

# Special Specification 4170

## Timber Rail Bridge Construction



1.	<b>DESCRIPTION</b>	<p>This Item shall govern the construction and rehabilitation of timber trestle bridges. Timber Bridge Construction and Rehabilitation includes, but is not limited to, furnishing and installing timber piles, timber posts, timber sills, timber bracing, timber caps, timber frame bents, timber stringers, timber bulkheads, and other incidentals as included in the plans or as specified herein.</p>
1.1.	<b>Pile (Complete)</b>	<p>A load-bearing continuous timber pile, including the foundation, extending up to the cap. For new construction, pile (complete) installation includes any drilling, backfill necessary to found the pile as well as any steel shims.</p>
1.2.	<b>Pile (Post)</b>	<p>A load-bearing continuous timber pile extending the existing foundation up to the cap. For rehabilitation, a pile (post) includes the installation of a timber sill on good foundation material as well as any necessary steel shims.</p>
1.3.	<b>Sill</b>	<p>Timber beams placed between pile foundations and pile postings that act as footings in the structure.</p>
1.4.	<b>Shim</b>	<p>Steel plates placed between structural members to allow for proper bearing and load transfer.</p>
1.5.	<b>Bracing</b>	<p>Horizontal, longitudinal, and diagonal timber bracing members connecting piles in a bridge structure.</p>
1.6.	<b>Cap</b>	<p>Transverse bridge support structure between the piles and the deck spanning the width of the bridge.</p>
1.7.	<b>Bent</b>	<p>Transverse bridge support structures including abutments. For rehabilitation, a bent includes a continuous sill, all piles posted, all bracing, and a continuous cap. For new construction, a bent includes all piles installed, all bracing, and a continuous cap.</p>
1.8.	<b>Stringer</b>	<p>Parallel timber beams placed axially on top of the bridge caps to support the deck ties for open deck bridges or the deck structure for ballast deck bridges.</p>
1.9.	<b>Curb</b>	<p>Timber tie spacers on open deck bridges placed on the outside of the rail that act as curbs along the track.</p>

- 1.10. **Bulkhead**  
Ballast containment and support structure at or near a bridge abutment. The bulkhead shall include the entire backwall and two wingwall structures if present or necessary.
- 1.11. **Backwall**  
Ballast containment and support structure at or near a bridge abutment within the envelope of the track or bridge structure. Backwalls shall include the entire backwall or individual timbers, as shown on the plans.
- 1.12. **Wingwall**  
Ballast containment and support structure at or near a bridge abutment that extends beyond the envelope of the track and bridge structure. Wingwalls shall include the entire wingwall or individual timbers, as shown on the plans.

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## 2. MATERIALS

All materials specified herein must conform to American Railway Engineering and Maintenance-of-Way Association "Manual for Railway Engineering" current edition, (AREMA). All material shall be handled to avoid structural damage or unnecessary disfiguring. All structural lumber and timber shall 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.

- 2.1. **Timber and Lumber.**
- 2.1.1. For structures, all material delivered to the project shall bear a grade stamp and have a grading certificate. The grade stamp and grading certificate shall not constitute final acceptance of the material. The Engineer may reject any or all the timber or lumber that does not comply with the Specifications or has been damaged during shipment or upon delivery. The grading certificate shall be issued by either the grading bureau whose stamp is shown on the material, or by the lumber mill. The certificate shall 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 shall conform to current American Wood Preservers Association (AWPA) and AREMA Standards. All timber that has been treated with preservatives shall 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 shall be handled with rope slings. Sharp-pointed bars, peavies, hooks, tongs or similar tools shall not be used, except as approved by the Engineer.
- 2.1.4. All cutting, framing, and boring of treated timbers shall 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, shall be treated by means of CCA or ACA water-borne salt treatment. Unfilled holes, after being treated, shall be plugged with a filler approved by the Engineer. All countersunk recesses for bolts which would form pockets to retain water shall 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 shall 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 shall be subject to approval by the Engineer.
- 2.1.7. Materials shall be stored in designated materials storage areas shown in the plans or at the job site where SW3P measures are in effect. Materials shall be stored in a neat manner at proper clearance from tracks.
- 2.1.8. Care shall be exercised to prevent fires in material held in storage. The ground underneath and near piling and lumber shall be cleared of all weeds, rubbish and combustible material.
- 2.1.9. Treated lumber shall be close-stacked in a manner that will prevent long timbers or pre-framed material from sagging or becoming crooked.
- 2.1.10. Untreated lumber shall be open-stacked on suitable skids at least 1 foot above the ground and above possible high water; it shall be piled in a manner to shed water and to prevent warping.
- 2.1.11. When required, it shall be protected from the weather by suitable covering. Piling shall be stacked in a manner to prevent excessive bending.
- 2.1.12. Hardware received at the job site shall be protected from corrosion by storing under cover or by a protective coating.
- 2.1.13. Piles.
- 2.1.13.1. All pile material 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. Pile retrofits shall be cut to the dimensions shown in the plans or as approved by the Engineer.
- 2.1.13.2. 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 by the Engineer.
- 2.1.13.3. Pile Sizes
- The ratio of "out of round" maximum to minimum diameter at the butt or the tip of any pile shall not exceed 1:2.
  - All circumference measurements must be taken under the bark.
  - The circumference at the butt may not exceed the circumference at 3 feet from the butt by more than 8 inches.
- 2.1.13.4. Quality
- All piles 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.
  - A pipe or stump rot hole in cedar and cypress may not be more than 1-1/2 inches in diameter. Cypress piles may have peck aggregating not more than the limitation for holes.
  - Piles may have sound turpentine scars that are not damaged by insects.
  - Piles shall be cut above the ground swell and have continuous and reasonably uniform taper from butt to tip.
- 2.1.13.5. Knots
- 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, and the entire cluster cannot be greater in size than permitted for 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. Knots shall be measured at a right angle to the length of the pile.

