SECTION 502 - TIMBER STRUCTURE

502.01 Description. This section describes constructing timber structures and timber portions of composite structures.

502.02 Materials.

Bridge Paints 708.01
Structural Steel 713.01
Structural Timber and Lumber 714.01
Timber Preservatives 714.02
Hardware for Timber Structures 714.03

502.03 Construction.

(A) Falsework. Place falsework or centering in accordance with Subsection 503.03(B) – Falsework, Formwork, or Centering.

(B) Storage of Material. Store lumber and timber on work site in orderly piles or stacks. Open-stack untreated material on supports at least 12 inches above ground surface and in a manner to shed water and prevent warping. Close-stack treated lumber in a manner to shed water and prevent warping. Stack and strip lumber and timber to permit free circulation of air between tiers and courses. Cover material to protect from weather.

(C) Workmanship. Framing shall be true and exact. Drive nails and spikes with just sufficient force to set heads flush with surface of wood. Deep hammer marks in wood surfaces are considered evidence of poor workmanship and are sufficient cause for removal of worker who caused them. Provide workmanship on metal parts in accordance with Section 501 - Steel Structures.

(D) Treated Timber. Provide preservative treatment in accordance with contract documents.

   (1) Preservative Treatment for Timber. Treat lumber and piles in accordance with AWPA Standards and contract documents.

   (2) Handling. Handle treated timber carefully without sudden dropping, breaking of outer fibers, bruising, or penetrating surface with tools. Handle treated timber with rope slings. Do not use cant hooks, peaveys, pikes, or hooks.
(3) **Cutting, Framing, and Boring.** Cut, frame, and bore treated timbers before treatment, when practicable. Place untreated cuts, borings, or other joint framings above high-water elevation when treated timbers are to be placed in waters infested by marine borers.

(4) **Cuts and Abrasions.** Dry and remove dirt, grease, and other foreign matter from cut surfaces prior to applying preservative. Trim abrasions before covering or brush coating treated piles or timber as follows:

(a) Cover cuts and abrasions in treated piles or timbers with two applications of a mixture of 60 percent creosote oil and 40 percent roofing pitch.

(b) Brush coat cuts and abrasions in treated piles or timbers with at least two applications of hot creosote oil, and cover with hot roofing pitch.

(c) Brush two coats of concentrated salt preservatives on cut surfaces of salt-treated timber.

(5) **Bolt Holes.** Treat with creosote oil all bolt holes bored after initial treatment, using a pressure bolt-hole treater acceptable to the Engineer. After treating bolt holes, plug unfilled holes with creosoted plugs.

(6) **Temporary Attachment.** Treat as required herein for bolt holes, all holes resulting from attaching forms or temporary braces to treated lumber with nails or spikes; and fill holes by driving zinc-coated nails, spikes, or creosoted plugs flush with surface.

(E) **Untreated Timber.** In structures of untreated timber, coat following surfaces in accordance with AWPA Standard M4:

(1) Ends, tops, and contact surfaces of sills, caps, floor beams, and stringers.

(2) Ends, joints, and contact surfaces of bracing and truss members.

(3) Timber bumper surfaces and back faces of bulkheads.

(4) Other timber surfaces that are to be in contact with earth, metal, or other timber.

(F) **Treatment of Pile Heads.** After cutting and before placing caps, treat pile heads receiving caps as follows:
(1) **Treated Piles.** Protect heads of treated timber piles by following methods. Unless otherwise specified, use fabric covering method.

(a) **Zinc Covering.** Cover sawed surface with:

1. Three applications of a mixture of 60 percent creosote oil and 40 percent roofing pitch.

2. Thoroughly brush coat with three applications of hot creosote oil, and cover with hot roofing pitch.

Before placing cap, place sheet of No. 12 gage zinc on each pile head. Sheet of zinc shall be of sufficient size to project at least 4 inches beyond pile. Bend down, trim neatly, and fasten sheet of zinc to pile face with large-headed zinc-coated roofing nails.

(b) **Fabric Covering.** Cover pile heads with alternate layers of hot pitch and waterproofing cotton fabric conforming to ASTM D 173. Use four applications of pitch and three layers of fabric. Cut fabric large enough to cover pile top and fold down at least 6 inches along all sides of pile. Fold down fabric neatly over pile and secure with large headed zinc-coated nails; or by binding or serving with not less than seven complete turns of zinc-coated wire, held in place by large-headed zinc-coated nails and staples. Trim edges of fabric projecting below wire wrapping.

(2) **Untreated Piles.** Apply the following treatments to untreated pile heads:

(a) Brush coat sawed surface thoroughly with two applications of hot creosote oil.

(b) Coat sawed surface heavily with red primer paint. Cover untreated piles with cotton duck of at least 8-ounce weight. Fold duck down over sides of pile and secure with large-headed roofing nails. Trim edges of duck below nails. Waterproof duck by thoroughly saturating and coating with one or more applications of red primer paint.

