

## 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 AWWPA 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.

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- (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 AWWA 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:

97 (1) **Treated Piles.** Protect heads of treated timber piles by  
98 following methods. Unless otherwise specified, use fabric covering  
99 method.

100  
101 (a) **Zinc Covering.** Cover sawed surface with:

102  
103 1. Three applications of a mixture of 60 percent  
104 creosote oil and 40 percent roofing pitch.

105  
106 2. Thoroughly brush coat with three applications of  
107 hot creosote oil, and cover with hot roofing pitch.

108  
109 Before placing cap, place sheet of No. 12 gage zinc on  
110 each pile head. Sheet of zinc shall be of sufficient size to  
111 project at least 4 inches beyond pile. Bend down, trim neatly,  
112 and fasten sheet of zinc to pile face with large-headed zinc-  
113 coated roofing nails.

114  
115 (b) **Fabric Covering.** Cover pile heads with alternate  
116 layers of hot pitch and waterproofing cotton fabric conforming  
117 to ASTM D 173. Use four applications of pitch and three layers  
118 of fabric. Cut fabric large enough to cover pile top and fold  
119 down at least 6 inches along all sides of pile. Fold down fabric  
120 neatly over pile and secure with large headed zinc-coated  
121 nails; or by binding or serving with not less than seven  
122 complete turns of zinc-coated wire, held in place by  
123 large-headed zinc-coated nails and staples. Trim edges of  
124 fabric projecting below wire wrapping.

125  
126 (2) **Untreated Piles.** Apply the following treatments to untreated  
127 pile heads:

128  
129 (a) Brush coat sawed surface thoroughly with two  
130 applications of hot creosote oil.

131  
132 (b) Coat sawed surface heavily with red primer paint.  
133 Cover untreated piles with cotton duck of at least 8-ounce  
134 weight. Fold duck down over sides of pile and secure with  
135 large-headed roofing nails. Trim edges of duck below nails.  
136 Waterproof duck by thoroughly saturating and coating with one  
137 or more applications of red primer paint.

138  
139 (G) **Holes for Bolts, Dowels, Rods, and Lag Screws.** Bore holes for  
140 round drift-bolts and dowels 1/16 inch less in diameter than bolt or dowel to  
141 be used. Bore holes for square drift-bolts or dowels equal in diameter to the  
142 least dimension of bolt or dowel. Bore holes for machine bolts same  
143

## 502.03

143 diameter as bolt. Bore holes for rods 1/16 inch greater in diameter than rod.  
144 Bore holes for lag screws not larger than body of the screw at base of head.

145

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

148

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

151

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

156

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

161

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

165

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

169

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

173

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

176

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

179

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

184

185 **(L) Pile Bents.** Drive piles in accordance with the contract documents,  
186 with a variation of above-ground portion of not more than 1/4 inch per foot  
187 from vertical; or batter so that cap may be placed in the specified location  
188 without excessive manipulation of piles. Redrive, or use other methods  
189 acceptable to the Engineer, to avoid such manipulations. Shimming on tops  
190 of piles will not be permitted.

191  
 192           Select pile sizes to avoid undue bending or distortion of sway bracing.  
 193    Exercise care in distribution of piles, of varying sizes, to secure uniform  
 194 strength and rigidity in bents of structures.

195  
 196           Make cut-offs to ensure even and uniform bearing between cap and  
 197 piles.

198  
 199 **(M) Framed Bents.**

200  
 201           **(1) Mud Sills.** For mud sills made from untreated timber, use  
 202 redwood, heart cedar, heart cypress, or other timber acceptable to the  
 203 Engineer. Embed mud sills firmly and evenly to solid bearing and  
 204 tamp in place.

205  
 206           **(2) Concrete Pedestals.** Finish concrete pedestals for support of  
 207 framed bents to provide an even bearing surface for sills or posts.  
 208 Use dowels of minimum 3/4-inch diameter to anchor sills or posts.  
 209 Form concrete pedestal around anchor sill or post so that anchor  
 210 projects at least 6 inches above top of pedestal.

211  
 212           **(3) Sills.** Provide sills with true and even bearing on mud sills,  
 213 piles, or pedestals. Drift-bolt sills to mud sills or piles, with bolts of not  
 214 less than 3/4-inch diameter that extend into mud sills or piles at least 6  
 215 inches. When possible, remove earth from contact with sills.

