SPECIAL SPECIFICATION

4385

Railroad Bridge Construction

1. Description. Construct Railroad bridges following the recommendations in the applicable Chapters of the current American Railway Engineering and Maintenance Association (AREMA) manual as modified by the joint Burlington Northern Santa Fe Railway (BNSF) and Union Pacific Railroad (UPRR) Common Standards.

Bridge construction associated with this project requires installation of pre-cast concrete and pre-stressed concrete bridge components on driven H-pile bents. The bridges are double track structures that are designed as independent single track structures. The Contractor has the option of the building sequence to use, subject to approval by the Engineer.

A. Reference Standards. Any items not covered specifically in this specification are to be in accordance with American Railway Engineering and Maintenance of Way Association (AREMA) Standards and recommended practices, subject to the approval of the Engineer.

In addition, drive piling in accordance with Item 404, “Driving Piling” and furnish and place steel piling in accordance with Item 407, “Steel Piling.”

Furnish and erect materials in accordance with Item 425, “Precast Prestressed Concrete Structural Members” and AREMA 2007 Publications, Chapter 8 and other applicable Sections of the manual.

B. Substructure. The substructure was designed using a driven H-pile (H14x89) bent arrangement utilizing 3 and 4 piles per bent. Refer to the plans for the details of the design and bracing. The design is based on the current BNSF/ UPRR prestressed concrete standard design dated April 17, 2007. The layout has been slightly modified to fit the double track configuration. The double track bridge is designed as two independent single track structures which are thus independent of each other for train loading.

1. Geotechnical. A geotechnical investigation and report was prepared by HVJ Associates and the applicability of their recommendations were compared to established Railroad construction procedures and the design loading used in the preparation of the bridge plans for this project. Refer to the plans and pertinent specifications for more details.

2. Piles. Piles are capped with a precast concrete component and welded to the piles utilizing an embedded steel plate in the bottom of the cap. Refer to the plans for details.
Drive the piles as skin friction piles to a capacity of 100 tons with a minimum pile tip elevation of 20 ft. below the expected scour elevation.

Permanently mark the finished pile length from the pile tip to the cutoff on the outside face of the pile flange approximately 6 in. below the cut off and ensure it is clearly visible.

3. **Temporary shoring.** When temporary shoring is required, provide to the Engineer for approval, a design and procedure for installation before beginning work.

4. **Utilities.** Verify the location of the utilities and pipelines before starting excavation and pile driving activities. Notify any parties that could be affected by the construction activities and follow their requirements for safety and proper protection of their specific facility. Monitor the site conditions and cease operations if damage to utilities or operational railroads is observed and immediately notify the affected parties including the Engineer.

5. **Existing Structure Removal.** Remove the existing timber bridge components as shown on the plans. Transport this material to an appropriate disposal site. Remove timber piles to at least the elevation indicated on the plans. Submit the demolition plan to the Engineer for approval and ensure it contains provisions to provide for safe train operation on a continual basis.

6. **Drainage.** Maintain adequate drainage throughout the construction phases and protect against runoff hazards and damage to railroad operations.

C. **Superstructure.** The design is based on the current BNSF/UPRR prestressed concrete standard design dated April 17, 2007. The layout has been slightly modified to fit the double track configuration. Each bridge location is configured as two separate structures, so each structure will only support one track.

Exercise caution to avoid damage to the bridge deck surfaces and other concrete and bridge components during transportation, storage, construction, unloading of ballast, placement of the track, and surfacing of the track across the bridge.

D. **Submittals.** Before beginning the bridge construction work, provide the following to the Railroad's Engineer:

1. **Schedule of Construction Sequencing Plan.** Submit for the Engineer’s approval, a “Schedule of Construction Sequencing Plan.” Include in the plan a comprehensive section on the procedure to minimize interruption to train operations. Also, include a section on the procedure to be followed during construction that will maintain a safe operation in the vicinity of utilities and a procedure to monitor the facilities during construction.

