

# Special Specification 4142

## Timber Rail Bridge Rehabilitation with Warranty



### 1. DESCRIPTION

This Item will govern the rehabilitation of timber trestle bridges. Timber Bridge Rehabilitation includes, but is not limited to, furnishing and installing timber bracing, timber stringers and timber helper stringers, timber piles, timber posts, timber bulkheads, timber caps, timber sills, timber frame bents, and other incidentals as included in the plans or specified herein. Construction of proposed rehabilitation work must be in accordance with AREMA Chapter 7, part 4, Construction and Maintenance of Timber Structures.

### 2. MATERIALS

All structural timber materials specified herein and otherwise proposed for use in rehabilitation or replacement must be stress-grade and must conform to American Railway Engineering and Maintenance-of-Way Association "Manual for Railway Engineering's most current edition, (AREMA) Chapter 7, Part 1. All material should be handled to avoid structural damage or unnecessary disfiguring. All structural lumber and timber must be marked with a certified lumber grade stamp provided by any agency certified by the American Lumber Standards Committee (ALSC). Timber must be select structural southern pine, or approved equivalent, in accordance with Southern Pine Inspection Bureau grading rules and free of wane. Timber must be seasoned and framed before treatment.

#### Construction

#### 2.1. Timber and Lumber.

2.1.1. For structures, all material delivered to the project must bear a grade stamp and have a grading certificate. The grade stamp and grading certificate will not constitute final acceptance of the material. The Engineer may reject any or all of the timber or lumber that does not comply with the Specifications or has been damaged during shipment or upon delivery. The grading certificate will be issued by either the grading bureau whose stamp is shown on the material, or by the lumber mill. The certificate must include the following:

- Name of the entity performing the grading;
- The grading rules being used;
- Name of the person doing the grading, with current certification;
- Signature of the responsible official;
- Date the lumber was graded; and,
- Grade, dimensions, and quantity of the timber or lumber

2.1.2. All creosote and pressure preservative treatments for materials must conform to current American Wood Preservers Association (AWPA) Standards and AREMA Guidelines Chapter 7, part 1.12. All timber that has been treated with preservatives should be handled with extreme care in unloading and assembling to avoid damage to the timber which would expose untreated wood.

2.1.3. These materials should be handled with wire rope slings. Sharp-pointed bars, peavies, hooks, tongs or similar tools should not be used, except as approved by the Engineer.

2.1.4. All cutting, framing, and boring of treated timbers must be done before treatment insofar as is practicable.

2.1.5. All cuts and holes required in the field for treated piles or timbers, and all abrasions, after being carefully trimmed, must be treated by means of CCA or ACA water-borne salt treatment. Unfilled holes, after being

treated, must be plugged with a filler approved by the Engineer. All countersunk recesses for bolts which would form pockets to retain water must be treated as cuts and then filled with an approved filler after the bolt is placed.

- 2.1.6. Whenever forms or temporary braces are attached to treated timber with nails or spikes, the hole should be filled by driving galvanized nails or spikes flush with the surface or plugging holes as required for cuts and holes, the adequacy of which will be subject to approval by the Engineer.
- 2.1.7. Materials must be stored in designated materials storage areas shown in the plans or at the job site where SW3P measures are in effect. Materials must be stored in a neat manner at proper clearance away from tracks.
- 2.1.8. 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 cleared of all weeds, rubbish and combustible material.
- 2.1.9. Treated lumber should be close-stacked in a manner that will prevent long timbers or pre-framed material from sagging or becoming distorted.
- 2.1.10. Untreated lumber should be open-stacked on suitable skids at least 1 ft. above the ground and above possible high water; it should be piled in a manner to shed water and to prevent warping.
- 2.1.11. When required, it should be protected from the weather by suitable covering. Piling should be stacked in a manner to prevent excessive bending.
- 2.1.12. Hardware received at the job site should be protected from corrosion by storing under cover or by a protective coating.

