CONSTRUCTION SPECIFICATION FOR STRUCTURAL WOOD SYSTEMS

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907.01 SCOPE

This specification covers the requirements for structural wood systems.

907.01.01 Specification Significance and Use

This specification has been developed for use in provincial- and municipal-oriented Contracts. The administration, testing, and payment policies, procedures, and practices reflected in this specification correspond to those used by many municipalities and the Ontario Ministry of Transportation.

Use of this specification or any other specification shall be according to the Contract Documents.
907.01.02 Appendices Significance and Use

Appendices are not for use in provincial contracts as they are developed for municipal use, and then, only when invoked by the Owner.

Appendices are developed for the Owner’s use only.

Inclusion of an appendix as part of the Contract Documents is solely at the discretion of the Owner. Appendices are not a mandatory part of this specification and only become part of the Contract Documents as the Owner invokes them.

Invoking a particular appendix does not obligate an Owner to use all available appendices. Only invoked appendices form part of the Contract Documents.

The decision to use any appendix is determined by an Owner after considering their contract requirements and their administrative, payment, and testing procedures, policies, and practices. Depending on these considerations, an Owner may not wish to invoke some or any of the available appendices.

907.02 REFERENCES

When the Contract Documents indicate that provincial-oriented specifications are to be used and there is a provincial-oriented specification of the same number as those listed below, references within this specification to an OPSS shall be deemed to mean OPSS.PROV, unless use of a municipal-oriented specification is specified in the Contract Documents. When there is not a corresponding provincial-oriented specification, the references below shall be considered to be to the OPSS listed, unless use of a municipal-oriented specification is specified in the Contract Documents.

When the Contract Documents indicate that municipal-oriented specifications are to be used and there is a municipal-oriented specification of the same number as those listed below, references within this specification to an OPSS shall be deemed to mean OPSS.MUNI, unless use of a provincial-oriented specification is specified in the Contract Documents. When there is not a corresponding municipal-oriented specification, the references below shall be considered to be the OPSS listed, unless use of a provincial-oriented specification is specified in the Contract Documents.

This specification refers to the following standards, specifications, or publications:

**Ontario Provincial Standard Specifications, Construction**

OPSS 501 Compacting  
OPSS 902 Excavating and Backfilling - Structures  
OPSS 904 Concrete Structures  
OPSS 905 Steel Reinforcement for Concrete  
OPSS 910 Stressing Systems for Post-Tensioning

**Ontario Provincial Standard Specifications, Material**

OPSS 1010 Granular - Base, Subbase, Selected Subgrade and Backfill Material  
OPSS 1350 Concrete - Materials and Production  
OPSS 1440 Steel Reinforcement for Concrete  
OPSS 1601 Wood - Material, Preservative Treatment and Shop Fabrication  
OPSS 1860 Geotextiles
Ontario Ministry of Transportation Publications

Structural Manual

CSA Standards

- G40.20-04/G40.21-04 (R2009) General Requirements for Rolled or Welded Structural Quality Steel/ Structural Quality Steel
- G164-M92 (R2003) Hot Dip Galvanizing of Irregularly Shaped Articles
- O86-09 Consolidation, Engineering Design in Wood
- S6-06 Canadian Highway Bridge Design Code

ASTM International

- A 307-10 Carbon Steel Bolts and Studs, 60000 psi Tensile Strength
- A 653/A 653M-10 Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot Dip Process
- A 722/A 722M-07 Uncoated High-Strength Steel Bar for Prestressed Concrete

907.03 DEFINITIONS

For the purpose of this specification, definitions in OPSS 1601 and the following definitions apply:

**Engineer** means a professional engineer licensed by the Professional Engineers Ontario to practice in the Province of Ontario.

**Fastener** means hardware used to connect wood members or components.

**Girders** means generally very large size beams and stringers or glued-laminated member for use in bending with load applied to the narrow face.

**Groove and Dap** means the wood base of a wood-concrete composite deck using alternating height laminations where the higher laminate is grooved and dapped according to CAN/CSA-S6.

**Laminated Wood Deck** means dimension lumber placed side by side on its narrow face to form a wood slab.

**Lamination** means dimension lumber sizes when used in a laminated wood deck.

**Longitudinally Laminated Deck** means a deck where the wood laminations are placed on edge and oriented parallel to the longitudinal centreline of the deck.

**Notch and Spike** means the wood base of a wood-concrete composite deck using uniform height laminations, where all laminations have square notches reinforced with spikes according to CAN/CSA-S6.