- 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 inch depth, and that the adjacent areas of the trunk are not affected.

- 2.1.13.6. Heartwood. Piles specified to have high heartwood content for use without preservative treatment shall exhibit a heartwood diameter at the butt not less than eight-tenths the diameter of the pile.
- 2.1.13.7. Sapwood. Piles for use with preservative treatment shall have sufficient sap wood to meet minimum penetration requirements.
- 2.1.13.8. Close Grain. If close grain is specified for softwood piles, the pile shall show on the butt end not less than 6 annual rings per inch, measured radially over the outer 3 inches of the 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.
- 2.1.13.9. Cutting and Trimming. Butts and tips of piles shall be sawed square with the axis of the piles and shall not be out of square by more than 1/10 inch per inch of diameter. All knots and limbs shall be trimmed or smoothly cut flush with the surface of the pile.
- 2.1.13.10. Peeling.
- Piles are classified according to the extent of bark removal as clean-peeled, rough-peeled or unpeeled.
  - 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 shall be removed. Piles for preservative treatment shall have no strip of inner bark larger than 1 by 6 inches.
  - Rough-peeled piles require the complete removal of all outer bark.
  - Unpeeled piles require no bark removal.
  - The sapwood of piles shall not be unnecessarily scarred or injured in the process of peeling.
  - Piles for preservative treatment shall be clean-peeled.
- 2.1.13.11. Lengths. Piles shall be furnished cut to any of the following lengths as specified: 16 feet to 40 feet, incl., in multiples of 2 feet; over 40 feet in multiples of 5 feet. Individual piles may exceed the length specified as much as plus 1 foot in piles 40 feet and shorter, and plus 2 feet in piles over 40 feet.
- 2.1.13.12. Twist of Grain. Spiral grain shall not exceed 180 degrees of twist when measured over any 20 foot section of the pile.
- 2.1.13.13. Special Requirements.
- A straight line from the center of the butt to the center of the tip of First-Class piles shall lie entirely within the body of the pile. First-Class piles shall be free from short crooks that deviate more than 2-1/2 inches from straightness in any 5 foot length.
  - Holes less than 1/2 inch in average diameter shall 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 inch, and the depth of any hole does not extend to more than 1-1/2 inch, 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.
  - Splits in First-Class Piles shall not be longer than the butt diameter. The length of any shake or combination of shakes, measured along the curve of the annual ring, shall not exceed one-third the circumference of the butt of the pile.

