer.



- 3.11 Upon completion of steel construction, Contractor shall submit to Engineer a complete and accurate record of the work performed.

#### 4 EXECUTION

- 4.1 Fabrication and erection of all steel members shall be in accordance with the requirements of Part 3 – Fabrication and Part 4 – Erection of Chapter 15 – Steel Structures of the AREMA Manual.
- 4.2 Contractor shall comply with all local, state and federal regulations and requirements during all the repair and replacement process for the steel repairs or replacements.
- 4.3 Workmanship and finish shall be of the highest grade in accordance with the best modern practices to conform to the specification for the item of work being finished.
- 4.4 Contractor shall be responsible for the construction of the finished work correct lines and elevations, and for the establishment of the lines and elevations required for setting the steelwork.
- 4.5 The Work must be planned and performed by the Contractor in such a manner as to continually maintain the bridge in condition that it is safe for 10 MPH train traffic at the end of each work window.
- 4.6 Rolled material before being worked shall be straight within the tolerances allowed by ASTM Specification A6. If straightening is necessary, it shall be done by methods approved by Engineer which will not adversely affect the behavior of the material.
- 4.7 All steel material that requires cutting shall be cut with either a mechanically guided burner or a cut-off saw. At no time will freehand flame cutting or freehand sawing with a hand held saw or mechanically operated hand held saw be allowed. The cut surfaces shall not be rougher than ANSI B46.1 surface texture 1000.
- 4.7.1 All re-entrant corners shall be filleted to a radius of not less than one (1) inch.
- 4.7.1.1 The re-entrant corners of copes shall have a smooth transition that meets the adjacent edges without offset or cutting past the point of tangency.
- 4.7.2 All beam copes and weld access holes shall be shaped free of notches or sharp re-entrant corners, except when web-to flange fillet welds are used on built-up shapes access holes are permitted to terminate perpendicular to the flange. Thermal cut edges shall meet the requirements of Paragraph 3.2.2 of AWS D1.5.
- 4.7.3 Thermal cut surfaces of holes and re-entrant cuts in primary members and their connections shall be ground to bright metal. For ASTM A6 Group 4 and 5 shapes and built-up shapes with web material thickness greater than 1-1/2 inch, the thermal cut surfaces shall be inspected by either magnetic particle or dye-penetrant methods.
- 4.7.4 All weld access holes required to facilitate welding operations shall have a length from the toe of the weld preparation of not less than 1-1/2 times the thickness of the material in which the hole is made.
- 4.7.5 Any sheared edges shall be planed to a depth of ¼ inch.
- 4.8 Members and parts of members shall be straight, true to line, and free from twists and bends. Unless otherwise noted in the Plans dimensional tolerance shall meet the requirements of Section 3.1.7 Dimensional Tolerances for Structural Members of Chapter 15 – Steel Structures of the AREMA Manual.
- 4.8.1 All members shall fit their intended position exactly as shown in the Plans.
- 4.8.2 The edges of web plates of bolted members that have no cover plates shall not be more than 1/8 inch above or below the backs of the top flange angles. Web plates of such



- members with cover plates may be  $\frac{1}{2}$  inch less in width than the distance back to back of flange angles.
- 4.8.3 In bolted splices of web plates there shall not be more than  $\frac{3}{8}$  inch opening between the plates.
  - 4.8.4 Where splice material at joints and splices in girder flanges are designed to transmit force all main material at that joint or splice shall be milled and brought to an even bearing in one plane across the end of each abutting piece at the joint or splice.
  - 4.8.5 The difference in diameter between the pin and the pin hole shall be  $\frac{1}{50}$  inch for pins up to 5 inches diameter, and  $\frac{1}{32}$  inch for larger pins.
  - 4.8.6 Both top and bottom surfaces of base and cap plates of columns shall be planed or straightened and the parts of the members in contact with them faced to fit. Connection angles for base plates and cap plates shall be connected to compression members before the members are faced.
- 4.9 Where the Plans specify bent plates the bending procedures shall be such that no cracking or deformation of the plate occurs.
- 4.9.1 All bends shall receive at least visual inspection. Material that does not form satisfactorily when fabricated shall be rejected.
  - 4.9.2 The bend radius and the radius of the male die should be as liberal as the finished part will permit but not less than 1.5 times the web thickness for plate up to one (1) inch, 2.0 times the web thickness for plates between one (1) and two (2) inches, and 2.5 times the web thickness for plates over two (2) inches.
  - 4.9.3 Bent plates for connections should preferably be oriented so that the bend line will be essentially perpendicular to the direction of rolling. If the bend line is parallel to the direction of rolling, the above minimum radii shall be multiplied by 1.5.
  - 4.9.4 In the area where bending is to occur, the edges of the plate shall be ground smooth and the corners rounded before bending.
  - 4.9.5 No heat shall be applied during bending without the express written approval of Engineer.
- 4.10 Location and number of bolts in bolted connections shall be as exactly called out in the plans. If the plans are unclear, Contractor is to receive direction from Engineer prior to drilling holes for the connection.
- 4.10.1 When replacing structural steel components in kind, the bolting pattern shall exactly match the pattern of the component being replaced.
  - 4.10.2 Unless otherwise noted on the Plans, all bolt holes shall be sub-drilled and reamed or drilled full diameter with any burrs removed. At no time are holes to be sub-punched and reamed or punched full size. All holes shall be  $\frac{1}{16}$ " larger than the specified bolt size.
  - 4.10.3 All bolt holes shall be aligned to permit insertion of the bolts without undue damage to the threads. Bolts shall be placed in all holes with washers provided under the turned element and the nuts installed to complete the assembly.
  - 4.10.4 Bolt heads shall face outward on exterior beam webs.
  - 4.10.5 Beveled washers shall be used where an outer face of the bolted parts has a slope of more than 1:20 with respect to a plane normal to the bolt axis.
  - 4.10.6 Compacting the joint to the snug-tight condition shall progress systematically from the most rigid part of the joint in a manner that will minimize relaxation of previously



- snugged bolts. The snug-tight condition is the tightness that is attained with a few impacts of an impact wrench or the full effort of an ironworker using an ordinary spud wrench to bring the connected plies into full contact.
- 4.10.7 Once all bolts are installed and snug-tight, the nut or head rotation specified in Table 15-3-3 of Chapter 15 – Steel Structures of the AREMA Manual shall be applied to all fastener assemblies in the joint, progressing systematically from the most rigid part of the joint in a manner that will minimize relaxation of previously tensioned bolts until all bolts have achieved at least 39Kips of tension (for 7/8 inch bolt). The part not turned by the wrench shall be prevented from rotating during this operation.
  - 4.10.8 A Skidmore-Wilhelm Calibrator or an acceptable equivalent tension-measuring device shall be at the job site during erection. Prior to bolt installation, the device shall be used to confirm the suitability of the complete fastener assembly, including lubrication, for installation and confirm the procedure and proper use by the bolting crew of the tensioning method.
  - 4.10.9 The required testing consists of a representative sample of not fewer than three complete fastener assemblies of each combination of diameter, length, grade, and lot to be used in the work shall be checked at the site of installation in a tension calibrator to verify that the tensioning method develops a tension that is equal to or greater than 1.05 times the required 39Kips for 7/8 inch bolts. Washers shall be used in the pre-installation verification assemblies as required in the work. If the actual tension developed in any of the fastener assemblies is less than 1.05 times the required 39Kips, the cause(s) shall be determined and resolved before the fastener assemblies are used in the work. Cleaning, lubrication, and retesting of these fastener assemblies are permitted, provided all assemblies are treated in the same manner.
  - 4.10.10 Bolts that have been tensioned beyond snug-tight condition shall not be reused.
  - 4.10.11 Fasteners shall be protected from dirt and moisture at the job site. Fasteners shall not be cleaned of lubricant that is present in as-delivered condition. Fasteners for slip critical connections which accumulate dirt shall be cleaned and relubricated prior to installation.
  - 4.10.12 Weathered or rusted bolts or nuts shall be cleaned and relubricated prior to installation. Recleaned or relubricated bolt, nut and washer assemblies shall be retested in accordance with the above prior to installation.
  - 4.10.13 Bolt, nut and washer combinations as installed shall be from same rotational-capacity lot.
  - 4.10.14 Where bolt holes cannot be made to line up, and with the approval of Engineer, holes may be reamed or drilled to a larger size and the appropriately sized bolt installed in accordance with the requirements of this section.
  - 4.10.15 All other fastenings shall be new placed in accordance with the plans, drawn up securely, and on completion of the structure shall be retightened.
  - 4.11 Shop welding of connections shall be as exactly called out in the plans. If the plans are unclear, Contractor is to receive direction from Engineer prior to commencing welding.
    - 4.11.1 All welding shall conform to the requirements of the American Welding Society (AWS) Bridge Welding Code D1.5M / D1.5 as modified by Section 1.2.2 – Welding of Chapter 15 – Steel Structures of the AREMA Manual.
    - 4.11.2 For Fracture Critical Members, only machine welding using the Submerged Arc Welding (SAW) process shall be used for flange and web butt splices, and flange to web welds, unless otherwise authorized by the Engineer.



