

PART 1 - GENERAL

- 1.1 RELATED WORK
- .1 Concrete Reinforcement: Section 03 20 00
 - .2 Cast-In-Place Concrete: Section 03 30 00

- 1.2 REFERENCES
- .1 ACI 347-04, Guide to Formwork for Concrete, American Concrete Institute.
 - .2 CAN/CSA-A23.1-09, Concrete Materials and Methods of Concrete Construction.
 - .3 CAN/CSA A23.2-09, Methods of Test and Standard Practices for Concrete.
 - .4 CAN/CSA 086-09, Consolidation, Engineering Design in Wood.
 - .5 CAN/CSA-S269.3-M92 (R2003), Concrete Formwork.
 - .6 CSA 0121-08, Douglas Fir Plywood.
 - .7 CSA 0151-09, Canadian Softwood Plywood.
 - .8 CSA 0437 Series- 93(2011) Standards on OSB and Waferboard.
 - .9 CSA 0153-M1980 (R2008), Poplar Plywood.
 - .10 CSA S269.1-1975 (R2003), Falsework for Construction Purposes.

- 1.3 WASTE MANAGEMENT AND DISPOSAL
- .1 Place materials defined as hazardous or toxic waste in designated containers.
 - .2 Ensure emptied containers are sealed and store safely for disposal.
 - .3 Use sealers, form release and stripping agents that are non-toxic, biodegradable and have zero or low VOC's.
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PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Formwork lumber:
 - .1 Plywood and wood formwork materials to CSA-0121 and CAN/CSA-086, and CSA-0153.
 - .2 For concrete with special architectural features, use formwork materials in accordance to CAN/CSA A23.1.
- .2 Falsework materials: to CSA S269.1.
- .3 Form ties:
 - .1 For concrete not designated "Architectural", use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25mm diameter in concrete surface.
 - .2 For architectural concrete, use snap ties complete with plastic cones and light grey concrete plugs.
- .4 Form release agent: chemically active release agents containing compounds that react with free lime present in concrete to provide water insoluble soaps, preventing concrete from sticking to forms; having no adverse affect on paint, adhesives, waterproofing, or other treatments which are specified for application to concrete and containing no non-drying ingredients such as mineral oil. Use form release agent with low V.O.C. content.

PART 3 - EXECUTION

3.1 ERECTION

- .1 Verify lines, levels and column centres before proceeding with formwork/falsework and ensure dimensions agree with drawings.
- .2 Obtain Departmental Representative's approval for use of earth forms.
- .3 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.
- .4 Fabricate and erect falsework in accordance with CSA S269.1.

3.1 ERECTION
(Cont'd)

- .5 Refer to architectural drawings for concrete members requiring exposed finishes.
- .6 Do not place shores and mud sills on frozen ground.
- .7 Provide site drainage to prevent washout of soil supporting mud sills and shores.
- .8 Fabricate and erect formwork in accordance with CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CAN/CSA-A23.1.
- .9 Step/lower all building foundations and column footings down as indicated on drawings. Contractor to coordinate with plumbing and electrical contractors to step footings down as required to allow all underground plumbing and electrical services to be sleeved through foundation walls or to pass over column pad footings. No services to be located under building foundations.
- .10 All stepped footings shown on the drawings are approximate and all of the required stepped footings may not be shown. The Contractor is to review all of the foundations and building services and submit to the Departmental Representative the proposed stepped footing locations and elevations to allow all of the services to be sleeved through the foundation wall and/or provide the required frost cover. The proposed stepped footing locations and elevations shall be submitted prior to commencing any foundation work.
- .11 Construction Joints:
 - .1 In general incorporate either horizontal or vertical construction joints in accordance with CAN/CSA-A23.1 and to the Departmental Representative's approval. Submit proposed joint locations for review prior to start of formwork erection.
 - .2 Provide construction joints in concrete where work is left off at day's end. Run reinforcement continuous through joints and shear key unless indicated otherwise.
 - .3 Provide proper key and reinforcement. In beams, provide inclined shear bars as required.

3.1 ERECTION
(Cont'd)

- .11 Construction Joints:(Cont'd)
 - .4 Immediately before next pour, clean construction joint and brush with grout of neat cement.
- .12 Construct forms for architectural concrete, and place ties as indicated and/or as directed. Joint pattern not necessarily based on using standard size panels or maximum permissible spacing of ties.
- .13 Coat formwork with form release agent before reinforcement, anchors or other accessories are placed, unless soaking with water during hot weather is acceptable. Do not coat plywood forms pre-coated with a chemical release agent.
- .14 Prior to the concrete pour, review and correct as necessary formwork tolerances and alignment, particularly where soffits of suspended slabs are used as exposed ceilings. See architectural drawings for locations, typically the surfaces 6.1m in from the exterior edge.
- .15 Align form joints and make watertight. Keep form joints to minimum.
- .16 Use 25mm chamfer strips or as indicated on external corners.
- .17 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.
- .18 Build in anchors, sleeves, and other inserts required to accommodate work specified in other sections. Assure that all anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.
- .19 Clean formwork in accordance with CAN/CSA-A23.1, before placing concrete.