(G) **Holes for Bolts, Dowels, Rods, and Lag Screws.** Bore holes for round drift-bolts and dowels 1/16 inch less in diameter than bolt or dowel to be used. Bore holes for square drift-bolts or dowels equal in diameter to the least dimension of bolt or dowel. Bore holes for machine bolts same
diameter as bolt. Bore holes for rods 1/16 inch greater in diameter than rod. Bore holes for lag screws not larger than body of the screw at base of head.

(H) **Bolts and Washers.** Use washers of size and type specified, under bolt heads and nuts.

Lock nuts of bolts after final tightening by burring threads. Furnish bolts having surplus threading of at least 3/8 inch per foot of timber thickness.

(I) **Countersinking.** Countersink wherever the contract documents require smooth faces. Paint horizontal recesses, formed for countersinking, with hot creosote oil. Fill horizontal recesses with hot pitch after bolt or screw is in place.

(J) **Timber Connectors.** Use split ring, toothed ring, shear plate, or spike grid timber connectors. Install split ring and shear plate connectors in precut grooves of dimensions as specified herein, or as recommended by manufacturer.

Cut timber connector grooves concentric with bolt hole; conform to cross-sectional shape of rings, and provide a snug fit. Cut inside groove diameter larger than nominal ring diameter.

Force toothed rings and spike grids into the wood so that timbers will be in firm contact. Use pressure equipment that does not damage the wood. Embed all connectors of this type at a joint uniformly and simultaneously.

Fabricate structural members using connectors prior to preservative treatment. Drill bolt holes within 1/16 inch from required placement. Drill bolt holes 1/16 inch larger than bolt diameter and perpendicular to timber face.

Store timber after fabrication, in a manner that will prevent dimensional changes in members before assembly.

If dimensions of material and details are not specified, submit shop drawings showing dimension and details.

(K) **Framing.** Cut and frame lumber and timber to a close fit so that joints have an even bearing over entire contact surfaces. Cut mortises and tenons true to size for their full depth to allow for a snug fit without shim. Open joints will be rejected.

(L) **Pile Bents.** Drive piles in accordance with the contract documents, with a variation of above-ground portion of not more than 1/4 inch per foot from vertical; or batter so that cap may be placed in the specified location without excessive manipulation of piles. Redrive, or use other methods acceptable to the Engineer, to avoid such manipulations. Shimming on tops of piles will not be permitted.
Select pile sizes to avoid undue bending or distortion of sway bracing. Exercise care in distribution of piles, of varying sizes, to secure uniform strength and rigidity in bents of structures.

Make cut-offs to ensure even and uniform bearing between cap and piles.

(M) Framed Bents.

(1) Mud Sills. For mud sills made from untreated timber, use redwood, heart cedar, heart cypress, or other timber acceptable to the Engineer. Embed mud sills firmly and evenly to solid bearing and tamp in place.

(2) Concrete Pedestals. Finish concrete pedestals for support of framed bents to provide an even bearing surface for sills or posts. Use dowels of minimum 3/4-inch diameter to anchor sills or posts. Form concrete pedestal around anchor sill or post so that anchor projects at least 6 inches above top of pedestal.

(3) Sills. Provide sills with true and even bearing on mud sills, piles, or pedestals. Drift-bolt sills to mud sills or piles, with bolts of not less than 3/4-inch diameter that extend into mud sills or piles at least 6 inches. When possible, remove earth from contact with sills.

(4) Posts. Fasten posts to pedestals with dowels of not less than 3/4-inch diameter, extending at least 6 inches into posts.

Fasten posts to sills by the following methods:

(a) By dowels of not less than 3/4-inch diameter, extending at least 6 inches into posts and sills.

(b) By drift-bolts of not less than 3/4-inch diameter, driven diagonally through post base and extending at least 9 inches into sill. Drive drift-bolts into holes, as indicated in the contract documents, at a 45-degree angle and so that drift bolts enter post at least 6 inches above post base.

(N) Caps. Place timber caps, with ends aligned, in a manner to secure an even and uniform bearing over tops of supporting posts or piles. Secure caps by drift-bolts of not less than 3/4-inch diameter, extending at least 9 inches into approximate center of posts or piles.

(O) Bracing. Bolt ends and intermediate intersections of bracing through pile, post, or cap using bolt of not less than 5/8-inch diameter. Use bracing of sufficient length to provide a minimum edge distance of 8 inches between
outside of bolt and end of brace.

(P) **Stringers.** Size stringers at bearings and place in position so that knots near edges will be in top portion of stringers.

Join outside stringers with lap joints or butt joints with ends cut on a taper. Lap join interior stringers to take bearing over full width of floorbeam or cap at each end. Separate lapped ends of untreated stringers at least 1/2 inch for circulation of air, and securely fasten by drift-bolting. Stagger joints when stringers are two panels in length.