**Reinforcing Spike** means a common nail used to reinforce the shear key in notch and spike wood-concrete composite decks.

**Stress-Laminated Wood Deck** means a laminated wood deck, which is held together by pressure applied perpendicular to the laminations using high-strength bars according to CAN/CSA-S6.
**Stringers** means sawn wood that has a minimum thickness of 114 mm and a width at least 51 mm greater than the thickness for use in bending with load applied to the narrow face.

**Transversely Laminated Deck** means a deck in which the wood laminations are placed on edge and oriented transversely to the longitudinal centre line of the deck.

**Truss Plates** means a sheet of steel that has been punched by a special die, where the displaced material forms sharp teeth, used to connect laminations at butt joints in wood-concrete composite decks.

**Wood-Concrete Composite Deck** means a deck that has a laminated wood base made composite with a reinforced concrete overlay.

**907.04 DESIGN AND SUBMISSION REQUIREMENTS**

**907.04.01 Submission Requirements**

**907.04.01.01 General**

All Working Drawings, stressing details, and calculations shall bear the seal and signature of an Engineer.

At least 14 Days prior to commencement of work, 5 copies of any proposal shall be submitted to the Contract Administrator.

When other authorities are involved in the approval of the design or construction of a highway structure, the submission shall be made at least 5 weeks prior to commencement of the work. One additional set is required to be submitted for each authority.

**907.04.01.02 Submission of Working Drawings for Fabrication and Fastening Details**

At least 4 weeks before the commencement of fabrication, the Contractor shall submit 5 complete sets of the Working Drawings to the Contract Administrator.

Fabrication details shall include the following:

a) The grade and species of all wood components and all necessary specifications.

b) The type of preservative treatments to be used for all wood components, including the penetration, and retention required.

c) Details of shop fabrication.

d) Details of all fabrication to be performed in the field.

e) Details of all field cuts and field boring.

f) Special handling or protection details required in the shop, during shipping, or in the field.

g) The field installation details of any temporary attachments such as running planks, barricades, and railings.

h) Protective treatment of heat-treated alloy components.

i) Fastening details.
907.04.01.03 Submission of Erection Procedures

Erection procedures shall bear the seal and signature of an Engineer.

At least 4 weeks before commencement of erection, the Contractor shall submit to the Contract Administrator, 5 complete sets of the erection procedures, including lifting point locations, details of all temporary supports, and prestressing procedures.

907.04.01.04 Return of Submissions

Two copies of each submission to be returned shall be marked as one of the following:

a) Stamped with wording that allows for permission to construct.

In this case, work can commence upon the Contractor's receipt of the Working Drawings. A copy of the Working Drawings shall be available at the site prior to and during construction.

b) Stamped with wording that allows for permission to construct as noted.

In this case, work can start upon the Contractor's receipt of the Working Drawings. The Working Drawings shall be updated as noted and shall have a stamp affixed that is signed by an Engineer stating that the Working Drawings have been revised according to the noted comments. A copy of the stamped updated Working Drawings shall be available at the site prior to and during construction.

c) Showing only required changes.

In this case, the Working Drawings shall be updated as required and the submission process repeated.

907.05 MATERIALS

907.05.01 Wood

Wood shall be according to OPSS 1601.

907.05.02 Preservatives

The preservatives shall be according to OPSS 1601.

For wood structural systems in bridges, preservatives shall also be according to the CAN/CSA-S6 and the Structural Manual.

907.05.03 Fasteners and Hardware

907.05.03.01 Bolts, Rods, and Lag Screws

Bolts, rods, and lag screws shall be according to ASTM A 307 or CSA G40.20/G40.21.

907.05.03.02 Truss Plates

Sheet steel for manufacturing truss plates shall be according to ASTM A 653, Type A or Type B.

907.05.03.03 Split Ring and Shear Plate Connectors

Split ring and shear plate connectors shall be according to CSA O86.
907.05.03.04  Glulam Rivets
Glulam rivets shall be according to CSA O86.

907.05.03.05  Nails and Spikes
Nails and spikes shall be according to CSA B111.

907.05.03.06  Drift Pins
Steel used for drift pins shall have minimum yield strength of 280 MPa and shall be according to CSA G40.20/G40.21.

907.05.03.07  Washers
Steel washers shall be according to CSA G40.20/G40.21. Malleable iron casting washers shall be according to ASTM A 47M.

907.05.03.08  High-Strength Bars
High-strength bars shall be according to ASTM A 722M.

907.05.03.09  Galvanizing
All fasteners and hardware shall be hot dip galvanized according to CSA G164, after manufacture. Heat-treated alloy components shall be galvanized according to the manufacturers specifications.