3.2 REMOVAL AND
RESHORING

- .1 Leave formwork in place until the concrete element has achieved at least 70% of the specified 28-day compressive strength for that element. Additional cylinders to be cast for

3.2 REMOVAL AND
RESHORING
(Cont'd)

- .1 (Cont'd)
the purpose of early testing to verify 70% of compressive strength has been achieved.
- .2 For structural slabs, immediately replace formwork with adequate shoring to standard specified formwork. Submit proposed stripping and reshoring schedule for review by the Departmental Representative prior to first concrete pour.
- .3 Monitor concrete temperature and moisture evaporation rates and provide appropriate hot weather protection as defined in clause 21 of CSA-A23.1. Maintain records of all measurements during hot weather periods for review by the Departmental Representative.
- .4 Be responsible for the safety of the structure, both before and after removal of the forms, until concrete has reached its specified 28 day strength.
- .5 Provide all necessary reshoring of members where early removals of forms may be required or where members may be subjected to additional loads during construction as required.
- .6 Space reshoring in each principal direction at not more than 3m apart.
- .7 All concrete formwork shall be checked for alignment and levels prior to the placing of concrete in these forms. The Contractor shall again check the formwork for alignment and levels during and immediately after each concrete pour.
- .8 Provide and maintain during the total duration on site, properly constructed guard rails and toe boards at all slab edges and around all slab openings. These are to be built in accordance with the Construction Safety Act and to the approval of the Departmental Representative. When the work of this trade is complete, all guard rails and toe boards are to be left in proper condition and will become Owners property. The dismantling of same shall become the responsibility of subsequent contractors.

PART 1 - GENERAL

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|---------------------------------------|---|
| <u>1.1 RELATED WORK</u> | .1 Concrete Forming and Accessories: Section 03 10 00
.2 Cast-In-Place Concrete: Section 03 30 00 |
| <u>1.2 REFERENCES</u> | .1 ACI SP 66-04, ACI Detailing Manual, 2004.
.2 ASTM A82/A82M-07, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
.3 ASTM A185/A185M-07, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
.4 ASTM A767/A767M-09, Standard Specification for Zinc-coated (Galvanized) Steel Bars for Concrete Reinforcement.
.5 CAN/CSA-A23.1/A23.2- 09 Concrete Materials and Methods of Concrete Construction.
.6 CAN/CSA A23.3-04, Design of Concrete Structures.
.7 CAN/CSA-G30.18-09, Billet- Steel Bars for Concrete Reinforcement.
.8 CSA G40.20/G40.21- 04(R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
.9 CSA W186-M1990 (R2007), Welding of Reinforcing Bars in Reinforced Concrete Construction.
.10 Reinforcing Steel Manual of Practice, 4th Edition by the Reinforcing Steel Institute of Canada. |
| <u>1.3 SOURCE
QUALITY CONTROL</u> | .1 Upon request, provide Departmental Representative with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum four (4) weeks prior to commencing reinforcing work. |

1.3 SOURCE
QUALITY CONTROL
(Cont'd)

- .2 Upon request inform Departmental Representative of proposed source of material to be supplied.
- .3 Mill test reports to include certification that reinforcing steel recycled steel content rating meets or exceeds 75%. Certification to also include a breakdown of the pre- consumer, post- industrial and post- consumer content percentages of recycled content.

1.4 SHOP DRAWINGS

- .1 Submit shop drawings including placing reinforcement in accordance with Section 01 33 00.
- .2 Indicate on shop drawing bar bending details, lists, quantities of reinforcement, sizes, spacings, locations of reinforcement and mechanical splices, if approved by Departmental Representative with identifying code marks to permit correct placement without reference to structural drawings. Indicate sizes, spacings and locations of chairs, spacers and hangers. Prepare reinforcement drawings in accordance with Reinforcing Steel Manual of Standard Practice - by Reinforcing Steel Institute of Canada.
- .3 Detail lap lengths and bar development lengths to CAN/CSA- A23.3, unless otherwise indicated. Provide Class B tension lap to CAN/CSA- A23.3 unless otherwise indicated.
- .4 Reinforcement shop drawings shall indicated the location of all concrete pour joints in slabs and walls. Departmental Representative's approval for location of joints is to be obtained prior to cutting and bending of reinforcement.

1.5 SUBSTITUTES

- .1 Substitute different size bars only if permitted in writing by Departmental Representative.