## 2.2. Piles.

- 2.2.1. All pile material must 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. Pile retrofits must be cut to the dimensions shown in the plans or as approved by the Engineer.
- 2.2.2. Replacement piles may be of any species which will satisfactorily withstand pile driving techniques and support the superimposed loads. Piles may be selected from the First Class category, either being friction piles or end-bearing piles. Piles must be furnished per the plans or as directed.
- 2.2.3. Pile Sizes
  - 2.2.3.1. The ratio of "out of round" maximum to minimum diameter at the butt or the tip of any pile must not exceed 1:2.
  - 2.2.3.2. All circumference measurements must be taken under the bark.
  - 2.2.3.3. The circumference at the butt may not exceed the circumference at 3 ft. from the butt by more than 8 in.
  - 2.2.3.4. Circular or square treated timber used to post piles must conform to above provisions.
- 2.2.4. Quality
  - 2.2.4.1. All piles will 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.
  - 2.2.4.2. A pipe or stump rot hole in cedar and cypress may not be more than 1-1/2 in. in diameter. Cypress piles may have peck aggregating not more than the limitation for holes.

- 2.2.4.3. Piles may have sound turpentine scars that are not damaged by insects.
- 2.2.4.4. Piles will be cut above the ground swell and have continuous and reasonably uniform taper from butt to tip.
- 2.2.5. Knots
  - 2.2.5.1. Sound knots must be no larger than one sixth the circumference of the pile located where the knot occurs. Cluster knots should be considered as a single knot, and the entire cluster cannot be greater in size than permitted for a single knot. The sum of knot diameters in any 1 ft. length of pile must not exceed one third of the circumference at the point where they occur. Knots will be measured at a right angle to the length of the pile.
  - 2.2.5.2. Piles may have unsound knots not exceeding half the permitted size of a sound knot, provided that the unsoundness extends to not more than a 1-1/2 in. depth, and that the adjacent areas of the trunk are not affected.
- 2.2.6. Heartwood. Piles specified to have high heartwood content for use without preservative treatment must exhibit a heartwood diameter at the butt not less than eight-tenths the diameter of the pile.
- 2.2.7. Sapwood. Piles for use with preservative treatment must have enough sap wood to meet minimum penetration requirements.
- 2.2.8. Close Grain. If close grain is specified for softwood piles, the pile must show on the butt end not less than 6 annual rings per inch, measured radially over the outer 3 in. of the cross section. Douglas-fir and pine averaging from 5 to 6 annual rings per inch will be accepted as the equivalent of close grain with one-third or more summerwood.
- 2.2.9. Cutting and Trimming. Butts and tips of piles must be sawed square with the axis of the piles and must not be out of square by more than 1/10 in. per inch of diameter. All knots and limbs should be trimmed or smoothly cut flush with the surface of the pile.
- 2.2.10. Peeling.
  - 2.2.10.1. Piles are classified according to the extent of bark removal as clean-peeled, rough-peeled or unpeeled.
  - 2.2.10.2. Clean peeled piles require the removal of all outer bark. In addition, at least 80 percent of the inner bark, well distributed over the surface of the pile should be removed. Piles for preservative treatment must have no strip of inner bark larger than 1 by 6 in.
  - 2.2.10.3. Rough-peeled piles require the complete removal of all outer bark.
  - 2.2.10.4. Unpeeled piles require no bark removal.
  - 2.2.10.5. The sapwood of piles should not be unnecessarily scarred or injured in the process of peeling.
  - 2.2.10.6. Piles for preservative treatment should be clean-peeled.
- 2.2.11. Lengths. Piles must be furnished cut to any of the following lengths as specified: 16 ft. to 40 ft., incl., in multiples of 2 ft.; over 40 ft. in multiples of 5 ft. Individual piles may exceed the length specified as much as plus 1 ft. in piles 40 ft. and shorter, and plus 2 ft. in piles over 40 ft.
- 2.2.12. Twist of Grain. Spiral grain must not exceed 180 degrees of twist when measured over any 20 ft. section of the pile.
- 2.2.13. Special Requirements.