2. **Utility permits and notifications.** Submit to the Engineer the documentation for the required permits and notifications of the affected utilities and pipelines.

3. **Equipment List.** Submit for approval by the Engineer, list of equipment that will be used in driving the piles. This includes specifications of the hammer energy rating and a procedure to establish the actual energy being delivered to the pile.
4. **Contractor Safety.** Submit to the Engineer, documentation that employees or others who enter the bridge construction site have received the Federal Railroad Administration (FRA) Part 214, “Railroad Workplace Safety” training and are currently eligible to work on or near active railroad tracks and bridges.

Follow the Port Terminal Railroad Association’s (PTRA) applicable rules for live track operations and the direction of the railroad flagmen during construction.

5. **Materials.** Before installation or use, submit for approval by the Engineer documentation of material certifications and compliance to the plans and specifications.

2. **Materials.**

   A. **Steel Components and H-Piles.** Provide Steel H-piles that are A588 HP14x89 as defined in the American Institute of Steel Construction current Manual of Steel Construction. Provide other steel sections sized per plan design. Use American Society for Testing and Materials (ASTM) A588 atmospheric corrosion-resistant high-strength low-alloy structure steel components including, but not limited to, pile splices and bracing.

   1. **Painting.** Steel is to be unpainted.

   2. **Welding.** Use the Shielded Metal Arc Welding (SMAW) or Flux Core Arc Welding (FCAW) process per the American Welding Society (AWS) D1.5. Acceptable filler metal is E7018 Electrode for SMAW and E70T-A or E70T-5 electrode for FCAW. For other acceptable electrodes, refer to AWS D1.5.

   B. **Concrete Components.** Provide precast/prestressed concrete products by using a pre-approved Railroad (UPRR, BNSF) supplier. Submit shop drawings and written documentation that the supplier is currently on the BNSF and UPRR approved supplier list for concrete bridge components.

   Ensure that the concrete material, placing, and curing are in accordance with the requirements specified in the specifications for precast/prestressed concrete products and the current edition of the AREMA Chapter 8 Manual for Railway Engineering.

   The minimum acceptable compressive strength of the girder concrete is 6000 psi after 28 days and 4500 psi at the transfer of the prestressing force. The minimum acceptable compressive strength of the ballast retainer concrete is 4000 psi after 28 days.

   Use air entraining agents that are in accordance with the requirements specified in the current edition of ASTM C260. Ensure that the total entrained air content is 6% +/- 1% by volume of the plastic concrete.

   Use concrete aggregate that is in accordance with the requirements specified in the current edition of ASTM C33. Use course aggregate Size No. 67.

   C. **Prestressing Strand.** Provide a prestressing strand that is a 0.5 in. diameter, seven-wire, uncoated, low-relaxation strand which is in accordance with the requirements
specified in ASTM A416. Use a strand with an ultimate tensile strength of 270 ksi. Provide an initial prestress of 31,000 lbs. per strand unless noted otherwise.

Test the strand in accordance with the Precast/Prestressed Concrete Institute (PCI) recommendations (Moustafa Method) and ensure it is certified by the fabricator as having bond characteristics to satisfy the prediction equations for transfer and development length given in the AREMA Manual for Railway Engineering.

An alternate strand pattern which has the same eccentricity as the pattern shown on the plans and is better suited for the manufacturer’s facility will be considered. However, the manufacturer must submit plans and computations for the Engineer’s approval before casting.

D. Reinforcing Steel. Provide deformed reinforcing steel, per ASTM A615 Specifications and that meets Grade 60 requirements, except that bars crossing curb joints are to be to current ASTM A1035 Specifications. Bars required to meet ASTM A1035 are noted in the bending diagrams.

Ensure fabrication of reinforcing steel conforms to Chapter 7 of the Concrete Reinforcing Steel Institute (CRSI) Manual of Standard Practice. Dimensions of bending details out to out of bar.