1.6 WASTE
MANAGEMENT AND
DISPOSAL

- .1 Collect, separate and recycle all site generated waste materials in accordance with Section 01 74 21.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Reinforcing steel: billet steel, grade 400, deformed bars to CAN/CSA G30.18, unless indicated otherwise.
- .2 Minimum recycled steel content of all reinforcing steel to be 75%.
- .3 Cold-drawn annealed steel wire ties: to ASTM A82.
- .4 Welded steel wire fabric: to ASTM A185. Provide in flat sheets only.
- .5 Chairs, bolsters, bar supports, spacers: to CAN/CSA-A23.1.
- .6 Mechanical splices: subject to approval of Departmental Representative.
- .7 Plain round bars: to CSA-G40.21.

2.2 FABRICATION

- .1 Fabricate reinforcing steel in accordance with CAN/CSA-A23.1, ACI SP-66, and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.
- .2 Obtain Departmental Representative's approval for locations of reinforcement splices other than those shown on placing drawings.
- .3 Upon approval of Departmental Representative, weld reinforcement in accordance with CSA W186.
- .4 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

PART 3 - EXECUTION

3.1 FIELD BENDING

- .1 Examine formwork to ensure that it has been completed and adequately braced in place before starting reinforcement placing.
- .2 Do not field bend or field weld reinforcement except where indicated or authorized by Departmental Representative.
- .3 When field bending is authorized, bend without heat, applying a slow and steady pressure.
- .4 Replace bars which develop cracks or splits.

3.2 PLACING
REINFORCEMENT

- .1 Place reinforcing steel as indicated on reviewed placing drawings and in accordance with CAN/CSA-A23.1 and as follows:
 - .1 Clean all reinforcing of millscale, oil grease, or other deleterious material before and after placing reinforcement.
 - .2 Secure reinforcing steel rigidly in position with annealed wire or use approved clips to intersections supported on reinforcing chairs.
 - .3 Take care to ensure that the position of the bars do not alter during concreting and that the correct cover as noted on the drawings is maintained at all times.
- .2 Use plain round bars as slip dowels in concrete. Paint portion of dowel intended to move within hardened concrete with one coat of lead or asphalt paint. When paint is dry, apply a thick even film of mineral lubricating grease.
- .3 Prior to placing concrete, obtain Departmental Representative's approval of reinforcing material and placement. Provide ESB Representative 48 hours' notice to when reinforcing material will be installed and ready for inspection.
- .4 Ensure cover to reinforcement is maintained during concrete.

PART 1 - GENERAL

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| <u>1.1 RELATED WORK</u> | .1 | Concrete Forming and Accessories: Section 03 10 00 |
| | .2 | Concrete Reinforcing: Section 03 20 00 |
| | .3 | Insulation: Division 07 |
| | .4 | Waterproofing: Division 07 |
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| <u>1.2 REFERENCES</u> | .1 | ACI 302.1 R-04, Guide for Concrete Floor and Slab Construction. |
| | .2 | ASTM C109/C109M-11, Test Method for Compressive Strength of Hydraulic Cement Mortars (using 2 in. or 50 mm Cube Specimens). |
| | .3 | ASTM C260-10a, Specification for Air-Entraining Admixtures for Concrete. |
| | .4 | ASTM C309-11, Specification for Liquid Membrane- Forming Compounds for Curing Concrete. |
| | .5 | ASTM C494/C494M-11, Specification for Chemical Admixtures for Concrete. |
| | .6 | ASTM C827-2010, Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures. |
| | .7 | ASTM C939-2010, Test Method for Flow of Grout for Preplaced- Aggregate Concrete (Flow Cone Method). |
| | .8 | ASTM C979-2010, Pigments for Colored Concrete. |
| | .9 | ASTM D412-06a(R2013), Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension. |
| | .10 | ASTM D624-00(R2012), Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers. |
| | .11 | ASTM D1653-2013, Test Methods for Water Vapour Transmission of Organic Coating Films. |
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| 1.2 REFERENCES
(Cont'd) | .12 | ASTM D1751-04(R2008), Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types). |
| | .13 | ASTM D2240-05(R2010), Method for Rubber Property- Durometer Hardness. |
| | .14 | ASTM E1155-96(R2008), Procedures to Determine Floor Flatness and Levelness using the F-Number System. |
| | .15 | CSA A23.1-09/A23.2- 09, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete. |
| | .16 | CAN/CSA-A23.3- 04(R2010), Design of Concrete Structures. |
| | .17 | CAN/CSA-A3000-08, Consolidation - Cementitious Materials Compendium. |
| | .18 | CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet for Use in Building Construction. |
| | .19 | CAN/CGSB-37.2, Emulsified Asphalt, Mineral Coloid- Type, Unfilled, for Damproofing and Waterproofing and for Roof Coatings. |
| 1.3 SUBMITTALS | .1 | At least four (4) weeks prior to commencing work, inform Departmental Representative of proposed source of aggregates and provide access for sampling. |
| 1.4 CERTIFICATES | .1 | Minimum four (4) weeks prior to starting concrete work submit to Departmental Representative manufacturer's test data and certification by qualified independent inspection and testing laboratory that the following materials will meet specified requirements: <ul style="list-style-type: none"> .1 Portland cement. .2 Supplementary cementing materials. <ul style="list-style-type: none"> .1 For fly ash, provide details of supply, supplier's quality control program, test data for at least three (3) samples from the previous month's supply and details of proposed quality control |