- 2.2.13.1. A straight line from the center of the butt to the center of the tip of First-Class piles should lie entirely within the body of the pile. First-Class piles should be free from short crooks that deviate more than 2-1/2 in. from straightness in any 5 ft. length.
- 2.2.13.2. Holes less than 1/2 in. in average diameter should be permitted in First-Class piles provided that the sum of average diameters of all holes in any square foot of pile surface does not exceed 1-1/2 in., and the depth of any hole does not extend to more than 1-1/2 in., and provided that holes are not caused by decay or marine borer attack. Internal holes or damage to the cross-section (bearing) surfaces caused by decay, marine borers, or insects are not permitted.
- 2.2.13.3. Splits in First-Class Piles must not be longer than the butt diameter. The length of any shake or combination of shakes, measured along the curve of the annual ring, must not exceed one-third the circumference of the butt of the pile.
- 2.2.14. **Fasteners.**
- 2.2.14.1. Bolts, dowels, washers, and other hardware, including nails, should be black or galvanized as specified in the plans, but if not so specified should be galvanized when used in treated timber structures. Fasteners must meet the requirements of AREMA Chapter 7, section 1.6. All bolts must be ASTM A307A or approved equal. All nuts must be ASTM A563A hex or approved equal. Use gae lock fastener nut or approved equal on all bolts.
- 2.2.14.2. Malleable Iron. Malleable iron castings must conform to current ASTM Specifications, designation A47, Grade 35018, with minimum yield point of 35,000 psi.
- 2.2.14.3. Rolled Steel. Rolled steel plates, bars and shapes must conform to current ASTM Specifications, designation A36.
- 2.2.14.4. Nails, Spikes and Drift Bolts. Nails, spikes and drift bolts should 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 should be of a type with grooved, barbed or otherwise deformed shanks for greater holding power.
- 2.2.14.5. Through Bolts. Through bolts should be made of rolled steel with U.S. standard square or hexagon heads and nuts unless otherwise specified on the plans.
- 2.2.14.6. Washers. Round plate washers should be made of rolled steel. Finish may be black or hot dip galvanized.
- 2.2.14.7. Lag Screws. Lag screws, including steel drive dowels and spikes with spirally grooved shanks, should be made of rolled steel. Heads for lag screws should be U.S. standard unless otherwise specified.
- 2.2.14.8. Special Castings. Special castings, including such parts as gib plates, angle blocks, etc., should be made of cast or malleable iron. They must be true to pattern, free from wind, without injurious defects and of the size and shape specified on the plans.
- 2.2.14.9. Cap - Stringer Fasteners. Cap-stringer fasteners should be made of rolled steel of the size and shape specified on the plans.
- 2.2.14.10. Metal Joint Connectors.
- 2.2.14.11. Spiked grids, cast shear plates and claw plates should be made of malleable iron.
- 2.2.14.12. Split rings, toothed rings, bull dog types, pressed shear plates and clamping plates should be made of rolled steel.
- 2.2.14.13. Metal joint connectors must be of the size and design specified in the plans.

- 2.2.14.14. Brace Plates and Washer Plates. Brace plates and washer plates or similar items should be made of rolled steel to the size and details specified on the plan.
- 2.2.15. **Shims.**
- 2.2.15.1. Shim stock should be made of steel plate and must be of adequate size and shape to allow full-bearing on the cap, stringer, or other surface as called for in the plans.
- 2.2.16. **Steel Stringers**
- 2.2.16.1. Provide steel stringers meeting the requirements of TxDOT Standard Specification Item 442 "Metal for Structures."
- 2.2.16.1. Steel stringers should be made to the size and details specified on the plans where required for replacement of 2timber stringers.
- 2.2.17. **Gage Side Guard Rails**
- 2.2.17.1. Railroad bridge gage side guard rails must be new or secondhand materials of the rail section specified by the plans or as provided by the railroad.