## 2.2. Fasteners.

- 2.2.1.1. Bolts, dowels, washers, and other hardware, including nails, shall be black or galvanized as specified in the plans, but if not so specified shall be galvanized when used in treated timber structures.
- 2.2.1.2. Malleable Iron. Malleable iron castings shall conform to current ASTM Specifications, designation A47, Grade 35018, with minimum yield point of 35,000 psi.
- 2.2.1.3. Rolled Steel. Rolled steel plates, bars and shapes shall conform to current ASTM Specifications, designation A36.
- 2.2.1.4. Nails, Spikes and Drift Bolts. 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.
- 2.2.1.5. Through Bolts. Through bolts shall be made of rolled steel with U.S. standard square or hexagon heads and nuts unless otherwise specified on the plans.
- 2.2.1.6. Washers. Round plate washers shall be made of rolled steel. Finish may be black or hot dip galvanized.
- 2.2.1.7. Lag Screws. Lag screws, including steel drive dowels and spikes with spirally grooved shanks, shall be made of rolled steel. Heads for lag screws shall be U.S. standard unless otherwise specified.
- 2.2.1.8. Special Castings. 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.
- 2.2.1.9. Cap - Stringer Fasteners. Cap-stringer fasteners shall be made of rolled steel of the size and shape specified on the plans.
- 2.2.1.10. Metal Joint Connectors.
- 2.2.1.11. Spiked grids, cast shear plates and claw plates shall be made of malleable iron.
- 2.2.1.12. Split rings, toothed rings, bull dog types, pressed shear plates and clamping plates shall be made of rolled steel.
- 2.2.1.13. Metal joint connectors shall be of the size and design specified in the plans.
- 2.2.1.14. Brace Plates and Washer Plates. Brace plates and washer plates or similar items shall be made of rolled steel to the size and details specified on the plan.
- 2.2.2. Shims.
- 2.2.2.1. Shim stock shall be made of steel plate and shall be of adequate size and shape to allow full-bearing on the cap, stringer, or other surface as called for in the plans.
- 2.3. **Steel Stringers**
- 2.3.1. Steel stringers shall meet the requirements of TxDOT Standard Specification Item 442 "Metal for Structures."
- 2.3.2. For the replacement of timber stringers, steel stringers shall be made as specified by the plans.
- 2.4. **Bulkheads, Backwalls, Wingwalls**
- 2.4.1. Timber backwalls and wingwalls shall be constructed with timbers measuring a minimum of 8"x16"x16' unless otherwise shown on the plans or as directed by the Engineer.

- 2.4.2. Wingwalls shall extend a minimum of 4 feet past the track and bridge structure unless otherwise shown on the plans or as directed by the Engineer.

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### 3. EQUIPMENT

All on-track equipment used in connection with the project shall 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 the approval for use by the Engineer.

#### 3.1. Construction and Work Methods

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

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. 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.
- 3.1.2. Any Items not covered specifically herein shall 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.
- 3.1.3. All workers employed in the project or supervising the project shall have been certified according to Federal Railroad Administration regulations contained in 49 CFR 214, Subpart C, Roadway Worker Protection.
- 3.1.4. All workers employed in the project or supervising the project will wear appropriate Personal Protective Equipment, 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.
- 3.1.5. 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 regard to occupancy of the track. If, in the judgment of TXPF, flagmen are required, they will be furnished at TXPF's expense.
- 3.1.6. The Contractor shall require his employees, agents, or subcontractors to comply with all instructions or warnings of TXPF's flagmen as to clearance for the passage of trains.
- 3.1.7. All scaffolding, materials, and equipment used in the Contractor's operations shall, 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.
- 3.1.8. TxDOT's acceptance of timber rail bridge rehabilitation and its appurtenances which have been built shall be based on the Engineer's written statement that construction and construction materials have met TxDOT standards.