1.4 CERTIFICATES
(Cont'd)

- .1 (Cont'd)
- .2 (Cont'd)
 - tests to be made between shipment to concrete supplier and use in the concrete.
 - .3 Grout.
 - .4 Admixtures.
 - .5 Aggregates.
 - .6 Water.
 - .7 Joint filler for non coloured and coloured slabs.
- .2 Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CSA- A23.1 and that mix design is adjusted to prevent alkali aggregate reactivity problems.
- .3 Provide certification that mix proportions selected will produce concrete of specified quality, yield and colour and that strength will comply with CSA-A23.1 and that mix design is adjusted to prevent alkali aggregate reactivity problems.
- .4 Provide written confirmation from concrete supplier the percent replacement of mass of Portland cement for fly ash/supplementary cementing materials for all concrete mix designs.

1.5 WASTE
MANAGEMENT AND
DISPOSAL

- .1 Separate waste materials and reuse and recycle in accordance with Section 01 74 21.
- .2 Use trigger operated spray nozzles for water hoses.
- .3 Designate a cleaning area for tools to limit water use and runoff.
- .4 Carefully coordinate the specified concrete work with weather conditions.
- .5 Ensure emptied containers are sealed and stored safely for disposal away from children.
- .6 Prevent plasticizers, water-reducing agents and air-entraining agents from entering drinking water supplies or streams. Using appropriate safety precautions, collect liquid

1.5 WASTE
MANAGEMENT AND
DISPOSAL
(Cont'd)

- .6 (Cont'd)
or solidify liquid with an inert,
non-combustible material and remove for
disposal. Dispose of all waste in accordance
with applicable local, provincial and national
regulations.
- .7 Choose least harmful, appropriate cleaning
method which will perform adequately.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Portland cement and supplementary cementing
materials: to CAN/CSA-A3000.
- .2 Water: to CSA-A23.1.
- .3 Aggregates: to CSA- A23.1. Coarse aggregates
to be normal density.
- .4 Air entraining admixture: to ASTM C260.
- .5 Chemical admixtures: to ASTM C494.
Departmental Representative to approve
accelerating or set retarding admixtures
during cold and hot weather placing.
- .6 Shrinkage compensating grout: premixed
compound consisting of non-metallic aggregate,
Portland cement, water reducing and
plasticizing agents.
 - .1 Compressive strength: 50 MPa at 28 days.
 - .2 Consistency:
 - .1 Fluid: to ASTM C827. Time of efflux
through flow cone (ASTM C939), under 30
s.
 - .2 Flowable: to ASTM C827. Flow table,
5 drops in 3 s, (ASTM C109, applicable
portion) 125 to 145%.
 - .3 Plastic: to ASTM C827. Flow table,
5 drops in 3 s, (ASTM C109, applicable
portions) 100 to 125%.
 - .4 Dry pack to manufacturer's
requirements.
- .7 Vapour Retarder Membrane: Underslab 15-MIL,
puncture resistant, Polyolefin to ASTM E1745,
Class A (Premium), puncture resistance to ASTM
D1709, water vapour resistance to ASTM
F1249/ASTM E96.

2.1 MATERIALS (Cont'd)

- .8 Sealant polyurethane:
 - .1 Self-levelling to ASTM C920, Type M, Grade P, Class 25.
- .9 Curing compounds: to CSA-A23.1 and to ASTM C309, Type 1-D with fugitive dye, except for exposed concrete. Ensure compatibility with concrete floor hardeners and finish floor adhesives.
- .10 Rigid board underslab and foundation wall perimeter insulation to CAN/CSA S701 and as specified in Section 07 21 13. See architectural drawings for locations and requirements.
- .11 Mechanical waterstops: ribbed extruded PVC Arctic Grade of sizes required with prewelded corner and intersecting pieces.
 - .1 Tensile strength: to ASTM D412, method "A", Die "C".
 - .2 Elongation: to ASTM D412, method "A", Die "C", minimum 275%.
 - .3 Tear resistance: to ASTM D624, method "A", Die "B", minimum 30kN/m.
- .12 Control/Isolation Joint Filler:
 - .1 Two component, quick setting, semi-rigid, solvent free, self leveling, polyurea; minimum tensile strength of 4.5 MPa; minimum elongation of 200% as per D412, and a minimum shore A hardness of 85 as per ASTM D2240.
 - .2 Ensure compatibility of filler with concrete slab hardeners and/or sealers. Refer to architectural drawings and finish schedules for hardener and sealer locations.
- .13 Concrete sealer:
 - .1 Refer to Spec Section 03 35 05.