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### 3. **EQUIPMENT**

All on-track equipment used in connection with the project must comply with Federal Railroad Administration regulations contained in 49 CFR 214 Subpart D, Roadway Maintenance Machine Safety. All other equipment must be in a safe and good operating condition and is subject to inspection and the approval for use by the Engineer.

#### 3.1. **Construction and Work Methods**

##### 3.1.1. General

3.1.1.1. The Contractor will fully inform the Engineer of the construction methods he proposes to use, the adequacy of which will be subject to the approval of the Engineer.

3.1.1.2. Concurrence on the part of the Engineer of any proposed construction methods or approval of equipment does not relieve the Contractor of the responsibility for the safety or correctness of the methods, the adequacy of his equipment or from carrying out the work in full accordance with the contract.

3.1.1.3. The following codes, regulations, reference standards, and specifications apply to work included in this section:

- AREMA, Manual for Railway Engineering
- Applicable referenced ASTM Specifications
- Track Safety Standards of the Federal Railroad Administration (FRA).
- Standard Drawings supplied by the Engineer.
- Special Specifications contained herein.

3.1.1.4. Any Items not covered specifically herein must be in accordance with AREMA Standards and recommended practices subject to the approval of the Engineer. Construction must adhere to all TxDOT Standard Plans and FRA requirements.

3.1.1.5. The following review/approval milestones will be monitored during the project:

3.1.1.5.1. Timber Rail Bridge Rehabilitation.

Review, approve and coordinate the timber rail bridge rehabilitation and construction to assure compliance with TxDOT requirements.

- 3.1.1.6. All workers employed in the project or supervising the project must have been certified according to Federal Railroad Administration regulations contained in 49 CFR 214, Subpart C, Roadway Worker Protection. All workers employed in the project or supervising the project will wear appropriate Personal Protective Equipment at all times, including hard hat, steel toed work boots, safety glasses, and reflective work vests or clothing. FRA Bridge Worker Safety rules (49 CFR 214 Subpart B) will apply to all workers performing bridge work.
- 3.1.1.7. When the Contractor desires to occupy any space above the top of rail within the horizontal distance of 10 ft. of either side of the centerline of any track, measured at right angles to the track centerline, it will be necessary that he obtain authority from Texas Pacifico Transportation (TXPF) with at least 24 hr. advanced notice. The authority will be requested and granted according to TXPF operating rules, and the Contractor will fully comply with all instructions issued by TXPF in regards to occupancy of the track. If, in the judgment of TXPF, flagmen are required, they will be furnished at TXPF's expense.
- 3.1.1.8. The Contractor will require his employees, agents, or subcontractors to comply with any and all instructions or warnings of TXPF's flagmen as to clearance for the passage of trains.
- 3.1.1.9. All scaffolding, materials, and equipment used in the Contractor's operations must, at all times, be maintained at a clearance from the tracks as approved by the Engineer, except when working within the limits of authority granted to occupy the tracks.
- 3.1.1.10. TxDOT's acceptance of timber bridge rehabilitation and its appurtenances which have been built will be based on the Engineer's written statement that construction and construction materials have met TxDOT standards.
- 3.1.1.11. Unless otherwise specified in the plans or as directed by the Engineer, all removed materials will become the property of the contractor. All removed materials and debris must be removed from TxDOT property and disposed of in a manner approved by the Engineer.
- 3.1.1.12. All timber bridge construction and materials must be in accordance with AREMA guidelines and recommended practices, unless otherwise specified by the Engineer.
- 3.1.1.13. Contractor will provide all labor and equipment necessary to complete the installation of permanent and temporary work as indicated in the plans and specified herein. The Contractor will employ only competent bridge carpenters for timber bridge rehabilitation activities. All their work must be true and exact. Nails and spikes will be driven with just enough force to leave heads flush with wood surfaces.
- 3.1.1.14. Workmanship on metal parts must comply with requirements for steel structures.
- 3.1.2. Timber Framing
  - 3.1.2.1. General.
    - 3.1.2.1.1. All lumber and timber must be accurately cut and framed to a close fit in such a manner that the joints will have even bearing over the entire contact surface. Mortises must be true to size for their full depth and tenons should fit snugly. No shimming will be permitted in making joints nor will open joints be accepted.
  - 3.1.2.2. Bracing.
    - 3.1.2.2.1. Sash and sway bracing, tower bracing and girts should bear firmly against the piles or timber to which it is secured. When necessary, filler will be placed to avoid bending the bracing more than 1 in. out of line when the bracing bolts or other fastenings are drawn up tight. Built-up fillers will not be permitted. Each filler will be

