1.0 GENERAL

1.1 REFERENCE STANDARDS

.1	CSA-A23.1-09	Concrete Materials and Methods of Concrete Construction
.2	CSA-A23.2-09	Methods of Test for Concrete
.3	CSA-S269.3-M92-R2008	Concrete Formwork
.4	ACI SP4 Chapter 5 - 05	Formwork for Concrete
.5	ACI Standard 347 - 04	Recommended Practice for Concrete Formwork
.6	CSA-086.1-09	Design in Wood (Limit States Design)
.7	CSA-O121-08	Douglas Fir Plywood
.8	CSA-O153-M1980 R08	Poplar Plywood

1.2 TOLERANCES

.1 The tolerances for all concrete work shall conform to the requirements of CSA Standard CSA-A23.1, Section 10.

1.3 PRODUCT HANDLING

.1 Protect formwork materials before, during, and after installation and protect installed work and materials of other trades.

.2 In the event of damage immediately make required repairs or replacements necessary to the approval of the inspector and at no extra cost to the Departmental Representative.

1.4 MOCK-UPS FOR BOARD FORM FINISH

.1 Mock-ups: field-erected examples of work complete with specified materials and workmanship.

.2 Erect mock-ups for the board form finish at locations acceptable to Departmental Representative.

.3 Reviewed and accepted mock-ups will become standards of workmanship and material against which installed work will be verified.

2.0 PRODUCTS

2.1 FORMWORK MATERIALS

.1 Form Material:

.1 Exposed surfaces – standard lumber with square edges

.2 Unexposed surfaces - metal, plywood to CSA 0121-08 or CSA 0153-M1980 R08, or wood lumber to CAN/CSA 086.1-09.

.3 Plywood and wood formwork materials shall conform to CSA S269.3 M92-R2008, be free from warp and sawn straight so that lines and shapes will be accurately retained.

.4 Formwork for unexposed surfaces shall be made with a good grade of lumber or plywood and fitted so that there will be no leakage of mortar.

.5 Use metal forms, plywood lined forms or plywood forms of sufficient structural strength for exposed surfaces. Plywood for lining shall be new material GIS exterior grade fir plywood manufactured with waterproof glue.

.2 Ties and Spreaders:

.1 Form ties shall be of a type, which are adjustable in length to permit tightening of forms. Use only the snap-off type of form tie, which will leave no metal within 25-mm of the concrete surface after removal. Twisted wire form ties will not be accepted.

.3 Form Release Agent:

.1 Form release agent shall be a pre-approved chemical agent, not an oil based product.

3.0 EXECUTION

3.1 FORMWORK

.1 Lines and Levels:

.1 Verify lines, levels, and column centers before proceeding with work and ensure that dimensions agree with drawings.

.2 Co-ordinate and co-operate with all other trades in forming and setting of recesses, chases, sleeves, inserts, bolts, and hangers.

.2 Design:

.1 Design, construct, and erect formwork in accordance with CSA A23.1-09, CSA 269.3-M92-R2008, ACI 347-04, and all applicable construction safety regulations for the place of work.

.2 Build forms sufficiently strong and rigid to sustain the weight or fluid pressure of the concrete without noticeable deflection. Ensure forms are sufficiently tight to prevent leakage of mortar.

.3 The Contractor shall be responsible for design and construction of falsework. The method and scheduling of re-shoring shall be submitted to the Departmental Representative for review prior to fabrication.

.4 Do not exceed the safe live load of the structure with any construction or shoring loads considering the age and strength of the concrete.

.5 Provide 20mm x 20mm chamfers strips for exposed corners or edges of columns, walls, beams, and slabs.

.3 Construction:

.1 Construct forms so that the finished concrete will conform to the shape and dimensions specified.

.2 Construct forms so that they may be dismantled and removed without damaging the concrete.

.3 Set shores on wedges or use adjustable shores so they may be removed without causing undue strains in the concrete.

.4 Provide temporary openings at the bottom of column and wall forms to facilitate cleaning and inspection. Use water to flush out cuttings, shavings, debris, snow and ice, and foreign matter. Ensure that water and debris fully drain to the exterior through clean-out ports, and close the openings with a patch, flush on the inside.

.5 Inform the Departmental Representative when formwork is complete and has been cleaned, to allow for inspection.

.4 Treatment of Forms:

.1 Use a non-staining form release agent free from volatile constituents for treating forms.

.2 Install form release agent on form surfaces and allow to dry prior to placing reinforcing steel, anchoring devices and embedded parts.

.3 Untreated forms shall be kept wetted down to prevent shrinkage prior to placing concrete and shall be surface wetted at time of placing.

.5 Alignment:

.1 Provide suitable means for checking the alignment and elevation of formwork. Check these items frequently during placement of the concrete.

.2 Carry out corrective wedging as required until concrete is in place.

.3 The Departmental Representative shall have the right to order concrete removed which has become misaligned during placing.

.4 Align forms to ensure movement and deflections of the finished product are confined. Tolerances for all concrete work shall conform to the requirements of CSA Standard CSA-A23.1-09 and ACI 347-04.

.5 Formwork for slabs and beams shall be cambered as shown on the drawings. For the calculation of such cambers, an allowance for settlement, closure of form joints, elastic shortening of forms and shoring, must be made and added to camber requirements.

.6 Stripping:

.1 Formwork shall not be removed until the concrete has gained sufficient strength to carry dead loads and all possible construction loads likely to be imposed upon it. Notify the Departmental Representative before removing formwork.

.2 Remove Falsework progressively, in accordance with CSA 269.3-M92-R2008 and ensure that no shock loads or unbalanced loads are imposed upon the structure.

.3 Loosen forms carefully, and in a method that will prevent spalling and other damage to the concrete surface or edges. Do not use wedge pry bars, hammers or tools against exposed concrete finish surfaces.

.4 Leave forms loosely in place for protection until curing requirements are complete.

.5 Completely remove the forms from under steps and similar void spaces, through temporary openings if necessary.

.6 Remove metal spreader ties on exposed concrete by removing or snapping off inside the wall surface. Point up and patch the resulting pockets to match the surrounding areas.

.7 Re-Use of Formwork:

.1 Forms may be re-used after adequate cleaning provided the surfaces are not cracked or become roughened. Such formwork shall be trimmed and properly patched.

END OF SECTION