SECTION 502 - TIMBER STRUCTURE

502.01 Description. This work includes constructing timber structures and timber portions of other structures according to the contract. *|

502.02 Materials. Materials shall conform to the following: *|

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

502.03 Construction Requirements.

(A) Falsework. The Contractor shall place the falsework or centering upon a substantial footing safe against undermining and protected from softening. *|

The Contractor shall space, drive, and remove the falsework piling when used and acceptable to the Engineer. *|

The Contractor shall set the falsework to give the structural camber shown in the contract or ordered by the Engineer. The Contractor shall place the falsework so that the top of the falsework excluding blocking shall be level transversely. *|

(B) Storage of Material. The Contractor shall keep the lumber and timber stored on the work site in orderly piles or stacks. The Contractor shall open-stack the untreated material supports at least twelve (12) inches above the ground surface to avoid absorption of ground moisture and permit air circulation. The Contractor shall stack and strip the lumber and timber to permit free circulation of air between the tiers and courses. The Contractor shall protect the material from the weather by a suitable covering. *|

(C) Workmanship. The Contractor shall employ bridge carpenters. Framing shall be true and exact. The Contractor shall drive the nails and spikes with just sufficient force to set the heads flush with the surface of the wood. The Engineer will consider deep hammer marks in wood surfaces evidence of poor workmanship and sufficient cause for removal of the worker causing the poor workmanship. The workmanship on metal parts shall conform to Section 501 - Steel Structures. *|

(D) Treated Timber. The preservative treatment shall according to the contract. *|

(1) **Preservative Treatment for Timber.** Treatment of lumber and piles shall be according to the current AWPA Standard Specifications for Preservative Treatment by Pressure Processes and herein. *|

(2) **Handling.** The Contractor shall handle treated timber carefully without sudden dropping, breaking of outer fibers, bruising or penetrating the surface with tools. The Contractor shall handle treated timber with rope slings. The Contractor shall not use cant hooks, peaveys, pikes or hooks. *|

(3) **Cutting, Framing, and Boring.** The Contractor shall cut, frame, and bore treated timbers before treatment when practicable. When the Contractor places treated timbers in waters infested by marine borers, the Contractor shall avoid untreated cuts, borings or other joint framings below high water elevation. *|

(4) **Cuts and Abrasions.** The Contractor shall: *|

(a) cover the cuts and abrasions in treated piles or timbers with two (2) applications of a mixture of sixty (60) percent creosote oil and forty (40) percent roofing pitch or *|

(b) brush coat the cuts and abrasions in treated piles or timbers with at least two (2) applications of hot creosote oil and covered with hot roofing pitch. *|

The Contractor shall trim the abrasions before covering or brush coating the treated piles or timber. *|

The Contractor shall brush the two (2) coats of concentrated salt preservatives on the cut surfaces of salt treated timber. The cut surfaces shall be thoroughly dry and free from dirt, grease or other foreign matter that would hinder the maximum penetration of the preservative. *|

(5) **Bolt Holes.** The Contractor shall treat the bolt holes bored with creosote oil by an acceptable pressure bolt hole treater. After treating the bolt holes, the Contractor shall plug unfilled holes, with creosoted plugs. *|

(6) **Temporary Attachment.** Whenever the Contractor attaches the forms or temporary braces to treated timber with nails or spikes, the Contractor shall fill the holes by driving zinc-coated nails or spikes flush with the surface or plugging holes as required for bolt holes. The Contractor shall request this temporary attachment for acceptance by the Engineer. *|

(E) **Untreated Timber.** In structures of untreated timber, the Contractor shall coat the following surfaces thoroughly with two (2) coats of hot creosote oil before assembling: *|

(a) ends, tops and contact surfaces of sills, caps, floor beams and stringers, and *|

(b) ends, joints, and contact surfaces of bracing and truss members. *|

The Contractor shall treat back faces of bulkheads and other timber that is to be in contact with earth, metal or other timber similarly. *|

(F) **Treatment of Pile Heads.** The Contractor shall treat the pile heads, after cutting to receive the caps and before placing the caps as follows: *|

(1) **Treated Piles.** The Contractor shall protect the heads of treated timber piles by the following methods. If not specified, the Contractor shall use the fabric covering method. *|

(a) Zinc Covering. The Contractor shall cover the sawed surface with: *|

1. three (3) applications of a mixture of sixty (60) percent creosote oil and forty (40) percent roofing pitch or *|

2. thoroughly brush coat with three (3) applications of hot creosote oil and covered with hot roofing pitch. *|