- 4.11.3 The following welds shall not be made on any structural steel:
  - 4.11.3.1 Those listed in AWS D1.5 Bridge Welding Code
  - 4.11.3.2 Plug or slot welds. Fillet welds in holes or slots are may be used when called out in the Plans.
  - 4.11.3.3 Intermittent welds.
  - 4.11.3.4 Butt joints of plates with transition of both thickness and width, and subject to other than axial compressive stress.
  - 4.11.3.5 Partial joint penetration groove welds transverse to the direction of stress.
  - 4.11.3.6 Any welds of tension flanges of flexural members.
- 4.11.4 All Welds shall be made with E7018 Electrodes.
- 4.11.5 All welds shall be made by either Shielded Metal Arc Welding (SMAW) or Submerged Arc Welding (SAW) Process.
- 4.11.6 There shall be through fusion between weld metal and base metal and between successive passes of the weld. All craters shall be shall be filled to the full cross section of the weld.
- 4.11.7 Surfaces and Edges to be welded shall be smooth, uniform and free from fins, tears, cracks, or other deficiencies which would adversely affect the quality or strength of the weld. Surfaces to be welded and surfaces adjacent to a weld shall also be free from loose or thick scale, slag, rust, moisture, grease or other foreign material that will inhibit proper welding.
- 4.12 Unless otherwise shown in the Plans, or approved in writing by Engineer, field welding of steel is prohibited. Where field welding is allowed the following requirements in addition to the above shall be met.
  - 4.12.1 All welding shall conform to the requirements of the American Welding Society (AWS) Bridge Welding Code D1.5M / D1.5 as modified by Section 1.2.2 – Welding of Chapter 15 – Steel Structures of the AREMA Manual.
  - 4.12.2 For Fracture Critical Members, only machine welding using the Submerged Arc Welding (SAW) process shall be used for flange and web butt splices, and flange to web welds, unless otherwise authorized by the Engineer.
  - 4.12.3 Field welding shall be made by either SMAW or Flux-cored Arc Welding (FCAW) process. Welding electrodes must be E7018 for SMAW or E70T-1,5 for FCAW.
- 4.13 All materials and workmanship shall be subject to inspection by Engineer in accordance with the requirements of Section 3.5 Inspection of Chapter 15 – Steel Structures of the AREMA Manual.
  - 4.13.1 The Contractor shall give the Engineer ample written notice of the beginning of fabrication work, in order that inspection may be provided. Fabrication work shall not be done before the Engineer has been so notified.
  - 4.13.2 The Contractor shall provide the Inspector, without charge, facilities for the inspection of materials and workmanship. The Inspector shall be allowed free access to the fabricating areas.
  - 4.13.3 The acceptance by the Inspector of material or finished members shall not prevent their rejection later if found defective. Rejected material and workmanship shall promptly be replaced or made good by Contractor.





- 4.13.4 The Inspector shall observe the installation and tightening of bolts to determine that the specified tightening procedure is properly used, and shall determine that all bolts have been tightened.
  - 4.13.4.1 When there is disagreement concerning the results of tension in the turn-of-nut method of installation, the arbitration procedure described in the current Specification for Structural Joints using A325 and A490 Bolts approved by the Research Council on Structural Connections (RCSC) shall be used.
- 4.14 Welding shall be inspected in accordance with the requirements of Section 3.5.5 Inspection – Welded Work of Chapter 15 – Steel Structures of the AREMA Manual.
  - 4.14.1 The required radiographic, ultrasonic and magnetic particle inspections of welds shall be performed by Contractor or his representative. Such inspections shall be at Contractor's expense. In addition, Engineer may use any method of non-destructive testing for examination of weld passes or completed welds.
  - 4.14.2 Contractor shall give Engineer sufficient advance notice of the date on which the material will be radiographic, ultrasonic or magnetic particle inspected so that he may be present during inspection.
  - 4.14.3 An interpretation of all radiographic films shall be furnished to Engineer by Contractor. The interpretation report shall be submitted on a form approved by Engineer. In the event Engineer questions the interpretation of the radiographic films, a joint review of the film will be made; however, Engineer's final interpretation shall govern.
  - 4.14.4 The welded work shall be inspected as follows:
    - 4.14.4.1 All welds shall be visually inspected by the Fabricator.
    - 4.14.4.2 Welds for bearing stiffeners and all other welds carrying live load stresses in flexural members and tension members shall be 100% inspected by non-destructive testing methods.
    - 4.14.4.3 All other welds shall be tested at the rate of 10% by non-destructive testing methods unless the results of the testing indicate additional testing is warranted.
    - 4.14.4.4 Welds requiring repairs shall be retested after repairs are made.
    - 4.14.4.5 Contractor shall report the amount of inspection performed in lineal feet, location and length of defects, if any, and furnish a certification that these tests were performed in accordance with these Specifications.
    - 4.14.4.6 Engineer shall be furnished copies of all welding inspection reports including a certificate stating that required inspections have been made and that all welds meet the quality requirements of the Specifications.
- 4.15 Upon completion of the work, all surplus material or material salvaged from an existing structure shall be delivered to and be neatly stacked in a location designated by the Engineer. Material not salvageable and other refuse shall be properly disposed of. The premises shall be left in a clean, neat and orderly condition.
  - 4.15.1 In no case shall any materials be left within 200 feet of the bridge, upstream of the bridge or within 15 feet of track centerline.





### 5 MEASUREMENT AND PAYMENT

#### 5.1 Measurement:

- 5.1.1 Steel construction shall be measured for payment on the basis of individual components installed and accepted into the finished structure up to the estimated quantity given in the Proposal.
- 5.1.2 Installation of hardware is considered incidental to steel construction and shall not be measured for payment.
- 5.1.3 Steel, lead based paint residue and other material disposal is considered incidental to steel construction and shall not be measured for payment.

#### 5.2 Payment

- 5.2.1 Steel construction shall be paid for at the contract unit price for the structural steel bid items and shall constitute full payment for all labor, equipment, materials and supervision necessary to construct the steel in accordance with the Plans and Specifications.

END OF SECTION

### REVISION HISTORY

The following is the revision history for this standard:

5/1/2013 – Initial Issue



# STANDARD CONSTRUCTION SPECIFICATIONS

## 552 – BEARING CONSTRUCTION

### 1 GENERAL

- 1.1 These Bearing Construction Specifications are adopted by Railroad and are supplemental and complimentary to the requirements of the Contract issued by Railroad to Contractor for the purpose of performing construction and maintenance of Railroad's Structure(s) as specified in the Scope of Work and the Contract Documents. They apply to Contractor, its employees, agents, invitees and subcontractors.
- 1.2 Bearing construction shall consist of bridge bearings installed and maintained in accordance with these Specifications, the requirements of Part 10 – Bearing Design, and Part 11 – Bearing Construction of Chapter 15 – Steel Structures of the American Railway Engineering and Maintenance of Way Association (AREMA) Manual for Railway Engineering (Manual), and the details shown on the Plans.
- 1.3 Contractor is responsible for performing all bridge bearing construction operations in compliance with local, state, and federal laws, Railroad safety and operating rules, and Federal Railroad Administration regulations pertaining to workplace safety.
- 1.4 Bearing components are numbered in the direction of increasing mileposts and from left to right when facing the direction of increasing mileposts.