907.05.04  Granular Materials
Granular materials shall be according to OPSS 1010.

907.05.05  Geotextile
Geotextile shall be non-woven, Class II according to OPSS 1860, Table 1, with an FOS of 75-150 µm.

907.05.06  Concrete
Concrete shall be according to OPSS 1350 with a minimum 28-Day specified compressive strength of 30 MPa.

907.05.07  Steel Reinforcement
Steel reinforcement for concrete shall be according to OPSS 1440.

907.06  EQUIPMENT

907.06.01  Hydraulic and Mechanical Press
Hydraulic or mechanical presses capable of applying uniform pressure over the whole area of truss plates shall be used for the installation of all truss plates.

907.06.02  Hydraulic Jack System Stress-Laminated Wood Decks
The stressing equipment shall be according to OPSS 910.
The hydraulic jack system shall be capable of stressing a minimum of six post-tensioning locations at a time. For longitudinally laminated decks, the number of jacks shall not be less than those required to stress a length of deck equal to one half the width of the deck at the same time.

907.07 CONSTRUCTION

907.07.01 Handling and Storage of Wood

All wood shall be handled, stacked, and protected according to OPSS 1601.

907.07.02 Shop Fabrication

Shop preparation and fabrication shall be according to OPSS 1601.

907.07.03 Field Fabrication

Field fabrication shall only be permitted when specified in the Contract Documents. Field cut portions of treated wood members shall not be buried or placed in contact with the ground. Cutting and boring shall not puncture the internal voids of bridge decks containing the post-tensioning bars.

Field cuts, abrasions, and boreholes made in fabricated wood after preservative treatment shall be trimmed and treated to be according to OPSS 1601.

907.07.04 Fasteners

907.07.04.01 Bolts, Rods, and Lag Screws

Holes shall be prebored as specified in the Contract Documents. Holes shall be aligned and the bolts and rods shall be driven, with a hammer not larger than 0.5 kg, in order to make the connection. Lag screws shall be turned into the wood, not driven.

Holes for smooth dowels and drift pins shall be 1.5 mm less in diameter than the dowels or pins. Holes for galvanized bolts shall be bored with a bit 1.5 mm larger in diameter than the bolt.

Holes for lag screws shall have the same diameter and depth as the shank of the screw, plus a lead hole for the threaded portion with the diameter approximately 75% of the shank diameter.

Washers shall be placed under all bolt heads and nuts. Excess bolt lengths of more than 50 mm shall be cut off to a level where at least 5 threads are still extending beyond the nut. The cut ends of galvanized bolts shall receive 2 coats of zinc rich paint. After final tightening, all nuts shall be checked and threads burred effectively with a pointing tool to prevent loosening. Field cuts or damaged surfaces shall be touched-up with a zinc rich paint within 10 hours of exposure.

907.07.04.02 Nailing for Laminated Decks

Gauge lines for horizontal nailing shall be followed. Nails in the upper gauge line shall be inclined slightly downward and those in the lower gauge line inclined slightly upward. The nailheads shall be flush and well set so that they do not protrude from the surface. Power nailing devices shall be permitted for stress-laminated wood decks according to the CAN/CSA-S6.
907.07.05  Wood in Cribs

Excavation shall be according to OPSS 902.

Cribs shall be erected to the dimensions shown in the Contract Documents with each layer horizontal before placing the next. Wood with the least surface oils shall be located in or nearest to the water. Wood, which appears to be more heavily treated, shall be placed at the back of the crib against the ground.

The cribs shall be filled to 1 m below the top of the crib with boulder or rock fragments having dimensions in the range 200 to 600 mm. The top metre of the cribs shall be filled with Granular A or B. The granular material shall be protected against migration into the rock layer by the placement of geotextile fabric between the rock and the granular layers. The geotextile shall be placed uniformly, free of tears and as specified in the Contract Documents. All seams shall have a minimum overlap of 500 mm and the geotextile shall be fixed to prevent movement. Filling of the cribs shall be such that distortion is avoided. Fill material shall be placed in even horizontal layers and shall be compacted according to the requirements of OPSS 501.

907.07.06  Placement of Members

907.07.06.01  Stringers and Girders

Stringers and girders shall be placed and adjusted when necessary so that full and accurate bearing is achieved on the supports. Sawn wood members shall be oriented so that elevation differences between adjacent members, due to natural curvatures along their lengths, are minimized.