2.2 CONCRETE MIXES

- .1 General: Where practically possible, for all concrete mixes listed below, except for concrete flat slab work, concrete supplier to maximize the amount Portland cement replaced with fly ash or another approved cementitious recycled material while maintaining the characteristics listed for each concrete mix listed as well as the workability of each mix. Concrete supplier to provide written confirmation of the percent replacement of

- 2.2 CONCRETE MIXES .1 General:(Cont'd)
(Cont'd) Portland cement for fly ash/supplementary cementing materials for all mix designs.
- .2 Proportion normal density concrete in accordance with CSA- A23.1, Alternative 1 to give the following properties for concrete in all building foundations, elevator pit and sump pit:
- .1 Cement: Type GU.
 - .2 Minimum compressive strength at 28 days: 25 MPa.
 - .3 Class of exposure: F-2.
 - .4 Nominal size of coarse aggregate: 20 mm.
 - .5 Slump at time and point of discharge: 80 mm ±30 mm.
 - .6 Air content: 4 to 7%.
 - .7 Chemical admixtures: type as approved, and in accordance with ASTM C494.
- .3 Proportion normal density concrete in accordance with CSA- A23.1, Alternative 1 to give the following properties for concrete external pads, curbs and walkways.
- .1 Cement: Type GU.
 - .2 Minimum compressive strength at 28 days: 32 MPa.
 - .3 Class of exposure: C-2.
 - .4 Nominal size of coarse aggregate: 20 mm.
 - .5 Slump at time and point of discharge: 80 mm ±30 mm.
 - .6 Air content: 5 to 8%.
 - .7 Chemical admixtures: type as approved, and in accordance with ASTM C494.
- .4 Proportion normal density concrete in accordance with CSA- A23.1, Alternative 1 to give the following properties for concrete in mud slabs:
- .1 Cement: Type GU. Minimum compressive strength at 28 days: 20 MPa.
 - .2 Class of exposure: N. Nominal size of coarse aggregate: 20 mm. Slump at time and point of discharge: 80 mm ±30 mm.
 - .3 Air content: 4 to 7%. Chemical admixtures: type as approved, and in accordance with ASTM C494.
- .5 Proportion normal density concrete in accordance with CSA-A23.1, Alternative 1 to

- 2.2 CONCRETE MIXES .5 (Cont'd)
(Cont'd) give following properties for concrete slab on grade:
- .1 Cement: Type GU.
 - .2 Minimum compressive strength at 28 days: 25 MPa.
 - .3 Class of exposure: N.
 - .4 Nominal size of coarse aggregate: 20 mm.
 - .5 Slump at time and point of discharge: 75 mm maximum.
 - .6 Chemical admixtures: type as approved and in accordance with ASTM C494.
 - .7 Use of super plasticizer is permitted to ease placement of concrete. 75 mm maximum slump measured prior to the addition of super plasticizer.
- .6 Proportion normal density concrete in accordance with CSA-A23.1, Alternative 1 to give following properties for concrete filled cells of masonry units:
- .1 Cement: Type GU.
 - .2 Minimum compressive strength at 28 days: 20 MPa.
 - .3 Nominal size of coarse aggregate: 10 mm.
 - .4 Slump at time and point of discharge: 250mm maximum.
- .7 Proportion normal density concrete in accordance with CAN/CSA-A23.1, Alternative 1, to give the following properties for manhole benching and light pole bases:
- .1 Cement Type: GU
 - .2 Minimum compressive strength at 28 days: 40 MPa.
 - .3 Class of exposure: C-1.
 - .4 Nominal size of coarse aggregate: 38 mm.
 - .5 Slump at point of discharge: 50 mm.
 - .6 Air content (Category 1): 4 to 7%.
 - .7 Chemical admixtures: as approved by the Departmental Representative and in accordance with ASTM C494.
 - .8 Maximum water-cement ratio: 0.40.
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PART 3 - EXECUTION

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| <u>3.1 EXAMINATION</u> | .1 | Ensure that founding material on which footings and other concrete work are to be placed are free from water. Place concrete only on frost- free ground. Remove previously frozen bearing surfaces. |
| | .2 | If deemed necessary by geotechnical engineer, place a mud slab in the bottom of footing excavations to prevent softening of the in-situ foundation soils. |
| | .3 | Ensure foundations bear on structural fill, mud slabs on structural fill or bedrock, with minimum geotechnical bearing resistances noted on the drawings. All structural fill to be placed as directed by the geotechnical engineer and in the presence of the geotechnical engineer or one of their qualified representatives. |
| | .4 | All foundation bearing surfaces shall be inspected and approved by the Departmental Representative's geotechnical engineer prior to placing concrete. |
| | .5 | Ensure no plumbing and electrical conduit is placed under building foundations. Contractor to coordinate with mechanical and electrical Contractor and shall step/lower all foundations to have all services either sleeve through foundation walls or run above column pad footings. No plumbing or conduit shall be placed under foundations unless written consent from Departmental Representative. |
| <u>3.2 WORKMANSHIP</u> | .1 | Obtain Departmental Representative's approval before placing concrete. Provide 48 hours notice prior to placing of concrete. |
| | .2 | Pumping of concrete is permitted only after approval of equipment and mix. |
| | .3 | Ensure reinforcement and inserts are not disturbed during concrete placement. |
| | .4 | Prior to placing of concrete obtain Departmental Representative's approval of |

