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| Version | Date | Description of Revisions |
| 1 | August 30, 2006 | Approved final document. |
| 2 | November 5, 2007 | Minor revisions by Legal Services. |
| 3 | November 13, 2009 | Modified ‘Related Section’ |
| 4 | March 15, 2011 | Minor changes from Legal |
| 5 | June 5, 2012 | Added References and Replacement Parts Section |
| 6 | June 29, 2012 | Reformatted to Remove White Space |
| 7 | April 24, 2015 | General formatting |
| 8 | August 17, 2015 | First draft review of updated spec. (AV) |
| **9** | **September 16, 2015** | **Updated, Finalized Specification – Reference eDOCS #6263145 v3 (AV)** |
| 10 | April 26, 2018 | 2.1.5.2.5 Manufacturers and products removed (BM) |
| 11 | March 31, 2020 | References updated throughout  1.6 section added (BM) |

NOTE:

This is a CONTROLLED Document. Any documents appearing in paper form are not controlled and should be checked against the on-line file version prior to use.

**Notice:** This Document hardcopy must be used for reference purpose only.

**The on-line copy is the current version of the document.**

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## Related Sections

### *[Under "Related Sections", identify other Sections that are related to, and/or dependent on, the work results or information specified elsewhere. The list should be limited to Sections with specific information that the reader might expect to find in this Section, but is specified elsewhere. For example, if hardware for aluminum entrances is specified in the aluminum entrance Section, a cross-reference would be appropriate in the finish hardware Section. The purpose of this cross-referencing is for information only, to aid in finding those other requirements—not to define the scope of the Section.*

### *Cross-referencing here may also be used to coordinate assemblies or systems whose components may span multiple Sections and which must meet certain performance requirements as an assembly or system.*

### *Contractor is responsible for coordination of the Work.*

### *This Section is to be completed/updated during the design development by the Consultant. If it is not applicable to the section for the specific project it may be deleted.]*

### [List Sections specifying installation of products supplied but not installed under this Section and indicate specific items.]

### Section [\_\_\_\_\_\_ – \_\_\_\_\_\_\_\_\_\_\_\_]: Execution requirements for ...[item]... specified under this Section.

### [List Sections specifying products installed but not supplied under this Section and indicate specific items.]

### Section [\_\_\_\_\_\_ – \_\_\_\_\_\_\_\_\_\_\_\_]: Product requirements for ...[item]... for installation under this Section.

### [List Sections specifying related requirements.]

### Section [\_\_\_\_\_\_ – \_\_\_\_\_\_\_\_\_\_\_\_]: [Optional short phrase indicating relationship].

#### Section 01300 – Submittals

#### Section 07900 – Joint Sealers

## Measurement and Payment

*[Choose one of the following payment language provisions that best suits the individual project.*

*If this Section is not specifically referenced by an item in the Bid Form, please use the following language:*

.1 The work of this Section will not be measured separately for payment. All costs associated with the work of this Section shall be included in the Contract Price.

*OR If this Section is specifically referenced in the Bid Form, use the following language and identify the relevant item in the Bid Form:*

.1 All costs associated with the work of this Section shall be included in the price(s) for Item No(s). \_\_\_ in the Bid Form.

## If the work of this Section is to be measured and paid for by several different methods, please amend the standard wording given above to reflect the different methods of measurement and payment.]

## References

### *[Consultant to review standards references and amend as appropriate]*

### Canadian Standards Association (CSA)

#### CSA A23.1-14, Concrete Materials and Methods of Concrete Construction

#### CSA O86.1-19, Engineering Design in Wood.

#### CSA O121-17, Douglas Fir Plywood.

#### CSA O151-09 (R2014), Canadian Softwood Plywood

#### CSA O153-19, Poplar Plywood.

#### CSA S269.1-16 Falsework and Formwork.

### American Concrete Institute (ACI)

#### ACI 347R-14, Guide to Formwork for Concrete

### Ontario Provincial Standards Specifications (OPSS)

#### OPSS 919, Construction Specification for Formwork and Falsework.

### Council of Forest Industries of British Columbia (COFI)

#### COFI Exterior Plywood for Concrete Formwork.

## Design and Performance Requirements

### Design formwork in accordance with ACI 347R-14, CSA S269.1-16 and CSA A23.1-14 Clause *[6.5][Consultant to confirm accuracy of the reference to CSA A23.1-14]*. Formwork to provide specified finishes. Design formwork and falsework to carry dead loads and construction live loads. The Contractor shall conform to CSA standards for design formwork and falsework as specified in the Contract Documents.

