

**Part 1            General**

**1.1                RELATED SECTIONS**

- .1        Section 03 20 00 – Concrete Reinforcing.
- .2        Section 03 30 00 – Cast-in-Place Concrete.

**1.2                REFERENCES**

- .1        Canadian Standards Association (CSA International)
  - .1        CSA-A23.1-09/A23.2-09, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
  - .2        CSA O121-2008, Douglas Fir Plywood.
  - .3        CSA O151-09, Canadian Softwood Plywood.
  - .4        CSA O153-M1980(R2008), Poplar Plywood.
  - .5        CSA-O325-07, Construction Sheathing.
  - .6        CSA O437 Series-93(R2006), Standards for OSB and Waferboard.
  - .7        CSA-O86-09, Engineering Design in Wood.
  - .8        CSA S269.1-1975(R2003), Falsework for Construction Purposes.
  - .9        CAN/CSA-S269.3-M92(R2008), Concrete Formwork, National Standard of Canada

**1.3                MEASUREMENT PROCEDURES**

- .1        No measurement will be made under this Section. Include costs in items of work for which concrete formwork and falsework is required.

**1.4                SUBMITTALS**

- .1        Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2        Submit shop drawings for formwork and falsework.
  - .1        Upon request Submit drawings stamped and signed by professional engineer registered or licensed in Province of Manitoba, Canada.
- .3        Indicate 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 CSA S269.1, for falsework drawings. Comply with CAN/CSA-S269.3 for formwork drawings.
- .4        Indicate formwork design data: permissible rate of concrete placement, and temperature of concrete, in forms.

**Part 2            Products**

**2.1                MATERIALS**

- .1        Formwork materials:

- .1 For concrete without special architectural features, use wood and wood product formwork materials to CSA-O121, CAN/CSA-O86, and CSA-O153.
- .2 For concrete with special architectural features, use formwork materials to CSA-A23.1/A23.2.
- .2 Pan forms: removable steel, or reinforced plastic to match existing profiles and dimensions.
- .3 Tubular column forms: round, internally treated with release material.
  - .1 Spiral pattern may show in hardened concrete, except where column is designated architectural finish, where it shall not show in hardened concrete.
- .4 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 25 mm diameter in concrete surface.
  - .2 For Architectural concrete, use snap ties complete with plastic cones and light grey concrete plugs.
- .5 Form liner:
  - .1 Plywood: high density overlay.
- .6 Form release agent: non-toxic, biodegradable, low VOC.
- .7 Form stripping agent: colourless mineral oil, non-toxic, biodegradable, low VOC, free of kerosene.
- .8 Falsework materials: to CSA-S269.1.

**Part 3 Execution**

**3.1 FABRICATION AND ERECTION**

- .1 Fabricate and erect falsework in accordance with CSA S269.1.
- .2 Refer to drawings for concrete members requiring architectural exposed finishes.
- .3 Do not place shores and mud sills on frozen ground.
- .4 Provide site drainage to prevent washout of soil supporting mud sills and shores.
- .5 Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA-A23.1/A23.2.
- .6 Align form joints and make watertight. Keep form joints to minimum.
- .7 Locate horizontal form joints for exposed columns 2400 mm above finished floor elevation.
- .8 Use 25 mm chamfer strips on external corners and/or 25 mm fillets at interior corners, joints, unless specified otherwise.
- .9 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.

- .10 Construct forms for architectural concrete, and place ties as indicated and as directed. Joint pattern not necessarily based on using standard size panels or maximum permissible spacing of ties.
- .11 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections. Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.
- .12 Line forms for following surfaces:
  - .1 Surfaces designated as architectural finish.
  - .2 Secure lining taut to formwork to prevent folds.
  - .3 Pull down lining over edges of formwork panels.
  - .4 Ensure lining is new and not reused material.
  - .5 Ensure lining is dry and free of oil when concrete is poured.
  - .6 Application of form release agents on formwork surface is prohibited where drainage lining is used.
  - .7 If concrete surfaces require cleaning after form removal, use only pressurized water stream so as not to alter concrete's smooth finish.
  - .8 Cost of textile lining is included in price of concrete for corresponding portion of Work.
- .13 Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete.

**3.2 REMOVAL AND RESHORING**

- .1 Notify Contract Administrator 24 hours in advance prior to removing formwork.
- .2 Do not remove forms and bracing until concrete has gained sufficient strength to carry its own weight, construction loads, design loads that are liable to be imposed upon it. Verify strength of concrete by compressive test results.
- .3 Leave formwork in place for following minimum periods of time after placing concrete:

LOCATION	TEMPERATURE IN °C		
	21-35	15-21	10-15
Walls	2 days	3 days	4 days
Grade Beams	2 days	3 days	4 days
Side Forms	2 days	3 days	4 days
Slabs *	7 days	7 days	14 days
Beams *	7 days	7 days	14 days
Structural Shoring *	7 days	7 days	14 days

\* formwork below/supporting these elements shall remain in place for the minimums stated above and then replaced with shoring posts until concrete is 28 days old. Formwork can be removed and replaced with shoring posts earlier, if concrete test cylinders show a strength of 75% of the required 28 day strength.

- .4 Reshore structural members where required due to design requirements or construction conditions and as required to permit progressive construction.

