Section 2409. Timber Structures

2409.01 DESCRIPTION.

Construct structures composed wholly of timber or of timber combined with structural steel or concrete.

2409.02 MATERIALS.

Use materials for timber construction that meet requirements of Division 41 for the respective material as follows:

A. Timber and Lumber.
Use untreated structural parts to be painted that are furnished surfaced on four sides. Use stringers that are surfaced on two edges, top and bottom. Use timber that is furnished rough for all other sawed timber, unless specified otherwise.

1. **Untreated Structural and Common Timber.**
   Apply Section 4162.

2. **Treated Timber.**
   Apply Section 4163.

3. **Piling.**
   Apply Section 4165.

B. Steel.
Apply Section 4152 to steel rods for tension members or tie rods for wingwalls, all plates and structural shapes, and all drift pins and dowels. Apply Section 4151 to concrete reinforcement.

C. Hardware and Nails.
Apply Article 4153.07.

D. Paint.
Use the paint specified in the contract documents.

E. Wood Preservative.
Apply Article 4160.01.

F. Waterproofing Materials.
Use the waterproofing materials specified in the contract documents.

G. Timber Connectors.

1. Use connectors for resisting shearing stresses between tension members and for spreading the stress over the entire member that are of a design the Engineer approves. Fabricate connectors from metal and make them rugged enough to withstand handling and installing without damage.

2. When the contract documents specify tie rods to be coated with waterproofing, first clean the rods according to Article 2508.01, A, and then paint according to the manufacturer's recommendations.

3. For fastening and bracing other members to piles, use bolts in a variety of lengths which will conform to the diameter, shape, and position of the piles so that extra washers or shims will not be required to take up the extra length of bolt.

H. Concrete.
Use concrete in connection with timber structures that meets requirements of Section 2403.

2409.03 CONSTRUCTION.

A. General.

1. Apply the provisions of Sections 2401, 2402, 2403, 2404, 2405, 2408, and 2501 to various phases of the construction. Build timber portions of the structure to comply with the contract documents and requirements of this section.

2. Ensure all framing is true and exact. Drive nails and spikes with no more force than what is required to set the heads flush with the wood surface. Deep hammer marks in wood surfaces will be considered as evidence of poor work quality. Use washers under all bolt heads and nuts which would otherwise be in contact with wood.

3. Carefully handle treated timbers without sudden dropping, breaking of outer fibers, bruising, or penetrating the treated surface with tools, such as cant hooks, peaveys, timber tongs, or pike poles.

B. Storage of Materials.

1. Store lumber and timber delivered to the work site in neat piles. Clear the ground underneath and in the vicinity of material piles of all weeds and rubbish. Arrange lumber piles to shed water and prevent warping. If stored over a long period, further protect wood piles with a suitable covering.

2. Open stack untreated lumber on suitable skids at least 12 inches (0.3 m) above ground and above possible high water.

3. Close stack and pile treated timber and treated piling. When stored for long periods, cover the tops of stacks and ends of pieces to protect the material from the direct sunlight.

4. Store miscellaneous material and hardware so as to prevent loss or damage.

C. Holes for Bolts, Dowels, Rods, and Screws.

1. Bore the holes for drift bolts and dowels 1/16 inch (2 mm) smaller than the nominal diameter of the bolt or dowel used. Bore the holes for lag screws with a bit no larger than the body of the screw at the base of the thread.

2. Bore the holes for rods and bolts, other than drifts and dowels, to diameters as follows:
- **a.** In timber that is to be treated, bore the holes 1/8 inch (3 mm) larger than the nominal diameter of the bolt or rod used.
- **b.** In timber that has already been treated or that is not to be treated, bore the holes to be the same as the nominal diameter of the bolt or rod used.
- **c.** Countersink the heads of bolts or lag screws that would interfere with traffic or with other structural parts.

D. Treatment of Treated Pile Heads.
Treat all surfaces of treated pile heads cut after treatment with material specified in Section 4161.

E. Framing.

1. Accurately cut all lumber and timber and frame to a close fit in such manner that joints will have even bearing over the entire contact surfaces.

2. Bore the holes in all stringers, rails, posts, post blocks, and scupper blocks before the timber is treated. Complete all cutting, framing, and boring of treated timbers before treatment, whenever practical. Whenever boring or framing must be performed after preservative treatment, treat newly exposed surfaces as follows:
- **a.** Apply two coats of copper naphthanate to all daps, cuts, chamfers, and all abrasions, after carefully trimming these features.
- **b.** Apply two coats of copper naphthanate to all countersunk holes before the bolt is placed.