### When high range water reducer (super plasticizer) is used in concrete mix, design forms for full hydrostatic pressure.

### Make joints in forms watertight. Ensure that the joints are in line and level to get required finishes to comply with the architectural requirement and concrete finishes in accordance with Section 03345 - Concrete Curing and Finishing.

### Limit deflection of formwork to limits specified in CSA S269.1-16.

## Quality Assurance

### A professional engineer licensed to practice in the Province of Ontario shall design, supervise installation as required, and inspect concrete formwork and false work to ensure that formwork and falsework will carry dead loads and construction live loads.

### The Contractor shall utilize personnel with demonstrated competence and experience to install concrete formwork and falsework, to ensure that the joints are in line and level.

## Quality Control

### Upon completion of the falsework foundation and prior to installation of falsework, the Contractor’s engineer who completed the falsework foundation design shall conduct an interim inspection of the work to verify that the falsework foundation has been constructed according to the Falsework Foundation Design Report and issue written permission to proceed with the work.

### The Contractor shall arrange for inspection of formwork and falsework by a professional engineer licensed to practice in the Province of Ontario.

## Shop Drawings

### Submit shop drawings in accordance with Section 01300 - Submittals.

### Submit formwork and falsework drawings bearing seal and signature of a professional engineer for record purpose.

### Formwork and falsework shop drawings will not be reviewed for structural adequacy.

### Be fully responsible for the design, construction, supervision and maintenance of formwork and falsework.

#### Show design criteria with respect to the following, as specified in clause [6.5.2.1]*[Consultant to confirm clause]* of CSA A23.1-14 for Formwork.

##### Density of plastic concrete;

##### Rate, sequence, and method of placing concrete;

##### Concrete slump or slump flow;

##### Concrete admixtures;

##### Concrete temperature;

##### Specifications for formwork materials;

##### Maximum member or panel deflection;

##### Mass of components of formwork to be erected;

##### Locations and details of proposed construction joints; and

##### camber

### Indicate:

#### For suspended slabs:

##### Shoring left in place until concrete has reached specified strength.

##### Re-shoring below slabs or beams supporting shoring above.

##### Lateral bracing system.

#### For walls and columns on top of slabs and beams:

##### Shoring left in place until concrete in walls and columns above has reached specified strength.

##### Lateral bracing system.

### Layout of panel joints, form liners, and tie hole pattern.

### Double Wall Construction: Show details of double wall forming and premolded joint filler attachment.

### Indicate the method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts. Comply with the requirements of CSA S269.1-16 for falsework and formwork drawings

### Indicate re-shoring below slabs or beams supporting the shoring above. Provide a lateral bracing system.

### Each shop drawing submission shall bear the stamp and signature of a qualified professional engineer registered or licensed in the Province of Ontario, as required by the Ministry of Labour.

## Waste Management and Disposal

### *[Use this section only if required by the project scope.]*

### [Separate and recycle all waste materials in accordance with the Waste Reduction Workplan.] *[Consultant to consult with Region to determine whether any LEED requirements will be incorporated into the project]*

### Place materials defined as hazardous or toxic waste in designated containers.

### Ensure that emptied containers are sealed and stored safely for disposal.

### Use sealers, form release and stripping agents that are non-toxic, biodegradable and have zero or low volatile organic compounds (VOC).

# PRODUCTS

## Materials

### Formwork materials:

#### For concrete without special architectural features, use wood and wood product formwork materials in accordance with [CSA O86.1-19][CSA O121-17][CSA O151-17][CSA O153-19].

#### For concrete with special architectural features, use formwork materials in accordance with CSA A23.1-14.

### Pan forms: removable as indicated in the Contract Documents.

### Tubular column forms: round, spirally wound laminated fibre forms, internally treated with release material.

### Form ties:

#### For water holding structures including exterior walls provide ties with following:

##### Integral steel water stop 2.6 mm thick and 16 mm in diameter continuously welded to the tie

##### Neoprene water stop 5 mm thick and 24 mm in diameter whose centre hole is ½ the diameter of the tie or molded plastic water stop of a comparable size.