a single piece of treated lumber of like kind to that in the brace with a width of not less than 6 in. and a length of not less than 12 in.

- 3.1.2.2.2. When pile bents are taller than 10-ft., each must be braced transversely and every other pair will be braced longitudinally. No single cross-bracing will brace more than 20-ft. of vertical distance on the piles. If the vertical distance exceeds 20-ft., more than 1 cross-bracing will be used. Each brace end must be bolted through the pile, post, or cap with a bolt 3/4- in. in diameter or larger. Other brace/pile intersections must be bolted or boat-spiked as shown in the plans or as approved by the Engineer. Cross-bracing must lap both upper and lower caps and must be bolted to the caps or sills at each end.
- 3.1.2.3. Timber Curbs.
  - 3.1.2.3.1. Timber curbs must be of the size and length shown in the plans. Replacement timber curbing for damaged curbs must be of the same size and length of the existing timber curb or as approved by the Engineer.
  - 3.1.2.3.2. Timber curbs must be connected to bridge cross ties by bolts that are 3/4-in. minimum diameter. Timber curb bolts must extend completely through the timber curb and cross ties and be secured on the opposite end using flat washers, lock washers, and nuts.
  - 3.1.2.3.3. Timber curbs must be secured to the bridge deck near every fourth cross tie using a 3/4-in. minimum diameter bolt wherever possible. Timber curb securement bolts must extend completely through the timber curb and bridge deck and be secured on the opposite end using timber washers (malleable iron) and nuts.
  - 3.1.2.4. Stringers should be sized to provide a uniform depth and even bearing at bent supports and must be assembled in the structure according to plans. Stringers to bear on ½ the width of cap dimension with their ends placed as close as practical to adjacent stringers. Stringers should be sized at bearings and must be placed in position so that knots near edges will be in the top portions of the stringers.
  - 3.1.2.5. Posts in framed bents must be sawed to proper length (vertical or batter) and must have an even bearing on caps and sills. Posts must be fastened to pedestals according to the plans or as directed by the Engineer.
  - 3.1.2.6. Bulkheads at the ends of trestles should be of sufficient height and width to properly retain the shoulders of embankments and to provide a berm sufficient to prevent loss of embankment from beneath the bulkhead.
    - 3.1.2.6.1. When necessary, special anchorage, such as bulkhead piles buried in the embankment, will be provided to support the bulkhead.
  - 3.1.2.7. Caps must rest uniformly across the tops of posts or piles. Cap ends will be aligned evenly. Each cap will be fastened with drift bolts as indicated in the plans. The bolt must be approximately in the center of the pile or post or as shown in the plans.
  - 3.1.2.8. Sills should have a true and even bearing on foundation piles, timber grillages, mats, compacted backfill material or pedestals. When possible, all earth should be removed from contact with sills so that there will be free air circulation around them.
  - 3.1.2.9. Timber connectors must be of the types specified on the plans. Split-ring and shear-plate connectors must 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, will be forced into the contact surfaces of the timbers joined by means of proper pressure tools; all connectors of these types at any joint must be embedded simultaneously and uniformly.
- 3.1.3. Pile Posting, or replacing defective portions of piles should be performed as shown in the plans:
  - 3.1.3.1. Posting of the outside piles should not be permitted on bridges on curves where bents exceed 12 ft. in height or on tangents where bents are over 23 ft. in height.