Place cross-bridging at center of each span. Frame cross bridging between stringers neatly, and toe-nail with at least two nails in each end. Provide full bearing of cross-bridging members, at each end, against sides of stringers.

(Q) **Plank Floors.** Use planks for flooring that are surfaced on four sides (S4S).

Provide single plank floors, in accordance with the contract documents, consisting of a single thickness of plank supported by stringers or joists. Lay planks heart side down, with 1/4-inch openings between planks for seasoned material, and with tight joints for unseasoned material. Spike each plank securely to each joist. Lay planks so that no two adjacent planks vary in thickness by more than 1/16 inch.

Provide two-ply timber floors, in accordance with the contract documents, consisting of two layers of flooring supported on stringers or joists. Pressure treat lower course with creosote oil. Lay top course diagonally or parallel to roadway centerline, in accordance with the contract documents. Fasten each floor piece securely to lower course. Stagger joints in adjacent timbers at least 3 feet. Securely fasten ends of flooring when top flooring is placed parallel to roadway centerline. Bevel these members at each end of the bridge.

(R) **Nail-Laminated or Strip Floors.** Place strips on edge, at right angles to roadway centerline. Nail each strip to preceding strip at each end and at approximately 18-inch intervals, with nails driven alternately near top and bottom edges. Use nails of sufficient length to pass through two strips and at least halfway through third strip.

If timber supports are used, toe-nail every other strip to every other support. Use nails of size specified in the contract documents. When steel supports are used, attach strips to steel supports using zinc-coated
metal clips acceptable to the Engineer. Ensure that each strip is vertical and
tight against preceding strip, and bearing evenly on supports.

(S) Wheel Guards and Railing. Frame and erect wheel guards and
railing, in accordance with the contract documents and true to line and grade.

Use wheel guards, rails, and rail posts that are surfaced on four sides
(S4S).

Lay wheel guards in sections not less than 12 feet long, except where
necessary to match expansion joints or end joints.

(T) Trusses. Fabricate trusses with no irregularities of line. Provide
chords that are straight and true from end to end in horizontal projection; and
show a smooth curve through panel points conforming to correct camber in
vertical projection. Uneven or rough cuts at points of bearing will be rejected.

(U) Erection of Railing. Build railings after removal of falsework and
adjustment of trusses to correct alignment and camber.

(V) Painting.

(1) General. Apply three coats of paint to rails and rail posts of
untreated timber or timber treated with preservative salts. Paint parts
of structure, other than rails and rail posts, in accordance with the
contract documents. Paint hardware as specified for timber. Paint
metal parts, except hardware, with one shop coat and two field coats,
in accordance with Section 501 - Steel Structures.

Use type of paint as specified in the contract documents.

Painting of timber structures includes:

(a) Preparing timber and metal surfaces.

(b) Applying, protecting, and drying paint coatings.

(c) Supplying tools, tackle, scaffolding, labor and materials
necessary for entire work.

(2) Weather Conditions. Do not apply paint when:

(a) Air temperature is below 40 degrees Fahrenheit.

(b) Air is misty.

(c) Surfaces are damp.
(3) Cleaning. If painting is specified, clean timber surfaces of 
dust, dirt and other foreign matter by brushing or other effective 
means immediately before painting.

Clean metal parts in accordance with Section 501 - Steel 
Structures.

(4) Application. Apply paint with hand brushes. Putty cracks and 
openings in timber after priming coat has been placed and has dried. 
Do not apply succeeding coats of paint until preceding coat has been 
drying for at least three days and has hardened enough to prevent 
breaking under brush.

Stencil stream name and bridge structure number on left hand 
side, and year of construction on right hand side (as you approach 
bridge), of each end of bridge. Use 2-inch-high letters and figures, 
and paint that contrasts with background.

(W) Cleanup. Remove falsework, excavated or unwanted material, trash, 
and temporary buildings upon completion of timber structures and before 
final acceptance by the Engineer.

502.04 Measurement. Untreated timber and treated timber will be paid on a 
lump sum basis. Measurement for payment will not apply.

502.05 Payment. The Engineer will pay for accepted untreated timber and 
treated timber on a contract lump sum basis. Payment will be full compensation for 
work prescribed in this section and the contract documents.

The Engineer will pay for the following pay items when included in the 
proposal schedule:

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Pay Unit</th>
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<tbody>
<tr>
<td>Untreated Timber</td>
<td>Lump Sum</td>
</tr>
<tr>
<td>Treated Timber</td>
<td>Lump Sum</td>
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The Engineer will not pay for timber bumpers at ends of concrete floor slabs 
and will consider cost for timber bumpers at ends of concrete floor slabs as included 
in the contract prices for untreated and treated timber. Cost is for work prescribed in 
this section and the contract documents.

The Engineer will pay for timber piling in accordance with and under Section 
505 - Piling.

END SECTION 502