### 2 MATERIALS

- 2.1 Bearing components shall conform to the requirements of Part 10 – Bearing Design and Part 11 – Bearing Construction of Chapter 15 – Steel Structures of the AREMA Manual.
- 2.2 Unless otherwise specified in the plans, bearings for spans of 50 feet or longer shall have provision to accommodate rotation due to deflection of the span. This requirement can be accommodated by use of bearings with elastomeric pads, or pin arrangement.
- 2.3 Unless otherwise specified in the plans, the expansion end of spans shall be designed to accommodate movement through the use of low friction sliding surfaces or elastomeric pads.
- 2.4 Polytetrafluoroethylene (PTFE) sliding surfaces shall be virgin unfilled resin meeting the requirements of ASTM D4894 Specific Gravity between 2.13 and 2.19, unfilled PTFE sheets meeting the requirements of ASTM D3294 Type II Grade 1 Class C, or, with the approval of Engineer, unfilled PTFE fabric. Sheet PTFE may contain dimples.
  - 2.4.1 The allowable stress in bearing on the net area for unfilled PTFE, whether virgin PTFE resin, PTFE sheets, or woven PTFE fabric, bearing against stainless steel sliding surfaces shall not exceed 2,000 psi.
  - 2.4.2 Filler material, such as milled glass fibers or carbon shall not be used in PTFE sliding surfaces.
  - 2.4.3 The minimum thickness for PTFE material shall be 1/4 inch.
  - 2.4.4 The static coefficient of friction shall not exceed 0.06 when measured under a bearing pressure of 2,000 psi.
  - 2.4.5 Unfilled PTFE resin sliding surfaces shall be cast by the bearing manufacturer against a backing substrate according to details shown on the plans.
  - 2.4.6 PTFE sheet sliding surfaces shall be factory etched and epoxy-bonded to the substrate by the bearing manufacturer into a square-edged recess 1/16 inch deep in accordance with the requirements of the manufacturer of the approved adhesive system. After completion of bonding, the PTFE surface shall be smooth and free from bubbles.



- 2.4.7 PTFE fabric sliding surfaces shall be epoxy-bonded, or epoxy-bonded and mechanically fastened, to the substrate by the bearing manufacturer in accordance with the requirements of the manufacturer of the approved adhesive system.
  - 2.4.8 The substrate surface flatness shall not vary by more than 1/100 inch.
  - 2.4.9 The finished area of PTFE sliding surfaces shall be not less than or more than 5% greater than the plan dimensions.
  - 2.4.10 Sheet stainless steel mating surfaces shall be at least 20 gauge and conform to the requirements of ASTM A167 or A240 Type 304.
  - 2.4.11 Welded stainless steel overlay shall be at least 3/32 inch thick produced using Type 309L electrodes.
  - 2.4.12 The mating surface shall be at the top (face down) or otherwise oriented so that sliding movements will cause dirt and dust accumulation to fall from the mating surface. The mating surface shall completely cover the PTFE surface in all operating positions plus one inch in each direction of movement.
  - 2.4.13 After fabrication and before shipment, exposed sliding surfaces of PTFE and sliding elements which will be in contact with PTFE sliding surfaces, shall be coated with a protective coating material. If this coating material is to be left in place after the bearing assemblies are erected at the bridge site, the coating material shall also be a lubricant that is compatible with the PTFE sliding surface.
  - 2.4.14 Each completed bearing shall be shipped assembled and have its components clearly identified. Packaging shall be accomplished in such a manner as to ensure that the bearings will be protected against damage from handling, weather, or any normal hazard.
- 2.5 Compounds for elastomeric pads shall be shall be 100 percent virgin polyisoprene (natural rubber), virgin crystallization-resistant polychloroprene (neoprene), or cast polyurethane meeting the requirements of Table 15-10-2 of Chapter 15 – Steel Structures of the AREMA Manual.
- 2.5.1 The allowable average compressive stress for unconfined elastomeric bearings shall not exceed 1,000 psi for reinforced bearings or 800 psi for plain bearings.
  - 2.5.2 Elastomeric bearings which are designed to act as a single unit with a given shape factor shall be manufactured and vulcanized as a single unit and shall not be revulcanized after manufacture.
  - 2.5.3 Unless otherwise specified in the plans, elastomeric bearings over 1/2 inch thick shall be reinforced with steel laminates every 1/2 inch through the entire thickness.
  - 2.5.4 Unless otherwise specified in the plans, elastomer shall be 60- durometer, shall be adequate for 1,000 psi design compressive stress, and shall meet the requirements of Test Criteria I per Section 11.5.9 of Chapter 15 – Steel Structures of the AREMA Manual.
  - 2.5.5 Plain rubber or neoprene bearings shall be fully vulcanized.
  - 2.5.6 Plain elastomeric bearings shall be cast in uniform and integral units of such construction that the bearing cannot be separated by any mechanical means into well-defined elastomer layers.
  - 2.5.7 Cutting of plain bearings from previously molded strips or slabs shall be performed in a manner to avoid heating of the material, and to produce an edge with no tears or other jagged areas. The surface roughness shall not exceed 250  $\mu$ m per ANSI B46.1, Surface Texture.



## 552 – BEARING CONSTRUCTION

- 2.5.8 Reinforced elastomeric bearings shall have alternate layers of elastomer and steel reinforcement as shown on the design drawings, and shall be cast in individual molds under heat and pressure to form an integral unit of such construction that the bearing cannot be separated by any mechanical means into separate well-defined elastomer layers.
- 2.5.9 Steel reinforcement shall be abrasive blast cleaned to remove all rust, mill scale, and other contaminates and shall be free of sharp edges and burrs.
- 2.5.10 Steel reinforcement shall be covered by a minimum of 1/8 inch of elastomer on all faces. No surface of steel reinforcement shall be left exposed.
- 2.5.11 Molds shall have a finish that provides a smooth undamaged surface for the bearing.
- 2.5.12 External steel load plates shall be abrasive blast cleaned to near white metal to remove all rust, mill scale or other contaminates, and shall be hot bonded to rubber or neoprene bearings during vulcanization or molded to polyurethane bearings during casting.
- 2.5.13 Flash tolerance, finish, and appearance shall meet the requirements of the latest edition of the Rubber Handbook for Molded Extruded, Lath Cut and Cellular Products as published by the Rubber Manufacturers Association Inc., RMA Drawing Designation for Finish, F3, and RMA Drawing Designation for Flash Extension, T 0.063 inch for molded bearings.
- 2.5.14 Unless otherwise specified in the plans, for both plain and reinforced bearings, the permissible variation from the dimensions and configuration required by the plans shall be in accordance with Section 11.5.6 – Tolerances of Chapter 15 – Steel Structures of the AREMA Manual.
- 2.6 Unless otherwise specified in the plans, all structural steel for bearing assemblies shall conform to the requirements of ASTM A709, Grade 50W Weathering Steel where  $F_y = 50,000$  psi minimum and  $F_u = 70,000$  psi minimum.
- 2.7 Unless otherwise specified in the plans, all steel for pins shall conform to the requirements of ASTM A668 Class D where  $F_y = 37,500$  psi minimum.
- 2.8 Unless otherwise specified in the plans, all anchor bolts and rods shall conform to the requirements of ASTM F1554 Grade 55. Nuts for anchor bolts shall meet the requirements of ASTM F436.
  - 2.8.1 Concrete and steel beam spans shall have at least two (2) 1 ¼ inch anchor bolts with 16 inches of embedment per bearing.
  - 2.8.2 Deck Plate Girder, Through Plate Girder and Truss spans shall have at least four (4) 1 ½ inch anchor bolts with 16 inches of embedment per bearing.
- 2.9 Unless otherwise specified in the plans, structural bolts shall be 1" diameter ASTM A325 Type 3 bolts with one ASTM F436 Type 3 hardened circular washer and one ASTM A563-C3 hex heavy nut.
- 2.10 Unless otherwise specified in the plans, countersunk structural bolts shall be 1" diameter ASTM A449 Type 3 bolts with one ASTM F436 Type 3 hardened circular washer and one ASTM A563-C3 hex heavy nut.
- 2.11 Unless otherwise specified in the plans, sole plates shall have a minimum thickness of one (1) inch.
- 2.12 Unless otherwise specified in the plans, base and masonry plates shall have a minimum thickness of 1 ½ inches.
- 2.13 Flowable epoxy grout for use under base plates shall be Sika Sikadur -42 HES Grout or approved equivalent.