- 3.1.3.2. The number of piles that may be posted in a bent are:
- 1 pile in a four pile bent,
  - 2 piles in a five pile bent,
  - 3 piles in a six or seven pile bent.
  - No more than two posted piles can be adjacent to each other.
- 3.1.3.3. Where piles are decayed at the top, they may be cut off and double capped as shown in the plans or as approved by the Engineer.
- 3.1.3.4. A single pile may be corbelled.
- 3.1.3.5. Treatment. The tops of piles and any other disturbed treated areas must be treated with a treatment approved by the Engineer after the pile cut-off has been made.
- 3.1.3.6. Pile Covering.
- 3.1.3.6.1. The treated pile cut-off may be covered with plastic cement used with or without a fabric layer and topped with a 1/4 in. neoprene pad if desired.
- 3.1.3.6.2. The use of roofing material or sheet metal to cover the cut-off will not be permitted.
- 3.1.3.7. Placing Caps. Caps must be placed while the piles are held in correct position. Where drift bolts are used for making the connection, the caps and tops of piles must be bored the same diameter as the drift bolt and to a depth of 3 in. less than its length.
- 3.1.3.8. Bracing. Piling should not be trimmed or cut to facilitate the framing of sway or longitudinal bracing. Where necessary, filler blocks must be used between the pile and brace to establish the bracing in a true plane.
- 3.1.4. Fastenings, including bolts, dowels, lag screws, timber connectors and other type fastenings will be placed in accordance with the plans, drawn up securely, and on completion of the structure must be retightened. Holes should be bored:
- 3.1.4.1. For drift pins and dowels — with a bit 1/16-in. smaller in diameter than the pins and dowels.
- 3.1.4.2. For truss rods or bolts — with a bit the same diameter as the rods or bolts.
- 3.1.4.3. For lag screws — in 2 parts:
- with the shank lead hole the same diameter as the shank and as deep as the unthreaded shank is long; and
  - with the lead hole for the threaded part approximately  $\frac{2}{3}$  of the shank diameter unless otherwise shown in the plans.
- 3.1.4.4. A washer of the size and type specified should be used under all bolts and nuts which would otherwise come in contact with wood.
- 3.1.4.5. Screw-type fastenings must be screwed into place for the entire length of the fastening. Driving with a maul or other tool will not be permitted.
- 3.1.4.6. Countersinking should be done whenever smooth faces are required. Recesses formed for countersinking will be painted with ACA or CCA water-borne salt treatment and, after the bolts are screwed in place, must be filled with an approved filler.
- 3.1.4.7. All bolts must be checked by burring the threads after the nuts have been finally tightened. Vertical bolts must have nuts on the lower ends.

- 3.1.5 Steel stringers will be used to replace timber stringers when required by the plans.
- 3.1.5.1 Steel stringers will be secured to the timber bridge caps as shown by the plans or as approved by the engineer.
- 3.1.6 Gage side guard rails must not be higher than the running rails.
- 3.1.6.1 Gage side guard rails must consist of two rails, each spaced 10 in. from the inside of the adjacent running rail.
- 3.1.6.2 Gage side guard rails must be spiked on both sides of each rail to every bridge tie and spliced with fully-bolted joint bars.

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#### **4. WARRANTY**

The Contractor will warrant the rehabilitation of timber rail bridges for a period of 12 months. The warranty period begins with the Engineer's acceptance of the work.