Block the reinforcing steel to the proper location and securely wire it against displacement. Use plastic protection reinforcing supports, meeting CRSI Specifications, Chapter 3, Class 1. Do not tack weld reinforcing bars.

Meet the current AREMA requirements for the minimum concrete cover of reinforcing steel.

E. Handling and Storage of Material. Exercise care when transporting girders and other concrete components to eliminate damage or undesired stress development. Secure the components against movement during transportation. Handle and store concrete components in a manner that will insure that damage will not occur.

Store prestressed concrete girders level and support them at a maximum of 3 ft. from each end.

If slings are used in lieu of the lift loops, exercise caution to avoid damage to the ballast retainer and position the slings a maximum of 3 ft. from the girder ends.

3. Construction.

A. Equipment. Submit an equipment list to the Engineer for approval. The list is to include equipment and procedures to be used in driving the steel H-Pile. Include the following in the Contractor’s on-track equipment list: Make, Model, Year, and Primary Activity of the Equipment.

Equipment operators must be certified to operate on-track equipment in accordance with FRA, PTRA, and Port of Houston Authority (PHA) requirements. Be prepared to provide proof of certification if required by the Railroad.
1. **Pile Driving Equipment.** Provide a pile driving hammer that is rated at sufficient energy capacity to economically achieve the design pile capacity of 100 tons. Use a single acting diesel hammer with a minimum hammer energy rating of 35,000 ft-lbs. or approved equal. Use a ram weight of approximately 5000 lbs. Pile driving equipment with excessive energy rated will not be approved.

B. **Substructure Installation.** Refer to the applicable design plan sheets for further information.

1. **Pile Installation.** Drive piles to the required vertical or batter alignment, within the tolerance indicated on the plans.

   Drive piles to 100 ton capacity and a minimum pile tip elevation of 20 ft. below expected scour elevation. If sufficient pile penetration (of 20 ft. below expected scour elevation) cannot be obtained without damaging the pile or pile tip, submit an alternate construction plan to be approved by the Engineer. The minimum pile length used to make up a pile for driving is 15 ft. Shorter sections will be allowed to make up distance between the finished driven pile elevation and the cutoff elevation.

   The design pile capacity of 100 tons will be established by “Blow Count per Unit Length Method” with the pile driving hammer working at the optimum operating cycles and hammer drop. The Engineering News Record pile driving equation may be used to determine the required blow count criteria. Alternate methods may be submitted for approval by the Engineer.

   Monitor the pile driving equipment on a continuous basis to insure proper operation and that the required energy rating is being delivered to the pile.

   Make pile cut offs and splice joints square and beveled per the plans.

2. **Tolerances.** If allowable tolerances are exceeded and the Engineer requires corrective action, submit for approval by the Engineer, a structural analysis and proposed corrective action, signed and sealed by a Texas Licensed Professional Engineer. Refer to the plans for driving tolerances.

3. **Pile Driving Record.** Maintain a pile driving record and make it available to the Engineer for review and approval before a pile is determined to have obtained its required capacity of 100 tons. Mark piles in 1 ft. increments and subdivide as needed, starting at the pile tip so it is clearly visible for record keeping during the driving operation. Include the following in the pile driving record:

   - A running record of blow counts per foot.
   - Record of blow counts by the inch for the last 10 ft. of driving or as determined by the Engineer.
   - Length of the pile as measured from the tip to the cut off.
   - Record of the approximate operating energy being delivered by the hammer with the number of cycles per minute.
• The Engineer or his representative will witness the driving of each pile and will approve the establishment of the desired capacity and pile tip elevation.

• Format the pile driving record for inclusion into the as-built plans.

4. **Welds.** Ensure welds are performed by certified structural welders and in compliance with the AWS D1.5 requirements. Ensure pile splices conform to the plans and specifications or alternates approved by the Engineer.