- 2.14 Flowable epoxy grout for use under base plates in wet conditions shall be Sika Sikadur -53 UF Grout or approved equivalent.
- 2.15 Polymer concrete for use in building up thick bearing pads or pedestals shall be BASF Degadeck Polymer Concrete or approved equivalent.
- 2.16 Contractor is solely responsible for delivering all material to the project site.
- 2.17 All material shall be stored and handled to avoid structural damage or unnecessary disfiguring.
  - 2.17.1 Material, either plain or fabricated, shall be stored properly above the ground upon platforms, skids, or other supports. It shall be kept free from dirt, grease and other foreign matter, and shall be protected as far as practicable from corrosion.
  - 2.17.2 Materials stored at the site shall be kept in a neat manner at proper clearance to operated tracks.
  - 2.17.3 Hardware received at the job site shall be protected from corrosion by storing under cover or by a protective coating.
  - 2.17.4 Care should be exercised to prevent fires in material held in storage. The ground underneath and in the vicinity of stored material should be kept clear of all weeds, rubbish and combustible material.
- 2.18 Contractor shall be responsible for ensuring that all material meets the requirements as identified in the applicable paragraphs of the Contract Documents.
- 2.19 Final acceptance of the material shall be based upon satisfactory performance in the field.

### 3 SUBMITTALS

- 3.1 Prior to the start of bearing fabrication, Contractor shall submit to Engineer the name, qualifications and references of the proposed bearing fabricator.
- 3.2 Prior to the start of bearing fabrication, Contractor shall submit to Engineer mill affidavits and certifications, chemical, and physical test reports for all bearing materials.
- 3.3 Prior to the start of bearing fabrication, Contractor shall submit to Engineer proof that all welders and welding operators are currently qualified in accordance with the requirements of AWS D1.5 Bridge Welding Code to perform the type of work required and have at least one year's experience.
- 3.4 At least 14 days prior to the start of bearing fabrication, Contractor shall submit to Engineer for approval a complete set of shop drawings, prepared by a qualified steel detailer, for all bearings.
  - 3.4.1 Contractor shall verify dimensions and bridge layout prior to preparation of Shop Drawings.
  - 3.4.2 The Shop Drawing shall indicate all details and materials used for the bearings along with design information to indicate maximum stresses in the bearings under design load conditions..
  - 3.4.3 Contractor shall review all Shop Drawings and verify all dimensions and procedures prior to submittal to Engineer.
  - 3.4.4 Any discrepancies or other items for correction identified by Engineer shall be corrected and the Shop Drawings resubmitted.
  - 3.4.5 Fabrication shall not commence until the Shop Drawings are approved by Engineer.
  - 3.4.6 Engineer's approval of the Shop Drawings in no way shall relieve Contractor of responsibility for erectability, fabrication and fit in the field.



- 3.5 Prior to the start of bearing installation, Contractor shall submit to Engineer the results of all non-destructive examination of welding during fabrication.
- 3.6 Prior to the start of bearing installation, Contractor shall submit to Engineer certification of all elastomeric bearing test.
- 3.7 Prior to start of bearing installation, Contractor shall submit to engineer for approval his procedures for field cutting and drilling of steel. This plan shall include existing steel members as well as new steel components.
- 3.8 Prior to the start of bearing installation, Contractor shall submit to Engineer for approval a bearing construction plan. This plan shall provide detailed information on Contractor's proposed means and methods and shall include the following minimum information:
  - 3.8.1 Contractor's proposed means and methods.
  - 3.8.2 Name and experience of personnel in responsible charge of the bearing installation.
  - 3.8.3 Roster of proposed equipment.
  - 3.8.4 Means of access for the personnel, equipment and material to the work location.
  - 3.8.5 Modifications to the existing structure to accommodate the work. This includes such items as falsework, additional bracing for jacking and any other construction, temporary or otherwise, necessary to accommodate the work. Details for such modifications shall be designed by a competent Railroad Bridge Engineer familiar with the type of work proposed.
  - 3.8.6 Details of proposed quality assurance to include alignment and assembly verification.
- 3.9 Prior to start of work, Contractor shall submit catalog cuts of all commercial off the shelf polymer concrete, epoxy grout, bearing components and hardware for approval by Engineer.
- 3.10 Upon completion of bearing construction, Contractor shall submit to Engineer a complete and accurate record of the work performed.

#### 4 EXECUTION

- 4.1 Fabrication and installation of all bearing members shall be in accordance with the requirements of Part 10 – Bearing Design and Part 11 – Bearing Construction of Chapter 15 – Steel Structures of the AREMA Manual.
- 4.2 Contractor shall comply with all local, state and federal regulations and requirements during all the repair and replacement process for the bearing repairs or replacements.
- 4.3 Contractor shall be responsible for the construction of the finished work correct lines and elevations, and for the establishment of the lines and elevations required for setting the steelwork.
- 4.4 Workmanship and finish shall be of the highest grade in accordance with the best modern practices to conform to the specification for the item of work being finished.
- 4.5 Bearing assemblies shall be pre-assembled in the shop by the supplier and checked for completeness and geometry before shipping to the site.
- 4.6 Unless otherwise specified in the Plans, bearings and bearing components shall be straight, true to line, and free from twists and bends and shall meet the dimensional requirements of Section 11.2.6 Tolerances of Chapter 15 – Steel Structures of the AREMA Manual.
- 4.7 All steel material that requires cutting shall be cut with either a mechanically guided burner or a cut-off saw. At no time will freehand flame cutting or freehand sawing with a hand held saw or mechanically operated hand held saw be allowed. The surfaces shall not be rougher than ANSI B46.1 surface texture 1000.



## 552 – BEARING CONSTRUCTION

- 4.8 Holes in bearing plates shall be formed by drilling or reaming. Burrs shall be removed by grinding.
- 4.9 Sole plates of plate girders shall be in full contact with the girder flanges. Sole plates and masonry plates shall be planed or straightened.
- 4.10 Bearing plates shall be accurately set in level position as shown on the plans and shall have a uniform bearing over the whole area. They may be set on shims or on leveling screws, with approved non-shrink grout or polymer concrete so placed as to fill completely the space between the steel and the masonry.
  - 4.10.1 The surface finish roughness of bearing plates and base plates and other bearing surfaces that are to be in contact shall not exceed  $125\text{ }\mu\text{in}$  as measured in accordance with ANSI B46.1.
  - 4.10.2 Bearing surfaces of cast pedestals that are to be in contact with steel or masonry shall be planed.
  - 4.10.3 All grout and polymer concrete shall be placed in accordance with the manufacturer's requirements.
- 4.11 Unless otherwise specified in the Plans, anchor bolts shall be swedged or threaded to secure a satisfactory grip upon the material used to embed them in the holes.
  - 4.11.1 Contractor shall drill holes for anchor bolts and set them in approved epoxy grout, or preset them as shown on the plans.
  - 4.11.2 Location of anchor bolts shall take into account any variation from mean temperature of the superstructure at time of setting and anticipated lengthening of bottom chord or bottom flange due to dead load after setting so that at mean temperature and under dead load, the anchor bolts at expansion bearings will be centered in their slots. Care shall be taken that full and free movement of the superstructure at movable bearings is not restricted by anchor bolts or nuts.
- 4.12 Whenever bearings are designed by the Manufacturer and/or a Manufacturer's Warranty is provided, installation shall be performed under the Manufacturer's supervision.
- 4.13 Setting of sliding bearings shall take into account any variation from mean temperature of the supported span at time of setting. At mean temperature the sliding components shall be in proper alignment. Full and free movement of the superstructure at movable bearings shall not be restricted by improper settings or adjustment of bearings.
- 4.14 Each completed PTFE bearing assembly shall be handled, stored and erected in the field in such a manner as to ensure that the bearings will be protected against damage from handling, weather, or any other hazard.
  - 4.14.1 Each bearing shall be erected as an assembled unit as shipped. PTFE sliding surfaces and the mating stainless steel or other polished surfaces shall not be exposed to weather or ultraviolet (UV) light (sun light). Each completed bearing assembly shall be erected at the location and orientation in each structure in the project as marked on its top and in conformity with the plans.
  - 4.14.2 Any protective coating applied to exposed sliding surfaces of PTFE sliding expansion bearing elements, which is incompatible with the PTFE sliding surfaces, shall be thoroughly removed just before erection.
- 4.15 Elastomeric bearings shall be installed in accordance with the design plans. Substructure bearing surfaces to receive the bearings shall be level, smooth, and finished to the correct elevation.