- 3.1.9. Unless otherwise specified in the plans or as directed by the Engineer, all removed materials shall 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.
- 3.1.10. All timber bridge construction and materials shall be in accordance with AREMA specifications and recommended practices, unless otherwise specified by the Engineer.
- 3.1.11. Contractor shall 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 shall employ only competent bridge carpenters for timber bridge rehabilitation activities. All their work shall be true and exact. Nails and spikes shall be driven with just enough force to leave heads flush with wood surfaces.
- 3.1.12. Workmanship on metal parts shall comply with requirements for steel structures.
- 3.1.13. Timber Framing
- 3.1.13.1. All lumber and timber shall 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 shall be true to size for their full depth and tenons shall fit snugly. No shimming will be permitted in making joints nor will open joints be accepted.
- 3.1.13.2. Bracing.
- Sash and sway bracing, tower bracing and girts shall bear firmly against the piles or timber to which it is 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. Each filler shall be a single piece of treated 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.
  - When pile bents are taller than 10-feet, each shall be braced transversely and every other pair shall be braced longitudinally. No single cross-bracing shall brace more than 20-feet of vertical distance on the piles. If the vertical distance exceeds 20-feet, more than 1 cross-bracing shall be used. Each brace end shall be bolted through the pile, post, or cap with a bolt 3/4-in. in diameter or larger. Other brace/pile intersections shall be bolted or boat-spiked as shown in the plans or as approved by the Engineer. Cross-bracing shall lap both upper and lower caps and shall be bolted to the caps or sills at each end.
- 3.1.13.3. Timber Curbs.
- Timber curbs shall be of the size and length shown in the plans and be uniform across a structure. Replacement timber curbing for damaged curbs shall be of the same size and length of the existing timber curb or as approved by the Engineer.
  - Timber curbs shall be connected to bridge cross ties by bolts that are 3/4-in. minimum diameter. Timber curb bolts shall extend completely through the timber curb and cross ties and be secured on the opposite end using flat washers, lock washers, and nuts.
  - Timber curbs shall 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 shall extend completely through the timber curb and bridge deck and be secured on the opposite end using timber washers (malleable iron) and nuts.
- 3.1.13.4. Stringers shall be sized to provide a uniform depth and even bearing at supports and shall be assembled in the structure according to plans. Stringers shall be sized at bearings and shall be placed in position so that knots near edges will be in the top portions of the stringers. Stringer ends shall be placed as close as practical to adjacent stringers.
- 3.1.13.5. Posts in framed bents shall be sawed to proper length (vertical or batter) and shall have an even bearing on caps and sills. Posts shall be fastened to pedestals according to the plans or as directed by the Engineer.

- 3.1.13.6. Bulkheads at the ends of trestles shall 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. When necessary, special anchorage, such as bulkhead piles buried in the embankment, shall be provided to support the bulkhead.
- 3.1.13.7. Caps shall rest uniformly across the tops of posts or piles. Cap ends shall be aligned evenly. Each cap shall be fastened with drift bolts as indicated in the plans. The bolt shall be approximately in the center of the pile or post or as shown in the plans.
- 3.1.13.8. Sills shall have a true and even bearing on foundation piles, timber grillages, mats, pedestals, or compacted backfill. When possible, all earth shall be removed from contact with sills so that there will be free air circulation around them.
- 3.1.13.9. 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.
- 3.1.14. Pile Posting, or replacing defective portions of piles shall be performed as shown in the plans:
- 3.1.14.1. Posting of the outside piles shall not be permitted on bridges on curves where bents exceed 12 feet in height or on tangents where bents are over 23 feet in height.
- 3.1.14.2. The maximum 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.
- 3.1.14.3. 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.
- 3.1.14.4. A single pile may be corbelled.
- 3.1.14.5. Treatment. The tops of piles and any other disturbed treated areas shall be treated with a treatment approved by the Engineer after the pile cut-off has been made.
- 3.1.14.6. Pile Covering.
- The treated pile cut-off may be covered with plastic cement used with or without a fabric layer and topped with a 1/4 inch neoprene pad if desired.
  - The use of roofing material or sheet metal to cover the cut-off will not be permitted.
- 3.1.14.7. Placing Caps. Caps shall 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 shall be bored the same diameter as the drift bolt and to a depth of 3 inches less than its length.
- 3.1.14.8. Bracing. Piling 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.
- 3.1.15. 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. Holes shall be bored:
- 3.1.15.1. For drift pins and dowels — with a bit 1/16-inch smaller in diameter than the pins and dowels.

- 3.1.15.2. For truss rods or bolts — with a bit the same diameter as the rods or bolts.
- 3.1.15.3. 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.
- 3.1.15.4. A washer of the size and type specified shall be used under all bolts and nuts which would otherwise come in contact with wood.
- 3.1.15.5. 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.
- 3.1.15.6. Countersinking shall be done whenever smooth faces are required. Recesses formed for countersinking shall be painted with ACA or CCA water-borne salt treatment and, after the bolts are screwed in place, shall be filled with an approved filler.
- 3.1.15.7. All bolts shall be checked by burring the threads after the nuts have been finally tightened. Vertical bolts shall have nuts on the lower ends.
- 3.1.16. 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.

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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. prior to 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 prior to 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 prior to 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 prior to 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. Pile (Complete) will be measured by the each.
- 5.2. Pile (Post) will be measured by the each.
- 5.3. Sill will be measured by the each.
- 5.4. Shim will be measured by the each.
- 5.5. Bracing will be measured by the linear foot.
- 5.6. Cap will be measured by the each.
- 5.7. Bent will be measured by the each.
- 5.8. Stringer will be measured by the each.
- 5.9. Curb will be measured by the linear foot.
- 5.10. Bulkhead will be measured by the each.
- 5.11. Backwall will be measured by the each.
- 5.12. Wingwall will be measured by the each.