C. **Superstructure Manufacture.** Refer to the plans for the details of the design criteria. Use production procedures and dimensional tolerances for the manufacture of precast, prestressed girders that are in accordance with the AREMA Manual for Railway Engineering and the Precast/Prestressed Concrete Institute’s current Manual MNL 116 for Quality Control.

1. **Tolerances.** The tolerance locating lifting hoops is +/-1/2 in.

   Recess the ends of strands to a depth of 1 in. fill and finish. Fill such recesses and minor spalls to the plan dimensions using an epoxy bonding compound and grout.

   Form surfaces in a manner which produces a smooth and uniform appearance without rubbing or plastering. Unless otherwise noted, chamfer exposed edges of 90 degrees or less is to be 3/4 in. by 3/4 in. Ensure uniform surfaces have a smooth finish free of float and trowel marks.

2. **Ballast Retainer.** Cast the ballast retainer after the girder has been removed from the form.

3. **Fabricator Responsibilities.** Ensure the fabricator stencils the fabricator’s name, date of fabrication, piece mark, and lift weight.

   Confirm with the fabricator that placement of the ballast retainer fastening points for handrails are properly located to match the galvanized handrail assemblies.

   The fabricator is responsible for developing the lifting loop anchorage detail to provide a safety factor of 4 on the working load. Ensure the detail is proof-tested with the test results kept on file by the fabricator and available for inspection.

4. **Lifting Loops.** Do not recess the area around the lifting loops. After final placement of the concrete component, move the lifting hoops flush with the concrete surface. Exercise caution to insure the concrete surface is not damaged.

4. **Measurement.**

   A. **Steel H-Piling.** This Item will be measured by the foot of acceptable piling in place determined from the pile driving record and measured from pile tip to cap cutoff. The pile length will be rounded to the nearest foot. This will include necessary steel bracing per plans. No allowance for cutoff pile sections will be allowed.
B. **Double Track.** This Item will be measured by the foot of Concrete Double Track Bridge as constructed and installed in accordance with this specification and as shown on the plans for each bridge location.

1. **Cotton Patch Bayou Double Track Structure.** This includes but is not limited to the civil, drainage, and concrete components to the following list:
   - Prestressed 15 ft. Girders – 4 outside girders.
   - Prestressed 15 ft. Girders – 4 inside girders.
   - Abutment cap and end wall – 2 RH and 2 LH units.
   - Wing wall assemblies – 2 RH and 2 LH units.
   - Intermediate bent cap – 2 units.
   - Miscellaneous handrail units, bearing pads, and girder restraints – lump sum for double track structure.

2. **Glenmore Ditch Double Track Structure.** This includes but is not limited to the civil, drainage, and concrete components to the following list:
   - Prestressed 30 ft. Girders – 4 outside girders.
   - Prestressed 30 ft. Girders – 4 inside girders.
   - Abutment cap and end wall – 2 RH and 2 LH units.
   - Wing wall assemblies – 2 RH and 2 LH units.
   - Intermediate bent cap – 2 units.
   - Miscellaneous handrail units, bearing pads, and girder restraints.

5. **Payment.**

A. **Steel H-Piling.** The work performed and materials furnished in accordance with this Item and measured as provided under “Measurement” will be paid for at the unit price bid for the specified size and weight of “Railroad Bridge Construction (Steel H-Piling),” complete and in place, of piles driven to the required capacity of 100 tons. The work performed, incidental material furnished, equipment, labor, tools, and other incidentals are subsidiary to the pertinent pile installation.

B. **Double Track.** The work performed and materials furnished in accordance with this Item and measured as provided under “Measurement” will be paid for at the unit price bid for “Railroad Bridge Construction,” complete and in place, of the bridge specified. These prices are full compensation for fabricating, furnishing, handling, and installing each double track bridge as measured above, including labor, tools, equipment, and incidentals necessary to complete the work. This payment is additive to the pay item “Railroad Bridge Construction.” Bridges will not be deducted from the track
construction. The work performed, incidental material furnished, equipment, labor, tools, and other incidentals subsidiary to pertinent bridge construction.