3.2 WORKMANSHIP
(Cont'd)

- .4 (Cont'd)
proposed method for protection of concrete during placing and curing in adverse weather.
- .5 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .6 Do not place load upon new concrete until authorized by Departmental Representative.
- .7 In locations where new concrete is dowelled to existing work, drill holes in existing concrete. Place steel dowels and pack solidly with shrinkage compensating grout to anchor and hold dowels in positions as indicated.
- .8 Concrete protective cover to reinforcement as noted on the drawings.
- .9 Bars in slabs on grade and slabs-on- metal deck are to be accurately supported on plastic coated steel chairs to maintain exact cover requirements.
- .10 In cold weather protect concrete work to CSA-A23.1 and following:
 - .1 Cold weather is defined as a period when the mean air temperature drops below 5 C for more than three successive days.
 - .2 When air temperature is above 0 C and is forecast to remain so for 48 hours after placing, insulated tarps are acceptable protection provided concrete temperatures are monitored and comply with temperature limits specified in the following paragraph.
 - .3 For all other cold weather conditions protect concrete with a windproof enclosure of canvas or other material to allow free circulation of inside air around fresh concrete. At no point let walls of enclosure touch formwork and provide sufficient space for removal of formwork and for finishing. Supply approved heating equipment capable of keeping inside air at sufficiently curing temperatures:
 - .1 For an initial three days, at a temperature of not less than 15 C.
 - .2 Maintain concrete at temperatures of not less than 10 C for a total period of seven days plus the initial three days specified above.

3.2 WORKMANSHIP
(Cont'd)

- .10 (Cont'd)
 - .3 (Cont'd)
 - .3 At no time shall concrete temperatures exceed 30°C at surfaces.
 - .4 Reduce enclosure air temperature at a rate not exceeding 10 C per day until outside air temperature has been reached.
 - .5 Take temperature readings both of air and of concrete surfaces at several points within area protected at start and at end of working day. Maintain complete records of temperature readings.
 - .4 Ensure that concrete cures without suffering damage. When enclosure is provided, avoid rapid drying of the concrete.
 - .11 Monitor concrete temperature and moisture evaporation rates and provide appropriate hot weather protection as defined in clause 21 of CSA-A23.1. Maintain records of all measurements during hot weather periods for review by the Departmental Representative.

3.3 CONSTRUCTION

- .1 Do cast-in-place concrete work in accordance with CSA-A23.1.
 - .2 Where approved by Departmental Representative, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere. Sleeves and openings greater than 100mm x 100mm not indicated, must be approved by Departmental Representative.
 - .3 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of modifications from Departmental Representative before placing concrete.
 - .4 Coordinate locations and sizes of sleeves and openings required in concrete elements with architectural, civil, mechanical and electrical drawings and Contractors.
 - .5 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.
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3.3 CONSTRUCTION
(Cont'd)

- .6 Anchor bolts:
 - .1 Place anchor bolts to templates under supervision of trade supplying anchors prior to placing concrete.
 - .2 Protect anchor bolt holes from water accumulations.
- .7 Core-drilling/cutting of holes in any concrete element is not permitted without written consent from the Departmental Representative. All proposed core-drilling/cutting must be submitted to the Departmental Representative for review prior to execution of work. Request for core-drilling/cutting must have 72 hours' notice to allow Departmental Representative adequate time to review proposed locations.