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## 6. PAYMENT

The work performed and material furnished in accordance with this special specification and measured as provided under "Measurement" will be paid at the unit price bid for "Pile (Complete)"; "Pile (Post)"; "Sill"; "Shim"; "Bracing"; "Cap"; "Bent"; "Stringer"; "Curb"; "Bulkhead"; "Backwall"; "Wingwall".

Samples furnished to the Department for testing purposes will not be paid directly but are subsidiary to the items listed.

- 6.1. **Pile (Complete).** The price bid for "Pile (Complete)" is full compensation for furnishing and installing piles; all transportation; storage; labor, equipment, tools, treating, removal and disposal of existing components, erecting, installation, fasteners and for all other materials, tools, equipment, and incidentals necessary to complete the work.
- 6.2. **Pile (Post).** The price bid for "Pile (Post)" is full compensation for furnishing and installing piles; all transportation; storage; labor, equipment, tools, treating, removal and disposal of existing components, erecting, installation, fasteners and for all other materials, tools, equipment, and incidentals necessary to complete the work.
- 6.3. **Sill.** The price bid for "Sill" is full compensation for furnishing and installing sills; all transportation; storage; labor, equipment, tools, treating, removal and disposal of existing components, erecting, installation, fasteners and for all other materials, tools, equipment, and incidentals necessary to complete the work.
- 6.4. **Shim.** The price bid for "Shim" is full compensation for furnishing and installing shims; all transportation; storage; labor, equipment, tools, treating, removal and disposal of existing components, erecting, installation, fasteners and for all other materials, tools, equipment, and incidentals necessary to complete the work.
- 6.5. **Bracing.** The price bid for "Bracing" is full compensation for furnishing and installing bracing; all transportation; storage; labor, equipment, tools, treating, removal and disposal of existing components, erecting, installation, fasteners and for all other materials, tools, equipment, and incidentals necessary to complete the work.
- 6.6. **Cap.** The price bid for "Cap" is full compensation for furnishing and installing caps; all transportation; storage; labor, equipment, tools, treating, removal and disposal of existing components, erecting, installation, fasteners and for all other materials, tools, equipment, and incidentals necessary to complete the work.
- 6.7. **Bent.** The price bid for "Bent" is full compensation for furnishing and installing bents and abutments; all transportation; storage; labor, equipment, tools, treating, removal and disposal of existing components, erecting, installation, fasteners and for all other materials, tools, equipment, and incidentals necessary to complete the work.
- 6.8. **Stringer.** The price bid for "Stringer" is full compensation for furnishing and installing timber stringers; all transportation; storage; labor, equipment, tools, treating, removal and disposal of existing components, erecting, installation, fasteners and for all other materials, tools, equipment, and incidentals necessary to complete the work.
- 6.9. **Curb.** The price bid for "Curb" is full compensation for furnishing and installing "Curbs"; all transportation; storage; labor, equipment, tools, treating, removal and disposal of existing components, erecting, installation, fasteners and for all other materials, tools, equipment, and incidentals necessary to complete the work.
- 6.10. **Bulkhead.** The price bid for "Bulkhead" is full compensation for furnishing and installing bulkheads; all transportation; storage; labor, equipment, tools, treating, removal and disposal of existing components,

erecting, installation, fasteners, and for all other materials, tools, equipment, and incidentals necessary to complete the work. Excavation, backfill, temporary special shoring, timber bracing, and special anchorages will not be paid for directly but will be subsidiary to this item.

- 6.11. **Backwall.** The price bid for "Backwall" is full compensation for furnishing and installing bulkheads; all transportation; storage; labor, equipment, tools, treating, removal and disposal of existing components, erecting, installation, fasteners, and for all other materials, tools, equipment, and incidentals necessary to complete the work. Excavation, backfill, temporary special shoring, timber bracing, and special anchorages will not be paid for directly but will be subsidiary to this item.
- 6.12. **Wingwall.** The price bid for "Wingwall" is full compensation for furnishing and installing bulkheads; all transportation; storage; labor, equipment, tools, treating, removal and disposal of existing components, erecting, installation, fasteners, and for all other materials, tools, equipment, and incidentals necessary to complete the work. Excavation, backfill, temporary special shoring, timber bracing, and special anchorages will not be paid for directly but will be subsidiary to this item.