Before placing the cap, the Contractor shall place a sheet of No. 12 gage zinc on each pile head. The sheet of zinc shall be of sufficient size to project at least four (4) inches beyond the pile. The Contractor shall bend down, trim neatly, and securely fasten the sheet of zinc to the faces of the pile with large-headed zinc-coated roofing nails. *|

(b) Fabric Covering. The Contractor shall cover the pile heads with alternate layers of hot pitch and loosely woven fabric similar to membrane waterproofing. The Contractor shall use four (4) applications of pitch and three (3) layers of fabric. The cover shall measure at least six (6) inches more in dimension than the diameter of the pile. The Contractor shall fold down the cover neatly over the pile and secure the cover by large headed zinc-coated nails or by binding or serving with not less than seven (7) complete turns of zinc-coated wire securely held in place by large-headed zinc-coated nails and staples. The Contractor shall trim the edges of the fabric projecting below the wire wrapping according to the contract. *|

(2) **Untreated Piles.** The Contractor shall give the heads of untreated piles the following treatments, according to the contract or as ordered by the Engineer: *|

(a) The Contractor shall brush coat the sawed surface thoroughly with two (2) applications of hot creosote oil. *|

(b) The Contractor shall coat the sawed surface heavily with red primer paint. The Contractor shall then cover the untreated piles with cotton duck, of at least eight (8) ounce weight. The Contractor shall then fold them down over the sides of the pile and firmly secure with large-headed roofing nails. The Contractor shall trim the edges of the duck according to the contract. The Contractor shall then waterproof the duck by being thoroughly saturated and coat with one (1) or more applications of red primer paint. *|

(G) Holes for Bolts, Dowels, Rods and Lag Screws. The Contractor shall bore the holes for round drift-bolts and dowels with a bit one-sixteenth (1/16) inch less in diameter than the bolt or dowel to be used. The diameter of holes for square drift-bolts or dowels shall be equal to the least dimension of the bolt or dowel. *|

The Contractor shall bore the holes for machine bolts with a bit the same diameter as the bolt. *|

The Contractor shall bore holes for rods with a bit one-sixteenth (1/16) inch greater in diameter than the rod. *|

The Contractor shall bore the holes for lag screws with a bit not larger than the body of the screw at the base of the thread. *|

(H) Bolts and Washers. The Contractor shall use a washer, of the size and type specified, under bolt heads and nuts. *|

The Contractor shall lock the nuts effectually after the Contractor have finally tightened the nuts. *|

(I) Countersinking. The Contractor shall countersink wherever the contract requires smooth faces. The Contractor shall paint the horizontal recesses formed for countersinking with hot creosote oil. The Contractor shall fill the horizontal recesses with hot pitch after the bolt or screw is in place. *|

(J) Timber Connectors. Timber connectors shall be either the: split ring type, toothed ring type, shear plate type or spike grid type. The Contractor shall install the split ring and the shear plate type in precut grooves of dimensions as given herein or as recommended by the manufacturer. *|

The Contractor shall cut the connector grooves in timber concentric with the bolt hole, conform to the cross-sectional shape of the rings and provide a snug fit. Inside groove diameter shall be larger than nominal ring diameter so that the ring may expand slightly during installation. *|

The Contractor shall force the toothed ring and the spike grid into contact surfaces of the timbers joined by pressure equipment. The Contractor shall embed the connectors of this type at a joint uniformly and simultaneously. *|

The Contractor shall fabricate the structures using connectors before treatment. When prefabricated from templates or shop details, bolt holes shall not be more than one-sixteenth (1/16) inch from the required placement. Bolt holes shall be one-sixteenth (1/16) inch larger than bolt diameter. The Contractor shall bore the bolt holes perpendicular to the face of the timber. *|

The Contractor shall store the timber after fabrication to prevent changes in the dimensions of the members before assembly. *|

If the dimensions of material and details are not specified, the Contractor shall submit them for acceptance by the Engineer. *|

(K) Framing. The Contractor shall cut and frame the lumber and timber accurately to a close fit so that the joints shall have an even bearing over the entire contact surfaces. Mortises shall be true to size for their full depth and tenons shall fit snugly. The Engineer will not permit shimming or open joints in making joints. *|

(L) Pile Bents. The Contractor shall drive the piles according to the contract, with a variation of the portion above the ground of not more than quarter (1/4) inch per foot from the vertical or batter so that the Contractor may place the cap in its proper location without inducing excessive stresses in the piles. The Engineer will not permit excessive manipulation of the piles. The Engineer will require the Contractor to redrive or use other acceptable methods to avoid such manipulations. The Engineer will not permit shimming on tops of piles. *|

The Contractor shall select the piles carefully as to size to avoid undue bending or distortion of the sway bracing. The Contractor shall the exercise care in the distribution of piles of varying sizes to secure uniform strength and rigidity in the bents of structures. *|

The Contractor shall make cut-offs accurately to insure perfect bearing between the cap and piles. *|

(M) Framed Bents.