907.07.06.02  Laminated Wood Deck

Each lamination shall be placed in the bridge so that initially, full and accurate bearing is achieved. Subsequently the alignment of predrilled holes in stress-laminated decks or slots in composite wood-concrete decks shall be achieved. Finally, the laminations shall be brought to position by nailing.

907.07.07  Stress-Laminated Wood Decks

907.07.07.01  Stressing

Hydraulic jacks shall be used for stressing the stress-laminated wood decks. For transversely laminated decks, all tendons shall be uniformly stressed at the same time.

High-strength bars shall be stressed to the forces shown in the Contract Documents. The tensioning shall be performed in the following sequence:

a)  Initial stressing - at time of construction of deck.

   The initial stressing shall consist of two stressing operations not less than 12 hours apart.

b)  1st restressing - not less than 2 weeks after completion of the initial stressing.

c)  2nd Restressing - not less than 4 weeks after the 1st restressing.

The allowable variation of prestressing force in each bar shall be 5%.

The Contract Administrator may increase the time periods between restressings, when the ambient temperature is below 0 °C.
907.07.07.02 Securing of Deck

The deck shall not be secured to the supporting members, except as specified in the Segmental Construction clause, until after the 1st restressing. When a deck requires restraint against buckling during stressing, the restraint shall not inhibit free movement of the deck perpendicular to the laminates.

907.07.07.03 Segmental Construction

When a deck is to be constructed in segments, each segment shall undergo all restressings as specified in the Stressing clause before being installed. The method of installation of the segments shall be such that the final assembled deck is continuous.

When the method of installation requires the temporary release of stressing in a segment in order to facilitate installation, that segment shall then be stressed twice before any segments are attached to it. The first stressing shall be at the time of installation of that segment. The second stressing shall be performed no sooner than 4 x T after the first stressing, where T equals the total time period the segment was not under stress.

907.07.08 Wood-Concrete Composite Decks

907.07.08.01 Wood Base Construction

Wood-concrete interface construction of the deck shall be according to CAN/CSA-S6.

907.07.08.02 Concrete

Concrete placement and testing shall be according to OPSS 904.

907.07.08.03 Steel Reinforcement

Steel reinforcement for concrete shall be placed according to OPSS 905 and CAN/CSA-S6.

907.07.08.04 Reinforcing Spikes

Reinforcing spikes, for notch and spike construction, shall be driven into the top of the laminations in every notch of alternate laminations. These spikes shall be inclined at about 30° from the vertical toward the nearest internal support or end support. If the notches in adjacent laminations are staggered by more than 50 mm, then all laminations involved shall contain reinforcing spikes. Reinforcing spikes shall be a minimum of 50 mm longer than the full vertical depth of the wood deck.

907.07.09 Management of Excess Material

Management of excess material shall be as specified in the Contract Documents.

907.09 MEASUREMENT FOR PAYMENT

907.09.01 Actual Measurement

907.09.01.01 Wood in Cribs

Measurement of wood in cribs shall be by volume in cubic metres using dressed dimensions of the wood with no deductions for grooves, notches, and holes.
907.09.02 Plan Quantity Measurement

When measurement is by plan quantity, such measurement shall be based on the units shown in the clause under Actual Measurement.

907.10 BASIS OF PAYMENT

907.10.01 Wood in Structure - Item
Wood in Cribs - Item

Payment at the Contract price for the above tender item shall be full compensation for all labour, Equipment, and Material to do the work.

When rock is available on the Contract, no deduction shall be made from the tender item “Rock Excavation, Grading,” for the quantity of rock used in cribs.

907.10.02 Excavation for Wood Cribs

When excavation for wood cribs overlaps excavation for other work, measurement of the overlapping excavation shall be according to the specification for such other work.
Appendix 907-A, April 2011
FOR USE WHILE DESIGNING MUNICIPAL CONTRACTS

Note: This is a non-mandatory Commentary Appendix intended to provide information to a designer, during the design stage of a contract, on the use of the OPS specification in a municipal contract. This appendix does not form part of the standard specification. Actions and considerations discussed in this appendix are for information purposes only and do not supersede an Owner's design decisions and methodology.

Designer Action/Considerations

The following should be specified in the Contract Documents:

- Allowable field fabrication. (907.07.03)
- Prebored holes for bolts, rods, and lag screws. (907.07.04.01)
- Crib details. (907.07.05)
- Geotextile placement details. (907.07.05)
- Stressing forces for high-strength bars. (907.07.07.01)

The designer should ensure that the General Conditions of Contract and the 100 Series General Specifications are included in the Contract Documents.

Related Ontario Provincial Standard Drawings

No information provided here.