- 4.15.1 Top and bottom elastomer surfaces shall be level under dead load only. Tapered steel load plates bonded to the bearing, or tapered steel sole plates on the bridge span shall compensate for span grade, rotation, or camber.
- 4.16 Bearings which are to be attached to the bridge span and/or substructure shall use a positive attachment detail. Adhesive bonding is not permitted.
  - 4.16.1 Welding of bridge span members to the bearing load plates is not permitted without the written approval of Engineer.
- 4.17 Location and number of bolts in bolted connections shall be as exactly called out in the plans. If the plans are unclear, Contractor is to receive direction from Engineer prior to drilling holes for the connection.
  - 4.17.1 When replacing bearing components in kind, the bolting pattern shall exactly match the pattern of the component being replaced.
  - 4.17.2 Unless otherwise specified in the Plans, all bolt holes shall be sub-drilled and reamed or drilled full diameter with any burrs removed. At no time are holes to be sub-punched and reamed or punched full size. All holes shall be 1/16" larger than the specified bolt size.
  - 4.17.3 All bolt holes shall be aligned to permit insertion of the bolts without undue damage to the threads. Bolts shall be placed in all holes with washers provided under the turned element and the nuts installed to complete the assembly.
  - 4.17.4 Beveled washers shall be used where an outer face of the bolted parts has a slope of more than 1:20 with respect to a plane normal to the bolt axis.
  - 4.17.5 Once all bolts are installed and snug-tight, the nut or head rotation specified in Table 15-3-3 of Chapter 15 – Steel Structures of the AREMA Manual shall be applied to all fastener assemblies in the bearing. The part not turned by the wrench shall be prevented from rotating during this operation.
  - 4.17.6 A Skidmore-Wilhelm Calibrator or an acceptable equivalent tension-measuring device shall at the job site during erection. Prior to bolt installation, the device shall be used to confirm the suitability of the complete fastener assembly.
  - 4.17.7 Bolts that have been tensioned beyond snug-tight condition shall not be reused.
  - 4.17.8 Fasteners shall be protected from dirt and moisture at the job site.
- 4.18 Shop welding of connections shall be as exactly called out in the plans. If the plans are unclear, Contractor is to receive direction from Engineer prior to commencing welding.
  - 4.18.1 All welding shall conform to the requirements of the American Welding Society (AWS) Bridge Welding Code D1.5M / D1.5 as modified by Section 1.2.2 – Welding of Chapter 15 – Steel Structures of the AREMA Manual.
  - 4.18.2 All Welds shall be made with E7018 Electrodes.
  - 4.18.3 All welds shall be made by Shielded Metal Arc Welding (SMAW) or Submerged Arc Welding (SAW) Process.
  - 4.18.4 There shall be through fusion between weld metal and base metal and between successive passes of the weld. All craters shall be filled to the full cross section of the weld.
  - 4.18.5 Surfaces and Edges to be welded shall be smooth, uniform and free from fins, tears, cracks, or other deficiencies which would adversely affect the quality or strength of the weld. Surfaces to be welded and surfaces adjacent to a weld shall also be free from loose



or thick scale, slag, rust, moisture, grease or other foreign material that will inhibit proper welding.

- 4.19 Field welding of connections shall be as exactly called out in the plans. If the plans are unclear, Contractor is to receive direction from Engineer prior to commencing welding.
  - 4.19.1 Field welds other than those shown on the Plans or specified herein are prohibited unless specifically authorized by Engineer.
  - 4.19.2 All welding shall be per Bridge Welding Code AWS D1.5M / D1.5:2008, Modified or Supplemented by the AREMA Manual of Railway Engineering.
  - 4.19.3 Field welding shall be with the SMAW or FCAW process. Welding electrodes must be E7018 for SMAW or E70T-1,5 for FCAW.
  - 4.19.4 All other welding shall be with the SAW or SMAW process.
  - 4.19.5 All welders must possess a valid certification.
- 4.20 All materials and workmanship shall be subject to inspection by Engineer in accordance with the requirements of Section 3.5 Inspection of Chapter 15 – Steel Structures of the AREMA Manual.
  - 4.20.1 The Contractor shall give the Engineer ample written notice of the beginning of fabrication work, in order that inspection may be provided. Fabrication work shall not be done before the Engineer has been so notified.
  - 4.20.2 The Contractor shall provide the Inspector, without charge, facilities for the inspection of materials and workmanship. The Inspector shall be allowed free access to the fabricating areas.
  - 4.20.3 The acceptance by the Inspector of material or finished members shall not prevent their rejection later if found defective. Rejected material and workmanship shall promptly be replaced or made good by Contractor.
- 4.21 Welding shall be inspected in accordance with the requirements of Section 3.5.5 Inspection – Welded Work of Chapter 15 – Steel Structures of the AREMA Manual.
  - 4.21.1 Ultrasonic and magnetic particle inspections of welds shall be performed by Contractor or his representative. Such inspections shall be at Contractor's expense..
  - 4.21.2 Contractor shall give Engineer sufficient advance notice of the date on which the material will be radiographic, ultrasonic or magnetic particle inspected so that he may be present during inspection.
  - 4.21.3 The welded work shall be inspected as follows:
    - 4.21.3.1 All welds shall be visually inspected by the Fabricator.
    - 4.21.3.2 All welds shall be tested at the rate of 10% by non-destructive testing methods unless the results of the testing indicate additional testing is warranted.
    - 4.21.3.3 Welds requiring repairs shall be retested after repairs are made.
    - 4.21.3.4 Contractor shall report the amount of inspection performed in lineal feet, location and length of defects, if any, and furnish a certification that these tests were performed in accordance with these Specifications.
    - 4.21.3.5 Engineer shall be furnished copies of all welding inspection reports including a certificate stating that required inspections have been made and that all welds meet the quality requirements of the Specifications.



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- 4.22 The Work must be planned and performed by the Contractor in such a manner as to continually maintain the bridge in a condition that it is at least safe for ten (10) miles per hour train traffic at the end of each work window.
- 4.23 Upon completion of the work, all surplus material or material salvaged from an existing structure shall be delivered to, and be neatly stacked in, a location designated by the Engineer. Material that is not salvageable, along with other refuse shall be properly disposed of by contractor. The premises shall be left in a clean, neat and orderly condition.
  - 4.23.1 In no case shall any material be left within 200 feet of the bridge, upstream of the bridge, or within 15 feet of track centerline.

### 5 MEASUREMENT AND PAYMENT

- 5.1 Measurement:
  - 5.1.1 Bearing construction shall be measured for payment on the basis of individual bearings installed and accepted into the finished structure up to the estimated quantity given in the Proposal.
  - 5.1.2 Installation of hardware is considered incidental to bearing construction and shall not be measured for payment.
  - 5.1.3 Installation of leveling pads and pedestals is considered incidental to bearing construction and shall not be measured for payment.
  - 5.1.4 Steel, bearings, concrete, lead based paint residue and other material disposal is considered incidental to bearing construction and shall not be measured for payment.
- 5.2 Payment
  - 5.2.1 Bearing construction shall be paid for at the contract unit price for the bearing bid items and shall constitute full payment for all labor, equipment, materials and supervision necessary to construct the bearings in accordance with the Plans and Specifications.

END OF SECTION

### REVISION HISTORY

The following is the revision history for this standard:

5/1/2013 – Initial Issue



# STANDARD CONSTRUCTION SPECIFICATIONS

## 560 – BRIDGE DECK CONSTRUCTION

### 1 GENERAL

- 1.1 These Bridge Deck Construction Specifications are adopted by Railroad and are supplemental and complimentary to the requirements of the Contract issued by Railroad to Contractor for the purpose of performing construction and maintenance of Railroad's Structure(s) as specified in the Scope of Work and the Contract Documents. They apply to Contractor, its employees, agents, invitees and subcontractors.
- 1.2 Bridge Deck Construction shall consist of open deck bridge ties, guardrails and walkways constructed in accordance with these Specifications, the requirements of Part 4 – Construction and Maintenance of Timber Structures of Chapter 7 – Timber Structures of the AREMA Manual, and the details shown on the Plans.
- 1.3 Contractor is responsible for performing all bridge deck construction operations in compliance with local, state, and federal laws, Railroad safety and operating rules, and Federal Railroad Administration regulations pertaining to workplace safety.
- 1.4 Structural components are numbered in the direction of increasing mileposts and from left to right when facing the direction of increasing mileposts.