##### **4.1. Contractor Inspections.**

- 4.1.1. Conduct initial and semiannual inspections of the Timber Rail Bridge Rehabilitation. Conduct initial inspections within 7 days after work is completed. For Timber Rail Bridge Rehabilitation provide sketches that indicate which components were replaced, their lengths and cross-section dimensions, vertical and transverse dimensions relative to the top of rail and centerline of track, their timber grades, and any other pertinent as built information. Document each inspection with digital photography, and provide a copy of the digital photographs and sketches to the Department. Provide sketches, written reports and digital photographs within 30 days after the inspection. Conduct warranty inspections according to Special Specification 7498, Section 4.A.
- 4.1.2. Replace or repair work or materials that do not meet contract specifications. Notify the Engineer at least 72 hrs. before beginning any warranty work. If deficiencies are not corrected within 30 days of a semiannual inspection, the warranty period for the entire project will be extended on a daily basis starting on the 31st day until the deficiency is corrected.
- 4.1.3. A Department representative will be present for all semiannual inspections. Provide written notification to the Engineer no later than 15 days before any semiannual inspection.

##### **4.2. Department Inspections.**

- 4.2.1. The Contractor will be provided a copy of any inspections. The Contractor will be notified in writing of any needed warranty work between semiannual inspections. Within 30 days of receipt of the written notification, replace or repair work or materials that do not meet the contract specifications. If deficiencies are not corrected within 30 days of receipt of the written notification, the warranty period for the entire project will be extended on a daily basis starting on the 31st day until the deficiency is corrected. If it is found that the requirements are met, provide documentation of the evaluation results to the Engineer for review and his decision per Article 5.2, "Engineer as Referee."
- 4.2.2. The Department will conduct a final warranty inspection before the expiration of one year of the project completion date. The Contractor will be notified in writing of the final warranty inspection date at least 15 days before the inspection to allow the Contractor to be present. Absence or failure to witness the final inspection will not delay the final inspection. If the final warranty inspection identifies any work or materials that do not meet the contract specifications, replace or repair the work or materials to meet the contract specifications. Failure to repair or replace work or materials that do not meet the contract specifications, will result in the warranty period for the entire project being extended on a daily basis until all work or materials meet performance requirements and have passed an initial inspection.

- 4.2.3. The Contractor will be considered in default during the warranty period if:
- any warranty work is not completed within 60 days of an initial, semiannual or final warranty inspection, or receipt of written notice from the Engineer identifying an area of concern;
  - any warranty work from the initial inspection is not conducted within 7 days of when the work or materials are installed;
  - fails to perform the semiannual inspection or provide the report documenting the inspection; or,
  - submits a false or misleading report regarding whether the work or materials meet the performance requirements.
- 4.2.4. The warranty bond will insure the proper and prompt completion of required warranty work following completion of the project, including payments for all labor performed, equipment and material used in accordance with the specifications.

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## 5. MEASUREMENT

- 5.1. Timber Curbs will be measured by each timber curb removed and installed as one unit complete and in place.
- 5.2. Timber Stringers will be measured by each timber stringer removed and installed as one unit complete and in place.
- 5.3. Timber Helper Stringers will be measured by each timber helper stringer removed and installed as one unit complete and in place.
- 5.4. Pile Posting will be measured by each timber post removed and installed as one unit complete and in place.
- 5.5. Shims will be measured by each shim removed and installed as one unit complete and in place.
- 5.6. Caps will be measured by each timber cap removed and installed as one unit complete and in place.
- 5.7. Sills will be measured by each timber sill removed and installed as one unit complete and in place.
- 5.8. Bulkheads will be measured by each timber bulkhead removed and installed as one unit complete and in place.
- 5.9. Bracing will be measured by linear foot of timber bracing removed and installed as one unit complete and in place.
- 5.10. Replace Bent will be measured by each bent or abutment removed and installed as one unit complete and in place.
- 5.11. Steel Stringers will be measured by each steel stringer installed as one unit complete and in place.
- 5.12. Gage Side Guard Rails will be measured by linear foot installed.