3. Ensure grooves and daps for timber connectors make a tight fit with that part which is embedded in wood. For types of connectors which permit, draw adjacent wood surfaces into tight contact with each other. For types which will not permit this surface contact, fill the opening left by the connector with plastic cement troweled upon the surface before the joint is finally assembled. After assembly, strike off flush excess plastic cement that is squeezed out, and point fill any opening in the joint.

F. Pile Bents.

1. Drive pile bents as accurately as possible in the correct location and to vertical or batter lines indicated on the plans. If a pile is driven out of line, straighten it without damage before cutting it off or bracing it. Remove and replace piles driven below grade or damaged in driving or

straightening if so directed by the Engineer. Do not shim the tops of piles.

2. Carefully select, as to size, piles for any one bent to avoid undue bending or distortion of sway bracing.

3. Accurately cut off piles to ensure satisfactory bearing between the cap and all piles of a bent. Trim edges of piles outside the cap to a slope approximately 45 degrees with horizontal.

G. Framed Bents.

1. Construct framed bents as shown in the contract documents. In general, they will be supported by piles cut off approximately 3 feet (1 m) above ground level.

2. Remove soil from contact with sills to allow free circulation of air.

3. Fasten sills to the piles. Fasten posts to sills using dowels no smaller than 3/4 inch (19 mm) in diameter, projecting into both pile and sill no less than 6 inches (150 mm).

H. Caps.

1. Place timber caps to secure an even, uniform bearing on the top of supporting piles or posts. Fasten them to the piles using drift pins no less than 3/4 inch (19 mm) in diameter, extending at least 9 inches (225 mm) into the piles.

2. Place drift pins approximately in the center of the pile or cap. When steel channel caps are used, accurately shape the tops of all piles to provide a snug fit in the caps.

I. Bracing.

1. Bolt the ends of bracing through the pile, post, or cap with bolts no less than 5/8 inch (16 mm) in diameter. Fasten intermediate intersections with bolts and spikes as shown in the contract documents. Use spikes in addition to bolts in all cases.

2. Avoid notching the piles or shimming under the bracing whenever possible.

J. Stringers.

1. Size stringers at bearings and place in position so that knots near the edges are in top portions of the stringers. Outside stringers may have butt joints. Lap the interior stringers to take full bearing on caps. Fasten stringers to caps as shown in the contract documents.

2. Use bridging that is of the size and type shown in the contract documents. With untreated stringers and floors, place bridging so that

an air space of at least 1 inch (25 mm) is left beneath the floor. With treated stringers and floors, place bridging flush with the top of the stringers.

K. Painting.

1. Wood surfaces of the structure which are to be painted will be designated in the contract documents. Clean all surfaces to be painted according to Article 2508.01, A, 1 and 2. Paint with a paint system specified in the contract documents. Paint according to the paint manufacturer's recommendations.

2. Paint all metal work, except galvanized hardware, as provided in Article 2408.02, Q.

L. Decks.
Construct decks for timber structures of the type specified in the contract documents. Construct decks according to the provisions of Sections 2410, 2411, and 2412.

2409.04 METHOD OF MEASUREMENT.

A. The Engineer will compute the quantity of timber and lumber in thousands of board feet (cubic meters) from the nominal width and thickness, and the length measured to the nearest foot (0.1 m) for the material used in the finished work.

B. The weight (mass) of structural steel measured includes net weights (the mass) of rolled shapes or plates, of rods used as tension members, and of all bolts and rivets used to fasten steel parts together.

C. The weight (mass) of drift bolts, dowels, washers, bolts, and other hardware used to fasten wood parts together or to steel members will not be included in the weight (mass) of structural steel. The weight (mass) of these items is included in the weight (mass) of miscellaneous hardware. The Engineer will compute the weight (mass).

D. Spikes and nails are incidental to timber construction and will not be measured separately for payment.

2409.05 BASIS OF PAYMENT.

A. Payment for the quantities involved in timber structures will be according to the following:

- Excavation for Structures: Section 2402.
- Structural Concrete: Section 2403.

- Steel Reinforcement: Section 2404.
- Structural Steel: Section 2408.

B. Payment for miscellaneous hardware will be the contract unit price per pound (kilogram).

C. Payment for treated and untreated timber and lumber will be the contract unit price per thousand board feet (cubic meter), which includes the cost of spikes and nails.

D. Payment is full compensation for:
- Furnishing all materials, equipment, and labor, and
- Performance of all incidental work necessary to complete the structure in conformance with the contract documents.