### 2 MATERIALS

- 2.1 Bridge ties and associated hardware such as tie spacers and guard rails for open deck construction shall conform to the requirements of Part 1 – Material Specifications for Lumber, Timber, Engineered Wood Products, Timber Piles, Fasteners, Timber Bridge Ties and Recommendations for Fire-Retardant Coating for Creosoted Wood of Chapter 7 – Timber Structures of the AREMA Manual.
  - 2.1.1 Bridge ties shall conform to the requirements Section 1.7 Specifications for Timber Bridge Ties of Chapter 7 – Timber Structures of the AREMA Manual.
    - 2.1.1.1 The general quality of bridge ties shall conform to the appropriate grading rules.
    - 2.1.1.2 Bridge ties shall be free from any defects that may impair their strength or durability as bridge ties.
    - 2.1.1.3 Bridge ties shall be free of any signs of decay or rot.
    - 2.1.1.4 Bridge ties shall be free of knots with an average diameter exceeding one-fourth of the surface on which it appears. Such a knot may be allowed if it occurs outside of the bridge tie supports in an overhang area.
    - 2.1.1.5 Bridge ties shall be free of numerous knots that equal a large knot in damage effect.
    - 2.1.1.6 Bridge ties shall be free of shake of more than one-fourth the width or depth of the tie.
    - 2.1.1.7 Bridge ties shall be free of split more than three inches in length.
    - 2.1.1.8 Except in woods with interlocking grain, bridge ties shall have a slope in grain in less than 1 in 15.
    - 2.1.1.9 Except as provided in the grading rules of the respective species, all bridge ties shall be straight, well sawn, cut square at the ends, have bottom and top parallel (except for tapered ties) and sized surfaces when specified.



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- 2.1.1.10 The surface of a bridge tie shall be considered straight when a string stretched along any side is within 1/8 inch of being truly straight.
- 2.1.1.11 A bridge tie shall be considered well sawn when its surfaces are cut with score marks less than 1/8 inch in depth or when its surfaces are even.
- 2.1.1.12 The top and bottom surfaces or opposite sides of a bridge tie shall be considered parallel when any difference in tie thickness measured along the depth or along the sides is less than 1/4 inch. On sized or dapped sections the difference in the thickness cannot exceed 1/8 inch.
- 2.1.2 Depending on the intended service conditions, bridge ties may be classified as structural or bearing ties.
  - 2.1.2.1 Structural ties are normally used for open deck bridges having steel girder spans. Under these conditions the strength of the ties is governed by flexure or horizontal shear.
  - 2.1.2.2 Bearing ties are normally used for open decks of timber trestle spans or on open decks of steel beam spans having multiple beams where the strength of ties is governed by bearing on the top of the stringer.
- 2.1.3 Structural Bridge ties shall be treated No. 1 Grade in the following species:
  - 2.1.3.1 Douglas Fir - Costal Species.
  - 2.1.3.2 Southern Yellow Pine
- 2.1.4 Bearing ties shall be treated No. 1 Grade in the following species:
  - 2.1.4.1 Douglas Fir - Costal Species.
  - 2.1.4.2 Southern Yellow Pine
  - 2.1.4.3 Oak
- 2.1.5 Unless specified in the plans, the minimum cross-section for structural and bearing type bridge ties shall be based on the applicable clauses of Chapter 7, Part 2, and Chapter 15, Part 1, of the latest revisions of this manual. The sized or dapped depth shall be  $\pm 1/16$  inch. The depth of other areas shall be  $\pm 1/8$  inch.
- 2.1.6 Unless specified in the plans, the minimum width of bridge ties shall be eight (8) inches,  $\pm 1/8$  inch.
- 2.1.7 Unless specified in the plans, the minimum length of bridge ties shall be ten (10) feet nominal or center-to-center of outer supports plus three (3) feet whichever is greater,  $\pm 1/4$  inch. The minimum tie overhang beyond the outside edge of support shall be 6 inches.
- 2.1.8 Fabricated holes shall be located within 1/16 inch of the location shown on the Plans.
- 2.1.9 Unless specified in the plans, dapping of ties is not required unless necessary to accommodate coverplates while maintaining a uniform tie size.
- 2.1.10 Dapping or sizing shall be performed in a framing mill properly equipped to perform such work.
  - 2.1.10.1 When dapped bridge ties are used, the width of dap shall be the width of flange plus 1/2 inch and the depth of dap shall be such that the undapped portion will not bear on gusset plates, bracing, etc.



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- 2.1.11 On curved tracks, superelevation may be provided by tapered ties, which may be dapped or sized. Superelevation may also be provided by raising blocks securely fastened to the bottom of ties. An approved tie plan must be submitted to Engineer for approval.
- 2.2 Preservative Treating:
- 2.2.1 All timber shall be Creosote treated in accordance with Section 3.7 Specifications for Treatment of Chapter 30 – Ties of the AREMA Manual.
- 2.2.1.1 Creosote Coal Tar solution shall meet the requirements of American Wood Protection Association (AWPA) Standard P2 - Standard for Creosote Solutions.
- 2.2.1.2 Solid sawn timbers shall be treated in accordance with AWPA Standard C2 - Lumber, Timber, Bridge Ties and Mine Ties - Preservative Treatment by Pressure Processes.
- 2.2.1.3 The minimum preservative retention shall be 12 pounds per cubic foot using the Empty Cell process in accordance with AWPA Standard C1 - All Timber Products - Preservative Treatment by Pressure Processes.
- 2.2.2 To the extent possible, all shaping, dapping and drilling of timbers shall be accomplished prior to treating.
- 2.2.3 All cuts , bored holes, damage made in or suffered by treated lumber shall be carefully trimmed and then field treated by the application of two saturating coats of creosote or copper naphthenate containing at least 1% elemental copper or other approved wood treatment products as outlined in the American-Wood Preservative's Association (AWPA) Standard M4. All holes bored in treated material shall be field treated in such a manner that the entire surface of the hole receives thorough penetration. All countersunk recesses for bolts which would form pockets to retain water shall be treated as for cuts and then filled with suitable mastic after the bolt is placed.
- 2.3 Unless otherwise specified in the plans, timber guard rails (tie spacers) shall be new and shall have minimum exterior dimensions of four (4) inches by eight (8) inches.
- 2.4 Shims greater than three (3) inches in thickness shall be new, hardwood with a minimum width of twelve (12) inches and the depth required. The length shall be sufficient to provide proper bearing for the supported item without the use of adjacent shims.
- 2.5 Shims less than three (3) inches in thickness shall be new, marine grade plywood with a minimum width of 12 inches. The length shall be sufficient to provide proper bearing for the supported item without the use of adjacent shims. No more than three shims may be stacked to achieve the required height.
- 2.6 Unless otherwise specified in the plans, timber walkway and handrail installation shall match the existing construction with the following minimum requirements:
- 2.6.1 Timber walkway support timbers shall be new with minimum exterior dimensions matching the bridge tie dimension and with a length allowing for eight feet six inches (8' 6") of clearance from track centerline to the inside face of the handrail. Walkway supports shall be fastened to both stringer chords with  $\frac{3}{4}$  inch washer head drive spikes or hook bolts as appropriate.
- 2.6.1.1 Where the bridge ties are structural, four (4) inch by tie depth walkway support timbers, spaced to carry the walkway load, may be used to support the walkway in lieu of long structural ties.



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- 2.6.2 Timber walkway planking for use with support spaced at every fourth bridge tie shall be new with minimum exterior dimensions of two (2) inches by eight (8) inches and shall match the existing walkway construction and dimensions as closely as possible. Walkway planks shall be fastened to the walkway supports with ½ inch by five (5) inch lag screws.
- 2.6.3 Timber handrail, knee rail, toe rail, and bracing planking for use with support spaced at every fourth bridge tie shall be new with nominal exterior dimensions of two (2) inches by six (6) inches and shall match the existing walkway construction and dimensions as closely as possible. Handrail planks shall be fastened to the walkway supports with ½ inch by five (5) inch lag screws.
- 2.6.4 Timber handrail posts shall be new with nominal exterior dimensions of four (4) inches by four (4) inches and shall match the existing walkway construction and dimensions as closely as possible. Handrail posts shall be fastened to the walkway supports with at least two (2) ½ inch through bolts with lock nuts.
- 2.7 Unless otherwise specified in the plans, steel walkway and handrail components shall be new, commercial off-the-shelf materials. Contractor shall provide Engineer with catalog cuts of the proposed materials for approval.
  - 2.7.1 Walkway surfaces shall be of bar grate material fastened to the walkway supports with dome head drive spikes.
  - 2.7.2 Handrail posts shall be of galvanized steel angle material with an outstanding element to provide vertical support. Handrail posts shall be fastened to the walkway supports with ½" by five (5) inch.
  - 2.7.3 Handrail cable shall be 3/8 inch galvanized wire rope anchored to the handrail posts with 3/8 inch u-bolts.
- 2.8 Rail for inner guard rails shall be relay of reasonable quality and straightness.
  - 2.8.1 If the guard rail is 5 inches or more in height it shall not be more than 2 inches lower than the running rails.
  - 2.8.2 If the guard rail is less than 5 inches in height it shall not be more than 1 inch lower than the running rails.
  - 2.8.3 The guard rail shall be supplied with matching four or six hole joint bars with sufficient bolts to fully bolt the joints.
- 2.9 Rail anchors shall be new Unit spring type to match the base of the running rail.
- 2.10 Track spikes shall be new 5/8" x 6" and meet the requirements of Part 2 – Track Spikes of Chapter 5 – Track of the AREMA Manual.
- 2.11 Unless otherwise specified in the plans, fasteners shall meet the following minimum requirements:
  - 2.11.1 Malleable iron castings shall conform to current ASTM Specifications, designation A 47, Grade 35018, with minimum yield point of 35,000 psi.
  - 2.11.2 Cast iron shall conform to ASTM Specifications, designation A48, Class No. 30.
  - 2.11.3 Rolled steel plates, bars and shapes shall conform to ASTM Specifications, designation A36.
  - 2.11.4 Cast steel shall conform to ASTM Specifications, designation A27, Grade 65-35, full annealed with minimum yield point of 33,000 psi.
  - 2.11.5 Nails, boat spikes and drift bolts shall be made of square or round rolled steel. Where special heads are not specified, the manufacturer's standard heads will be acceptable.