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## 6. PAYMENT

- 6.1. Payment for "Timber Curbs" will be made at the unit price bid for "Timber Curbs". This price will be full compensation for furnishing and installing timber curbs; all transportation; storage; labor, equipment, tools, treating, removal of defective components, erecting, installation, fasteners and for all other materials, tools, equipment, and incidentals necessary to complete the work.

- 6.2. Payment for "Timber Stringers" will be made at the unit price bid for "Timber Stringers". This price will be full compensation for furnishing and installing timber stringers; all transportation; storage; labor, equipment, tools, treating, removal of defective components, erecting, installation, fasteners and for all other materials, tools, equipment, and incidentals necessary to complete the work.
- 6.3. Payment for "Timber Helper Stringers" will be made at the unit price bid for "Timber Helper Stringers". This price will be full compensation for all transportation; storage; labor, equipment, tools, treating, removal of defective components, erecting, installation, fasteners and for all other materials, tools, equipment, and incidentals necessary to complete the work.
- 6.4. Payment for "Pile Posting" will be made at the unit price bid for "Pile Posting". This price will be full compensation for furnishing and installing piles; all transportation; storage; labor, equipment, tools, treating, removal of defective components, erecting, installation, fasteners and for all other materials, tools, equipment, and incidentals necessary to complete the work.
- 6.5. Payment for "Shims" will be made at the unit price bid for "Shims". This price will be full compensation for furnishing and installing shims; all transportation; storage; labor, equipment, tools, treating, removal of defective components, erecting, installation, fasteners and for all other materials, tools, equipment, and incidentals necessary to complete the work.
- 6.6. Payment for "Caps" will be made at the unit price bid for "Caps". This price will be full compensation for furnishing and installing caps; all transportation; storage; labor, equipment, tools, treating, removal of defective components, erecting, installation, fasteners and for all other materials, tools, equipment, and incidentals necessary to complete the work.
- 6.7. Payment for "Sills" will be made at the unit price bid for "Sills". This price will be full compensation for furnishing and installing sills; all transportation; storage; labor, equipment, tools, treating, removal of defective components, erecting, installation, fasteners and for all other materials, tools, equipment, and incidentals necessary to complete the work.
- 6.8. Payment for "Bulkheads" will be made at the unit price bid for "Bulkheads". This price will be full compensation for furnishing and installing bulkheads; all transportation; storage; labor, equipment, tools, treating, removal of defective components, erecting, installation, fasteners, and for all other materials, tools, equipment, and incidentals necessary to complete the work. Excavation, backfill, temporary special shoring, timber piling, and special anchorages will not be paid for directly but will be subsidiary to this item.
- 6.9. Payment for "Bracing" will be made at the unit price bid for "Bracing". This price will be full compensation for furnishing and installing bracing; all transportation; storage; labor, equipment, tools, treating, removal of defective components, erecting, installation, fasteners and for all other materials, tools, equipment, and incidentals necessary to complete the work.
- 6.10. Payment for "Replace Bent" will be made at the unit price bid for "Replace Bent". This price will be full compensation for furnishing and installing bents; all transportation; storage; labor, equipment, tools, treating, removal of defective components, erecting, installation, fasteners and for all other materials, tools, equipment, and incidentals necessary to complete the work.
- 6.11. Payment for "Steel Stringers" will be made at the unit price bid for "Steel Stringers". This price will be full compensation for furnishing and installing stringers; all transportation; storage; labor, equipment, tools, treating, removal of defective components, erecting, installation, fasteners, and for all other materials, tools, equipment, and incidentals necessary to complete the work.
- 6.12. Payment for "Gage Side Guard Rails" will be made at the unit price bid for "Gage Side Guard Rails". This price will be full compensation for removal and reinstalling existing gage side guard rails on timber bridge; all transportation; storage; labor, equipment, tools, treating, removal of defective components, erecting, installation, fasteners and for all other materials, tools, equipment, and incidentals necessary to complete the work.