##### Orient the water stop perpendicular to the tie and symmetrical about the centre of the tie.

##### Through bolt ties are not permitted for water holding structures.

#### For concrete not designated 'Architectural', use removable or snap off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm in diameter in the concrete surface.

#### For Architectural concrete, use snap ties complete with plastic cones and light grey concrete plugs.

#### Submit samples for form ties.

### Form:

#### Plywood: high density overlay Douglas Fir in accordance with CSA O121-17 # 1 grade, square edge, 20 mm thick. When controlled form liner is used, the surface finish of the plywood may be of a lower grade.

#### Form Liner:

##### Controlled Permeability Form Liner.

##### Control the pore size to permit drainage of excess water after the placement of concrete.

##### Minimum water permeability at 200 mm water head of 20 L/m2/second.

##### Liner must be non compressible under wet concrete pressure.

### Form release agent: non-toxic, biodegradable, low VOC.

### Falsework materials: in accordance with CSA S269.1-16

### Sealant: in accordance with Section 07900 - Joint Sealers.

# EXECUTION

## Fabrication and Erection

### Verify all lines, levels and centres before proceeding with formwork/false work and ensure that the dimensions agree with the Contract Drawings.

### Fabricate and erect falsework in accordance with in accordance with CSA S269.1-16 and COFI Exterior Plywood for Concrete Formwork.

### Refer to the architectural drawings for concrete members requiring architectural exposed finishes.

### Do not place shores and mud sills on frozen ground.

### Provide Site drainage in order to prevent the washout of soil supporting mud sills and shores.

### Fabricate and erect formwork in accordance with ACI 347R-14 and CSA S269.1-16 to produce finished concrete conforming to the shape, dimensions, locations and levels indicated within the tolerances required by CSA A23.1-14.

### Align form joints and make them watertight. Keep form joints to a minimum.

### Locate horizontal form joints for exposed columns 2,400 mm above the finished floor elevation.

### Use 25 mm chamfer strips on external corners and/or 25 mm fillets at interior corners and joints, unless specified otherwise in the Contract Documents.

### Form chases, slots, openings, drips, recesses, expansion and control joints as indicated in the Contract Documents.

### Construct forms for architectural concrete, and place ties as indicated in the Contract Documents and/or as directed by the Consultant. The joint pattern is not necessarily based on using standard size panels or the maximum permissible spacing of ties.

### Build in anchors, sleeves, and other inserts which may be required to accommodate the items of Work specified in other Sections. Ensure that all anchors and inserts will not protrude beyond the surfaces designated to receive applied finishes, including painting.

### Controlled permeability form liner application locations:

#### [Provide liner on both faces of the wall]

#### [Provide liner on the face only exposed to grade or water i.e. face not exposed to view]

#### [For liquid holding structures provide liner on both faces except at tunnels and galleries where the liner shall be applied on the wet side only]

#### Provide liner in full sheets. Place seams in a regular horizontal and vertical pattern. Staple the liner to form at close spacing as recommended by the manufacturer. Prevent wrinkling of the liner.

#### Do not use form release agents on forms or liners.

### Line forms for the following surfaces:

#### Outer face of girders beams.

#### Exposed faces of abutments, wingwalls, piers and pylons. Do not stagger the joints of form lining material. Align joints to obtain a uniform pattern.

### Clean all formwork in accordance with CSA A23.1-14 before placing any concrete.

### If slip forming and/or flying forms are used, submit details of the equipment and procedures for the Consultant's review.

## Removal and Re-shoring

### Leave formwork in place for the following minimum periods of time after placing concrete:

#### One (1) Day for walls and sides of beams.

#### One (1) Day for columns.

#### Remove formwork after concrete has reached 75% of its specified 28 Day compressive strength determined by a field cured test cylinder for beam soffits, suspended slabs, decks and other structural members.

#### One (1) Day for footings and abutments. Contractor Note: The ambient conditions may require additional curing at the discretion of the Consultant.

### Provide all necessary reshoring of members where the early removal of forms may be required or where members may be subjected to additional loads during construction as required.

### Space reshoring in each principal direction shall be a maximum of 3,000 mm apart.

### Do not re-use damaged forms. Re-use formwork and falsework subject to the requirements of CSA-A23.1-14.

**END OF SECTION**