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- Nails used for fastening timbers shall be of a type having grooved, barbed or otherwise deformed shanks for greater holding power.
- 2.11.6 Through bolts shall be made of  $\frac{3}{4}$  inch A307 rolled steel with U.S. standard square or hexagon heads and nuts to match, unless otherwise specified on the plans. The use of threaded bar in lieu of bolts is to be avoided.
  - 2.11.7 Cast washers, such as Lewis Bolt and Nut Company's WSHMI or equivalent, shall be made of malleable or cast iron. The outside diameter shall not be less than  $3\frac{1}{2}$  times the diameter of the bolt on which it is used. The diameter of the hole shall be  $\frac{1}{8}$  inch larger than the diameter of the bolt.
  - 2.11.8 Plate washers, such as Lewis Bolt and Nut Company's WFF4H or equivalent, shall be made of rolled steel. The outside diameter shall be not less than  $3\frac{1}{2}$  times the diameter of the bolt on which it is used. The diameter of the hole shall be  $\frac{1}{8}$  inch larger than the diameter of the bolt.
  - 2.11.9 Dome Head Drive Spikes, such as Lewis Bolt and Nut Company's SDH4N or equivalent, Washer Head Drive Spikes, such as Lewis Bolt and Nut Company's SWH2M or equivalent, and steel drive dowels and spikes with spirally grooved shanks shall be made of  $\frac{3}{4}$  inch rolled steel. Heads for lag screws shall be U.S. standard unless otherwise specified.
  - 2.11.10 Drift pins shall be made of  $\frac{3}{4}$  inch rolled steel of the length and shape specified on the plans.
  - 2.11.11 Hook Bolts shall be made of  $\frac{3}{4}$  inch A307 rolled steel with a two inch head such as Lewis Bolt and Nut Company's HK2H2 or equivalent with a  $\frac{3}{4}$  inch Nylon Insert Lock Hex Nut such as Lewis Bolt and Nut Company's NFHN or equivalent unless otherwise specified on the plans.
- 2.12 Tie pads shall formed of randomly-dispersed cotton, rayon, nylon, or other approved fibers mixed with a rubber compound. The average fiber content shall be not less than 40%. The tensile strength shall be at least 850psi perpendicular to grain and 1030 psi parallel to grain. The Durometer hardness shall be at least 90 shore A type. The compressive strength shall be not less than 10,000 psi.
- 2.13 Contractor is solely responsible for delivering all material to the project site.
- 2.14 Storage and Handling:
- 2.14.1 All material shall be handled to avoid structural damage or unnecessary disfiguring.
  - 2.14.2 Timber treated with preservatives should be handled with extreme care in unloading and assembling to avoid damage to the timber which would expose untreated wood. These materials shall be preferably handled with rope slings. Sharp-pointed bars, peavies, hooks, tongs or similar tools shall not be used, except as approved by the Engineer.
  - 2.14.3 Timber should be stored on evenly spaced blocks to minimize ground contact and to prevent warping or permanent-set.
  - 2.14.4 Materials should be stored at the site in a neat manner at proper clearance to operated tracks.
  - 2.14.5 Hardware received at the job site should be protected from corrosion by storing under cover or by a protective coating.



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- 2.14.6 Care should be exercised to prevent fires in material held in storage. The ground underneath and in the vicinity of piling and lumber should be kept clear of all weeds, rubbish and combustible material.
- 2.14.7 Treated lumber should be close-stacked in a manner that will prevent long timbers or preframed material from sagging or becoming crooked.
- 2.15 Contractor shall be responsible for ensuring that all material meets the requirements as identified in the applicable paragraphs of the Contract Documents.
- 2.16 Final acceptance of the material shall be based upon satisfactory performance in the field.

### 3 SUBMITTALS

- 3.1 Prior to the start of work, Contractor shall submit a timber procurement plan for approval by Engineer. This plan shall provide detailed information on Contractor's proposed material and shall include:
  - 3.1.1 The species and grade of timber proposed.
  - 3.1.2 Details of the proposed treating of the material.
- 3.2 Prior to the start of construction, Contractor shall submit a bridge deck construction plan for approval by Engineer. This plan shall provide detailed information on Contractor's proposed means and methods and shall include the following minimum information:
  - 3.2.1 Contractor's proposed means and methods.
  - 3.2.2 Name and experience of personnel in responsible charge of the bridge deck construction.
  - 3.2.3 Roster of proposed equipment.
  - 3.2.4 Means of access for the personnel, equipment and material to the work location.
  - 3.2.5 Method of restoring preservative treatment for any wood exposed during the work. This includes saw cuts for fitting timber, holes bored to accommodate fasteners, and wood fibers damaged in handling and installation.
  - 3.2.6 Procedures for accommodating existing power lines, fiber optic and other utilities on the project site.
- 3.3 Prior to start of work, Contractor shall submit catalog cuts of all commercial off the shelf components and hardware for approval by Engineer.
- 3.4 Unless the tie dimensions are specifically called out in the Plans, Contractor shall submit a tie deck layout plan for approval by the Engineer. This plans shall include such details as tie dimensions, spacing, dapping, superelevation, guard rails, fasteners, and all other information specific to the bridge deck being installed.
- 3.5 Upon completion of timber construction, Contractor shall submit to Engineer a complete and accurate record of the work performed.

### 4 EXECUTION

- 4.1 Workmanship shall be of the best quality performed by competent bridge carpenters. All framing shall be true and exact. No blocking or shimming will be permitted except as provided herein.
- 4.2 The Work must be planned and performed by the Contractor in such a manner as to continually maintain the bridge in a condition that it is at least safe for ten (10) miles per hour train traffic at the end of each work window.
- 4.3 Upon completion of the work, all surplus material or material salvaged from an existing structure shall be delivered to, and be neatly stacked in, a location designated by the Engineer. Material that is



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not salvageable, along with other refuse shall be properly disposed of by contractor. The premises shall be left in a clean, neat and orderly condition.

4.3.1 In no case shall any material be left within 200 feet of the bridge, upstream of the bridge, or within 15 feet of track centerline.

### 4.4 Standard Plans:

4.4.1 Unless otherwise specified in the Plans, the Work of bridge deck construction shall be in accordance with the following standard plans found in Chapter 7 of the AREMA Manual:

4.4.1.1 Figure 7-A3-60. Floor Plan for Open-Deck Trestles

4.4.1.2 Figure 7-A3-69. Walk and Handrail – Open-Deck Trestles

4.4.2 Where the existing construction is more conservative in design and function than these standard plans, the work of bridge deck construction shall replicate the existing construction.

### 4.5 Bridge Tie Installation:

4.5.1 Unless otherwise specified in the Plans, bridge ties shall be positioned perpendicular to the track centerline and be spaced with a nominal clear distance of four (4) inches in accordance with the Plans.

4.5.1.1 Unless otherwise specified in the Plans, the first five ties at each end of the bridge shall be spaced tightly together to form a solid deck.

4.5.2 Bridge ties shall be laid with a uniform line with the left side, when looking in the direction of increasing mileposts, or the inside of curves, being the line side of the tie deck.