(1) Mud Sills. Untreated timber used for mud sills shall be of redwood or other durable timber. The Contractor shall bed the mud sills firmly and evenly to solid bearing. The Contractor shall tamp the mud sill in place. *|

(2) Concrete Pedestals. The Contractor shall finish the concrete *| pedestals for the support of framed bents carefully so that the *| sills or posts take even bearing on the concrete pedestals. The *| Contractor shall set the dowels of not less than three-quarter (3/4) *| inch diameter and projecting at least six (6) inches above the tops *| of the pedestals in the concrete pedestals when the Contractor casts *| the concrete pedestals for anchoring the sills or posts. *|

(3) Sills. Sills shall have true and even bearing on mud sills, piles or pedestals. The Contractor shall drift-bolt the sills to mud *| sills or piles with bolts of not less than three-quarter (3/4) inch *| diameter. The Contractor shall extend the bolts into the mud sills *| or piles at least six (6) inches. When possible, the Contractor *| shall remove the earth from contact with sills. *|

(4) Posts. The Contractor shall fasten the posts to pedestals with *| dowels of not less than three-quarter (3/4) inch diameter, extending *| at least six (6) inches into the posts.

The Contractor shall fasten the posts to the sills by the *| following methods: *|

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

(b) By drift-bolts of not less than three-quarter (3/4) inch diameter driven diagonally through the base of the post and extending at least nine (9) inches into the sill.

(N) Caps. The Contractor shall place the timber caps with ends aligned, *| to secure an even and uniform bearing over the tops of the supporting *| posts or piles. The Contractor shall secure the caps by drift-bolts of *| not less than three-quarter (3/4) inch diameter, extending at least nine *| (9) ~~in~~ches into the posts or piles. The drift-bolts shall be approximately in the center of the post or pile.

(O) Bracing. The Contractor shall bolt the ends of bracing through the *| pile, post or cap with a bolt of not less than five-eighths (5/8) inch *| diameter. The Contractor shall bolt or spike the intermediate *| intersections with wire or boat spikes, according to the contract. The *| Contractor shall use spikes besides bolts. *|

(P) Stringers. The Contractor shall size and place the stringers at *| bearings and in position so that knots near edges shall be in the top *| portions of the stringers.

Outside stringers may have butt joints with the ends cut on a taper. *| The Contractor shall lap the interior stringers to take bearing over the *| full width of the floor beam or cap at each end. The Contractor shall *| separate the lapped ends of untreated stringers at least half (1/2) inch *|

for the circulation of air. The Contractor shall also fasten the lapped ends of untreated stringers securely by drift-bolting where specified. When stringers are two (2) panels in length, the Contractor shall stagger the joints.

The Contractor shall frame neatly and accurately and toe-nail securely the cross-bridging between stringers with at least two (2) nails in each end. Cross-bridging members shall have full bearing at each end against the sides of stringers. The Contractor shall place cross-bridging at the center of each span.

(Q) Plank Floors. The Contractor shall surface the planks four (4) sides (S4S).

Single plank floors includes a single thickness of plank supported by stringers or joists. The Contractor shall lay the planks heart side down, with quarter (1/4) inch openings between the planks for seasoned material and with tight joints for unseasoned material. The Contractor shall spike each plank securely to each joist. The Contractor shall grade the planks carefully as to thickness and shall lay so that no two (2) adjacent planks shall vary in thickness by more than one-sixteenth (1/16) inch.

Two (2) ply timber floors includes two (2) layers of flooring supported on stringers or joists. The Contractor shall pressure treat the lower course with creosote oil. The Contractor may lay the top course either diagonal or parallel to the centerline of roadway according to the contract. The Contractor shall fasten each floor piece securely to the lower course. The Contractor shall stagger the joints at least three (3) feet. If the Contractor places the top flooring parallel to the centerline of the roadway, the Contractor shall take special care to securely fasten the ends of the flooring. At each end of the bridge, the Contractor shall bevel these members.

(R) Laminated or Strip Floors. The Contractor shall place the strips on edge, at right angles to the centerline of roadway. The Contractor shall spike each strip to the preceding strip at each end and at approximately eighteen (18) inch intervals with the spikes driven alternately near the top and bottom edges. The spikes shall be of sufficient length to pass through two (2) strips and at least half-way through the third strip.