3.4 PLACING
CONCRETE

- .1 Place concrete as specified in CSA- A23.1.
 - .2 Inform Departmental Representative at least 48 hours before each concrete placing operation.
 - .3 Do not place concrete when it is raining or likely to rain. If rain begins after concrete is placed, protect with waterproof covers until set.
 - .4 Do not permit vertical free fall of concrete mix to exceed 1500mm.
 - .5 For exposed concrete, take special precautions when placing to prevent segregation of concrete, and to avoid cold joints, honeycombing or voids. Do not allow vibrator to touch formwork.
 - .6 Use form vibrators only when sections are too narrow for internal type. Employ a sufficient number of vibrators to ensure complete consolidation of concrete throughout entire volume of each layer. Have available at least one extra vibrator on hand for emergency.
 - .7 Do not use vibrators for interior and exterior concrete slabs on fill or for the use of moving concrete for concrete slabs.
 - .8 Use only tools and handling equipment that are clear of rust or other harmful and foreign
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| 3.4 PLACING
CONCRETE
(Cont'd) | .8 | (Cont'd)
material to avoid efflorescence and staining
of slabs or hardened concrete. |
| | .9 | Use concrete pumps to place concrete only
with approval of methods, equipment and mix
design. |
| | .10 | Provide continuous supervision during
placement of concrete including concrete grout
to ensure reinforcing steel is maintained in
correct position. |
| 3.5 PLACING GROUT | .1 | Grout where indicated using procedures in
accordance with manufacturer's recommendations
which result in 100% contact over grouted
area. |
| 3.6 SAW CUTTING | .1 | Commence sawing as soon as the concrete has
hardened sufficiently to permit cutting
without chipping, spalling or tearing and
before all controlled shrinkage cracking
occurs. See Section 20.2.1 of CSA- A23.1. All
sawcuts shall be located and completed as per
the drawings and all sawcuts are to terminate
at the face of columns, foundation walls and
other control joints as shown on the drawings. |
| 3.7 FINISHING | .1 | Finish concrete in accordance with CSA-A23.1. |
| | .2 | Use smooth form finish for all concrete
surfaces. Use form facing material that will
produce a smooth, hard, uniform texture on the
concrete. Do not use material with raised
grain, torn surfaces, worn edges, patches,
dents or other defects that will impair the
texture of the concrete surface. Patch the
holes and defects. Completely remove fins. |
| | .3 | Use smooth steel trowel finish for concrete
slabs on grade, suspended slabs on metal deck,
and floating floors in mechanical rooms. |
| | .4 | Remove tie cones and patch with latex
modified concrete finish. Mix to be in strict
accordance with manufacturer's instructions. |

3.7 FINISHING (Cont'd)

- .5 Use rubbed finish for all interior concrete exposed to view. Patch tie holes and defects. Remove fins exceeding 6 mm in height.
- .6 Rub exposed sharp edges of concrete with carborundum to produce 3mm radius edges unless otherwise indicated.
- .7 Applying curing compounds to concrete surfaces as required. Confirm in writing the compatibility of curing compound with the applied finish on each concrete surface.
- .8 Slab and Floor Finish Classifications:
 - .1 All concrete slabs-on-grade are to have a moderately flat, Class A finish as defined in CAN/CSA A23.1, Table 22.
- .9 Elevation survey:
 - .1 If requested by Owner, this Contractor shall carry out an elevation survey on finished slab-on- grade and floating floor surfaces in accordance with the measurement procedures outlined in CAN/CSA A23.1, clause 22.1.2. to ensure all concrete slabs meet the specified surface finishes/tolerances.
- .10 Tolerances:
 - .1 Surface tolerances are to be within the specified limits of CAN/CSA A23.1, Table 15 and Table 22.
 - .2 Tolerances are to be in accordance with CAN/CSA A23.1 unless noted otherwise.

3.8 REPAIRS

- .1 In the event that the post- finishing survey shows that the slab surface does not meet the specified tolerances, corrective action shall be taken within five (5) working days, or as directed by the Departmental Representative.
- .2 The Contractor shall submit proposed corrective action in writing, with complete details of methods, tools, and materials for the Departmental Representative's approval. Upon acceptance of the proposed method, a test area is to be prepared, and upon acceptance, is to be the standard for the remainder of the repairs.
- .3 High points are to be ground down to a smooth surface conforming to the specifications and

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| 3.8 REPAIRS
(Cont'd) | .3 | (Cont'd)
with a surface finish equal to the remainder of the slab. If cutting or chipping by hammer is required at high areas, then the area is to be cut low with square saw cut edges, and patched as noted below. |
| | .4 | Low areas are to be filled by patching with a bonded topping. Edges of patch areas are to be chipped and saw cut square a minimum of 25mm deep. Alternatively, the Departmental Representative may approve feather edging if epoxy type topping is used and a properly bonded smooth finish can be removed before placing patch material. Patches are to be finished to a smooth surface equal to the finish on the remainder of the slab, and cured adequately. All patching procedures are to be in strict accordance with the manufacturer's directions and to the approval of the Departmental Representative. |
| 3.9 INSULATION | .1 | Examination:
.1 Examine substrates and immediately inform Departmental Representative in writing of defects.
.2 Prior to commencement of work, ensure substrates are firm, straight, smooth, dry, free of snow, ice, frost and clean of dust and debris. |
| | .2 | Workmanship and Application: as specified in Division 07. |
| 3.10 JOINT FILLERS | .1 | Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Departmental Representative. When more than one piece is required for a joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening. |
| | .2 | Locate and form isolation, construction and control joints as indicated. Install joint filler. |
| | .3 | Use 6mm thick joint filler to separate slabs-on-grade from vertical surfaces and extend joint filler from bottom of slab to |