4.5.3 Every second bridge tie shall be fastened to the stringers as follows:

4.5.3.1 For timber stringers, each end of the bridge tie shall be fastened to the outside stringer ply with a  $\frac{3}{4}$  inch washer head drive spike that achieves a minimum of five (5) inches of penetration into the stringer.

4.5.3.2 For steel stringers, each end of the bridge tie shall be fastened to the stringers with a  $\frac{3}{4}$  inch hook bolt equipped with a malleable washer and lock type nut.

4.5.3.3 Holes for the fasteners shall be predrilled.

4.5.4 Ties installed on the rivet or bolt heads of built-up girders shall have the fasteners re-tightened after passage of ten revenue trains or once the new ties have set down on the girder flange.

### 4.6 Guard Timber Installation:

4.6.1 Guard timbers shall be framed in accordance with the plans and laid to line and uniform top surface along both sides of the tie deck at the ends of the ties where full bearing can be maintained.

4.6.2 Guard timbers shall be fastened to each tie with three quarter ( $\frac{3}{4}$ ) inch by ten (10) inch washer head drive spikes.

4.6.3 Holes for the drive spikes shall be predrilled at the third points of the guard timber width and at the centerline of every tie. The holes in the guard timber shall alternate sides of the timber with every tie.

### 4.7 Rail Installation:



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- 4.7.1 Where the scope of work calls for Contractor to furnish and install new rail, tie plates shall be double shouldered with minimum dimensions of 7 ¾ by 14 inches.
- 4.7.2 Where the scope of work calls for contractor to reuse existing rail, contractor shall acquire minimum 7 ¾ by 14 inch plates from Railroad before installing rail.
- 4.7.3 When specified in the plans tie pads shall be used under every tie plate. The size of tie pad shall conform to the tie plate used.
- 4.7.4 Rail shall be spiked to the ties at standard gage of 56 ½ inches,  $\pm$  1/16 inch, using 5/8 by six inch cut spikes. Each plate shall have two inside spikes and one outside spike. The field side spikes shall be on same sides of the tie.
- 4.7.5 Unless specified in the Plans the spiking pattern shall be as follows:
  - 4.7.5.1 In curves greater than two (2) degrees and less than four (4) degrees each plate shall have an additional plate holding spike on the field side.
  - 4.7.5.2 In curves over 4 degrees each plate shall have an additional plate holding spike on the gage side.
- 4.8 Rail Anchoring:
  - 4.8.1 On open-deck bridges, Contractor shall box anchor all ties fastened to the spans.
  - 4.8.2 On open-deck bridges with welded rail, Contractor shall box anchor every tie for 200 feet on each approach to the bridge.
  - 4.8.3 On open-deck bridges with jointed rail, Contractor shall box anchor every second tie for 200 feet on each approach to the bridge.
- 4.9 Inner Guard Rail Installation:
  - 4.9.1 Unless specified in the Plans inner guard rail shall be installed on all bridges where structural elements of the bridge extend above top of rail (i.e. through plate and through truss) or where foundation elements of the bridge extend beyond the footprint of the bridge deck and walkways (i.e. tower legs).
  - 4.9.2 Where required, the guard face of inner guard rails shall be installed 10 inches inside of the running rails and shall extend for a distance of 50 feet either side of the structure to be protected. On the approaches the guard rails shall be installed towards the center of the track to facilitate surfacing of the last approach tie.
  - 4.9.3 The guard rails shall converge to a point over a distance of five feet at each end.
  - 4.9.4 If manufactured guardrail ends are not available, Contractor may manufacture guard rail ends by removing the web of the guard rail for a distance of six inches and bending the ball of the rail down to form a ramp.
  - 4.9.5 Tie plates need not be used under inner guard rails unless the deck was already so equipped.
  - 4.9.6 Inner guard rails shall be spiked to with two rail holding spikes where the gage spikes are on the same side of the tie and the field spikes are on the opposite side of the tie.
  - 4.9.7 Inner guard rails shall be fully bolted.
  - 4.9.8 Where the existing guard rail is incomplete, Contractor shall secure from Railroad those additional materials required to complete the guard rail installation.
- 4.10 Walkway and Handrail Installation



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- 4.10.1 Unless specified in the Plans, or replacing in kind, new walkways shall be of metal walkway and hand rail materials. Walkway surfaces shall be of commercial bar grate material and handrails shall be of wire rope supported on metal posts.
- 4.11 Framing of Timber Walkways and Handrails:
  - 4.11.1 All cutting, framing, and boring of timbers to be treated, shall be done before treatment unless otherwise shown on the plans or specifically permitted by the Engineer.
  - 4.11.2 Each walkway support timber or long bridge tie supporting the walkway shall be fastened to the stringers regardless of the bridge tie fastening pattern.
  - 4.11.3 All cuts or abrasions made in or suffered by treated lumber shall be carefully trimmed and then field treated by the application of three saturating coats of hot creosote oil. All holes bored in treated material shall be field treated with hot creosote oil under pressure, using an approved type of bolt hole treater, in such a manner that the entire surface of the hole receives thorough penetration. All countersunk recesses for bolts which would form pockets to retain water shall be treated as for cuts and then filled with a suitable mastic after the bolt is placed.
  - 4.11.4 Refuge platforms, water barrels platforms, footwalks, motor car set-off or other special platforms shall be in accordance with the plans.
- 4.12 Connections:
  - 4.12.1 All fastenings, including bolts, dowels, lag screws, timber connectors and other type fastenings shall be new placed in accordance with the plans, drawn up securely, and on completion of the structure shall be retightened.
    - 4.12.1.1 All bolts shall only have one washer at each end of the bolt.
    - 4.12.1.2 Bolts shall be tightened until the washer begins to sink into the timber and the bolts shall be trimmed to be within 2" of the surface.
    - 4.12.1.3 Drift pins shall be driven flush.
  - 4.12.2 Holes for machine bolts shall be bored the same size as the nominal diameter of the bolt or rod used.
  - 4.12.3 Holes for lag screws shall be bored with a bit not larger than the body of the screw at the base of the thread.
  - 4.12.4 Screw-type fastenings shall be screwed into place for the entire length of the fastening. Driving with a maul or other tool will not be permitted.
  - 4.12.5 All holes shall be treated after drilling.
  - 4.12.6 Bolts and fasteners shall be liberally coated with preservative paste prior to installation.
  - 4.12.7 All unused holes shall be plugged with treated hardwood dowels that will fit snugly and be flush to the hole surface.
  - 4.12.8 Existing bolts within the panels adjacent to the component replacement shall be tightened upon completion of the component replacement.

## 5 MEASUREMENT AND PAYMENT

- 5.1 Measurement:
  - 5.1.1 Bridge deck construction shall be measured for payment on the basis of individual ties installed and accepted into the finished structure up to the estimated quantity given in the Proposal.



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- 5.1.2 Guard timber installation is considered incidental to bridge deck construction and shall not be measured for payment.
- 5.1.3 Inner guard rail installation is considered incidental to bridge deck construction and shall not be measured for payment.
- 5.1.4 Walkway and handrail installation shall be measured for payment on the basis of lineal foot of walkway and handrail installed and accepted into the finished structure up to the estimated quantity given in the Proposal.
- 5.1.5 Installation of hardware is considered incidental to bridge deck construction and shall not be measured for payment.
- 5.1.6 Timber and other material disposal is considered incidental to bridge deck construction and shall not be measured for payment.
- 5.2 Payment
  - 5.2.1 Bridge deck construction shall be paid for at the contract unit price for the bid item Bridge Tie Installation and shall constitute full payment for all labor, equipment, materials and supervision necessary to construct the bridge deck in accordance with the Plans and Specifications.
  - 5.2.2 Walkway and handrail construction shall be paid for at the contract unit price for the bid item Walkway Installation and shall constitute full payment for all labor, equipment, materials and supervision necessary to construct the walkway and handrail in accordance with the Plans and Specifications.

END OF SECTION

### REVISION HISTORY

The following is the revision history for this standard:

5/1/2013 – Initial Issue



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535	Internal Structural Repairs	5/2/2013	New
536	External Structural Repairs	5/2/2013	New
537	Concrete Sealing	5/1/2013	New
538	Waterproofing		
540	Timber Construction	5/2/2013	New
550	Steel Construction	5/2/2013	New
552	Bearing Construction	5/2/2013	New
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### 600 MATERIAL SPECIFICATIONS

END OF SECTION