If the Contractor uses timber supports, the Contractor shall toe-nail every other strip to every other support. The size of the spikes shall be according to the contract. When specified on the plans, the Contractor shall attach the strips securely to steel supports using acceptable zinc-coated metal clips. The Contractor shall ensure that each strip is vertical against the preceding one, and bearing evenly on the supports.

(S) Wheel Guards and Railing. The Contractor shall frame the wheel guards and railing accurately according to the contract and build them true to line and grade.

The Contractor shall surface the wheel guards, rails and rail posts four (4) sides (S4S).

The Contractor shall lay the wheel guards in sections not less than twelve (12) feet long.

(T) Trusses. Trusses, when completed, shall show no irregularities of line. Chords shall be straight and true from end to end in horizontal projection and show a smooth curve through panel points conforming to the correct camber in vertical projection. Bearing surfaces shall fit accurately. Uneven or rough cuts at the points of bearing will be cause for rejection of the piece containing the defect.

(U) Erection of Railing. The Contractor shall build the railings after the removal of the falsework and the adjustment of the trusses to correct alignment and camber.

(V) Painting.

(1) General. The Contractor shall apply three (3) coats of paint to the rails and rail posts of untreated timber or timber treated with preservative salts. The Contractor shall paint parts of the structure, other than rails and rail posts, according to the contract. The Contractor shall paint hardware as specified for timber. The Contractor shall give metal parts, except hardware, one (1) shop coat and two (2) field coats of paint according to Section 501 - Steel Structures.

The Contractor shall use the type of paint as specified in the contract.

The painting of timber structures shall include:

(a) the preparation of the timber and metal surfaces,

(b) the application, protection and drying of the paint coatings and

(c) the supplying of tools, tackle, scaffolding, labor and materials necessary for the entire work.

(2) Weather Conditions. The Contractor shall not apply paint when:

(a) the air temperature is below forty (40) degrees Fahrenheit,

(b) air is misty,

(c) surfaces are damp, or

(d) conditions are unsatisfactory for the work, as ordered by the Engineer. *|

(3) **Cleaning.** If painting is specified, the Contractor shall clean the timber surfaces of dust, dirt and other foreign matter by brushing or other effective means. The cleaning shall immediately precede painting so that the Contractor may apply the paint to clean surfaces. *|

Cleaning of metal parts shall conform to Section 501 - Steel Structures. |

(4) **Application.** The Contractor shall apply the paint with hand brushes. After the Contractor has placed and dried the priming coat, the Contractor shall putty the cracks and openings in the timber. The Contractor shall not apply succeeding coats of paint until the preceding coat has been drying for at least three (3) days and has hardened enough to prevent breaking under the brush. *|

The Contractor shall stencil the name of the stream and the number of the bridge structure on the left hand side. The Contractor shall stencil the year of construction on the right hand side (as you approach the bridge) of each end of the bridge. The Contractor shall stencil the letters and figures two (2) inches high and with paint contrasting with the background. The Contractor shall stencil at no cost to the State. *|

(W) **Cleanup.** Upon completion of the timber structures and before final acceptance, the Contractor shall remove falseworks, excavated or useless materials, rubbish, and temporary buildings. The Contractor shall replace or restore public and private fences or property damaged, and leave the structure site and adjacent highway in a neat and presentable condition according to the contract. The Contractor shall remove excavated material or falsework placed in the stream channel before final acceptance. *|

502.04 Method of Measurement. The Engineer will measure the timber incorporated into the structure by the thousand feet board measure (MFBM). The Engineer will base the computation of the quantity of lumber or timber in the structure on nominal sizes and the shortest commercial lengths that the Contractor can use. Short pieces of odd lengths from longer commercial lengths will be the exception. *|

The Engineer will not measure timber when contracted on a lump sum basis. *|

502.05 Basis of Payment. The Engineer will pay for the accepted quantities of timber at the contract unit price per thousand feet board measure or at the contract lump sum price for each pay items listed below and contained in the proposal. The price paid shall be full compensation for furnishing, *|

delivering, preparing, framing, assembling, building, and painting timbers and lumbers; for other materials for the complete structure; and for labors, equipments, tools, and incidentals necessary to complete the structure. *|

The Engineer will not pay for cofferdam construction, falsework, or other erection expenses. *|

The Engineer will make payment under: *|

Pay Item	**Pay Unit**
Untreated Timber	MFBM
Untreated Timber (____ MFBM)	Lump Sum
Treated Timber	MFBM
Treated Timber (____ MFBM)	Lump Sum

Payment will not include timber that the Engineer paid for under another item of work. *|

The Engineer will consider timber bumpers at the ends of concrete floor slabs as an incidental part of the work paid for under concrete. *|

The Engineer will pay for timber piling under Section 505 - Piling. *|