3.10 JOINT FILLERS (Cont'd)	.3	(Cont'd) within 13mm of finished slab surface unless indicated otherwise.
3.11 SLAB-ON-GRADE JOINTS	.1	Provide construction joint between adjacent concrete pours.
	.2	Provide an isolation joint where the slab-on-grade abuts a vertical element.
	.3	Provide saw cut control joints as indicated on the drawings except at those locations where construction joints or isolation joints are provided.
3.12 VAPOUR RETARDER MEMBRANE	.1	Vapour retarder membrane: .1 Install underslab vapour retarder membrane under all concrete slabs-on-grade inside building, except where waterproofing membrane is specified to go under slabs. .2 Install membrane in strict accordance with membrane manufacturer's printed instructions. .3 Lap underslab vapour retarder membrane minimum 150mm at joints and seals using joint sealer tape to create vapour and gas tight joints. .4 Seal all pipe and conduit penetrations through the membrane using pre-sized multipurpose penetration sealant and joint sealer tape to create vapour and gas tight seals. .5 Seal to inside of concrete foundation walls and concrete pits to create a vapour and gas tight connection. .6 Seal punctures in dampproof membrane before placing concrete. Use patching material at least 150mm larger than puncture and seal.
3.13 FIELD QUALITY CONTROL	.1	Inspection and testing of concrete and concrete materials will be carried out by the Departmental Representative or a Testing Laboratory designated by Departmental Representative in accordance with CSA-A23.1.
	.2	Owner will pay for costs of tests as specified in Section 01 45 00.

- 3.13 FIELD QUALITY .3 Test cylinders, a minimum of three (3)
CONTROL cylinders, to be provided as follows:
(Cont'd)
- .1 Each day's pour.
 - .2 Each change of supplier.
 - .3 Each 50m³ or fraction thereof.
 - .4 Additional test at the request of the Departmental Representative.
 - .5 If Contractor wants to strip formwork early, Contractor to request additional cylinders to be cast and shall pay for additional cylinders and testing of the additional cylinders.
- .4 Departmental Representative will take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.
- .5 Non-destructive Methods for Testing Concrete shall be in accordance with CSA-A23.2.
- .6 Inspection or testing by Departmental Representative will not augment or replace Contractor quality control nor relieve him of his contractual responsibility.

PART 1 -GENERAL

1.1 RELATED WORK .1 Cast-in-Place Concrete: Section 03 30 00

1.2 REFERENCES .1 CSA A23.1-09/A23.2-09, Concrete Materials and
Methods of Concrete Construction/Test Methods
and Standard Practices for Concrete.
.2 CAN/CGSB-25.20-95, Surface Sealer or Floors.

1.3 PRODUCT
AND MAINTENANCE
DATA .1 Provide product and maintenance data for
concrete floor finishes to Departmental
Representative for incorporation into
Operations and Maintenance Manual.
.2 Include application instructions for curing
compound.
.3 Submit WHMIS MSDS - Material Safety Data
Sheets. Indicate VOC content.

1.4 ENVIRONMENTAL
REQUIREMENTS .1 Temporary lighting: minimum 1200 W light
source, placed 2.4m above floor surface, for
each 40m2 of floor being finished.
.2 Electrical power: sufficient to operate
equipment normally used during construction.
.3 Work area: water tight protection against
rain and detrimental weather conditions.
.4 Temperature: maintain ambient and substrate
temperature at 10 C minimum, and maintain
relative humidity not higher than 40% during
same period.
.5 Moisture: ensure concrete substrate is within
limits prescribed by manufacturer.
.6 Ventilation: sufficient to prevent carbon
monoxide or high levels of carbon dioxide and
other injurious gases from affecting concrete.
.7 Safety: comply with requirements of Workplace
Hazardous Materials Information System (WHMIS)

1.4 ENVIRONMENTAL REQUIREMENTS (Cont'd) .7 Safety:(Cont'd)
regarding use, handling, storage and disposal
of hazardous materials.
PART 2 - PRODUCTS

2.1 MATERIALS .1 Sealing Compound:
.1 Surface sealer: to CAN/CGSB- 25.20, Type
1 solvent-based, color to be chosen by
architect.
.2 Use compatible additives, admixtures and
sealants.

PART 3 - EXECUTION

3.1 EXAMINATION .1 Verify the slab surfaces are ready to receive
work and elevations are as indicated on
drawings and as instructed by manufacturer.
.2 If requested, Manufacturer Representative to
attend a pre-job meeting with Contractor,
Departmental Representative will review
application of product, selection of colors
(if required) and areas required.

3.2 FLOOR FINISH .1 Finish concrete in accordance with CSA-A23.1,
Classification 1. Do not use curing and
sealing compound in areas where an applied
finish or adhesive is to be applied.
.2 Do not sprinkle dry cement or dry cement and
sand mixture over concrete surfaces.
.3 Saw cut crack-control joints to CSA A23.1
only where indicated on the Drawings.
.4 Apply sealing compound in accordance with
manufacturer's instructions.
.5 Cure concrete in accordance with CSA-A23.1
except where specified otherwise.

3.3 PROTECTION .1 Protect finished installation until floor treatment has completely cured and in accordance with the manufacturer's instructions.