216  
 217           **(4) Posts.** Fasten posts to pedestals with dowels of not less than  
 218 3/4-inch diameter, extending at least 6 inches into posts.

219  
 220                   Fasten posts to sills by the following methods:

221  
 222           **(a)** By dowels of not less than 3/4-inch diameter, extending  
 223 at least 6 inches into posts and sills.

224  
 225           **(b)** By drift-bolts of not less than 3/4-inch diameter, driven  
 226 diagonally through post base and extending at least 9 inches  
 227 into sill. Drive drift-bolts into holes, as indicated in the contract  
 228 documents, at a 45-degree angle and so that drift bolts enter  
 229 post at least 6 inches above post base.

230  
 231           **(N) Caps.** Place timber caps, with ends aligned, in a manner to secure an  
 232 even and uniform bearing over tops of supporting posts or piles. Secure  
 233 caps by drift-bolts of not less than 3/4-inch diameter, extending at least 9  
 234 inches into approximate center of posts or piles.

235  
 236           **(O) Bracing.** Bolt ends and intermediate intersections of bracing through  
 237 pile, post, or cap using bolt of not less than 5/8-inch diameter. Use bracing of  
 238 sufficient length to provide a minimum edge distance of 8 inches between

## 502.03

239 outside of bolt and end of brace.

240

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

243

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

249

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

254

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

257

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

264

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

273

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

279

280 If timber supports are used, toe-nail every other strip to every other  
281 support. Use nails of size specified in the contract documents. When steel  
282 supports are used, attach strips to steel supports using zinc-coated

283 metal clips acceptable to the Engineer. Ensure that each strip is vertical and  
284 tight against preceding strip, and bearing evenly on supports.

285

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

288

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

291

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

294

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

299

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

302

303 **(V) Painting.**

304

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

311

312 Use type of paint as specified in the contract documents.

313

314 Painting of timber structures includes:

315

316 **(a)** Preparing timber and metal surfaces.

317

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

319

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

322

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

324

325 **(a)** Air temperature is below 40 degrees Fahrenheit.

326

327 **(b)** Air is misty.

328

329 **(c)** Surfaces are damp.

330

**502.03**

331 **(3) Cleaning.** If painting is specified, clean timber surfaces of  
332 dust, dirt and other foreign matter by brushing or other effective  
333 means immediately before painting.

334  
335 Clean metal parts in accordance with Section 501 - Steel  
336 Structures.

337  
338 **(4) Application.** Apply paint with hand brushes. Putty cracks and  
339 openings in timber after priming coat has been placed and has dried.  
340 Do not apply succeeding coats of paint until preceding coat has been  
341 drying for at least three days and has hardened enough to prevent  
342 breaking under brush.

343  
344 Stencil stream name and bridge structure number on left hand  
345 side, and year of construction on right hand side (as you approach  
346 bridge), of each end of bridge. Use 2-inch-high letters and figures,  
347 and paint that contrasts with background.

348  
349 **(W) Cleanup.** Remove falsework, excavated or unwanted material, trash,  
350 and temporary buildings upon completion of timber structures and before  
351 final acceptance by the Engineer.

352  
353 **502.04 Measurement.** Untreated timber and treated timber will be paid on a  
354 lump sum basis. Measurement for payment will not apply.

355  
356 **502.05 Payment.** The Engineer will pay for accepted untreated timber and  
357 treated timber on a contract lump sum basis. Payment will be full compensation for  
358 work prescribed in this section and the contract documents.

359  
360 The Engineer will pay for the following pay items when included in the  
361 proposal schedule:

<b>Pay Item</b>	<b>Pay Unit</b>
Untreated Timber	Lump Sum
Treated Timber	Lump Sum

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363  
364  
365  
366  
367  
368  
369 The Engineer will not pay for timber bumpers at ends of concrete floor slabs  
370 and will consider cost for timber bumpers at ends of concrete floor slabs as included  
371 in the contract prices for untreated and treated timber. Cost is for work prescribed in  
372 this section and the contract documents.

373  
374 The Engineer will pay for timber piling in accordance with and under Section  
375 505 - Piling.

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**END SECTION 502**