- .5 Remove formwork progressively and in accordance with Building and Safety Code requirements and so that no shock loads or unbalanced loads are imposed on structure.
- .6 Loosen forms carefully. Do not wedge pry bars, hammers, or tools against concrete surfaces.
- .7 Store removed forms, for exposed concrete, so surfaces in contact with fresh concrete will not be damaged. Marked or scored forms will be rejected.
- .8 Re-use formwork subject to requirements of CAN/CSA-A23.1.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED SECTIONS**

- .1        Section 03 10 00 – Concrete Forming and Accessories.
- .2        Section 03 30 00 – Cast-in-Place Concrete.

**1.2                REFERENCES**

- .1        Canadian Standards Association (CSA International)
  - .1        CSA-A23.1-09/A23.2-09, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
  - .2        CAN/CSA-G30.18-09, Billet-Steel Bars for Concrete Reinforcement, A National Standard of Canada.
  - .3        CSA-G40.20/G40.21-04(R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .4        CAN/CSA-G164-M92(R2003)(withdrawn), Hot Dip Galvanizing of Irregularly Shaped Articles, A National Standard of Canada.
  - .5        CSA W186-M1990(R2007), Welding of Reinforcing Bars in Reinforced Concrete Construction.
- .2        American Society for Testing and Materials International (ASTM)
  - .1        ASTM A82-07, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
  - .2        ASTM A185/A185M-07, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
  - .3        ASTM A775/A775M-07b, Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
- .3        Reinforcing Steel Institute of Canada (RSIC)
  - .1        RSIC-2004, Reinforcing Steel Manual of Standard Practice.

**1.3                MEASUREMENT PROCEDURES**

- .1        Reinforcing steel will be measured in kilograms of steel incorporated into work, computed from theoretical unit mass specified in CAN/CSA G30.18 for lengths and sizes of bars as indicated.
- .2        No measurement will be made under this Section.
  - .1        Include reinforcement costs in items of concrete work in Section 03 30 00 - Cast-In-Place Concrete.

**1.4                SUBMITTALS**

- .1        Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2        Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice.
- .3        Submit shop drawings including placing of reinforcement and indicate:

- .1 Bar bending details.
- .2 Lists.
- .3 Quantities of reinforcement.
- .4 Sizes, spacings, locations of reinforcement and mechanical splices if approved by Contract Administrator, with identifying code marks to permit correct placement without reference to structural drawings.
- .5 Indicate sizes, spacings and locations of chairs, spacers and hangers.
- .4 Detail lap lengths and bar development lengths to CSA-A23.3, unless otherwise indicated.
  - .1 Provide class B tension lap splices unless otherwise indicated.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Substitute different size bars only if permitted in writing by Contract Administrator.
- .2 Reinforcing steel: All reinforcing steel to be CAN/CSA-G30.18M grade 400R deformed bars except column ties and beam stirrups which shall be grade 400W.
- .3 Cold drawn annealed steel wire ties: to ASTM A82.
- .4 Welded steel wire fabric: to ASTM A185/A185M. Provide in flat sheets only.
- .5 Epoxy Coating of non-prestressed reinforcement: to ASTM A775/A775M.
- .6 Galvanizing of non-prestressed reinforcement: to CAN/CSA-G164, minimum zinc coating 610 g/m<sup>2</sup>.
- .7 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.
- .8 Mechanical splices: subject to approval of Contract Administrator.
- .9 Plain round bars: to CSA-G40.20/G40.21.

**2.2 FABRICATION**

- .1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.
- .2 All reinforcing is to be detailed in accordance with the latest edition of the Reinforcing Steel Institute of Canada - Manual of Standard Practice, except otherwise noted
- .3 Obtain Contract Administrator's approval for locations of reinforcement splices other than those shown on placing drawings.
- .4 Upon approval of Contract Administrator, weld reinforcement in accordance with CSA W186.
- .5 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.
  - .1 Ship epoxy coated bars in accordance with ASTM A775A/A775M.

**2.3 SOURCE QUALITY CONTROL**

- .1 Upon request, provide Contract Administrator with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis.
- .2 Upon request inform Contract Administrator of proposed source of material to be supplied.

**Part 3 Execution**

**3.1 FIELD BENDING**

- .1 Do not field bend or field weld reinforcement except where indicated or authorized by Contract Administrator.
- .2 When field bending is authorized, bend without heat, applying slow and steady pressure.
- .3 Replace bars, which develop cracks or splits.

**3.2 PLACING REINFORCEMENT**

- .1 Place reinforcing steel as indicated on placing drawings and in accordance with CSA-A23.1/A23.2.
- .2 Use plain round bars as slip dowels in concrete where noted on the drawings.
  - .1 Paint portion of dowel intended to move within hardened concrete with one coat of asphalt paint.
  - .2 When paint is dry, apply thick even film of mineral lubricating grease.
- .3 Prior to placing concrete, obtain Contract Administrator's approval of reinforcing material and placement.
- .4 Ensure cover to reinforcement is maintained during concrete pour.
- .5 Protect epoxy coated portions of bars with covering during transportation and handling.

**3.3 FIELD TOUCH-UP**

- .1 Touch up damaged and cut ends of epoxy coated reinforcing steel with compatible finish to provide continuous coating.

**END OF SECTION**

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## **Part 1 General**

### **1.1 RELATED SECTIONS**

- .1 Section 03 10 00 – Concrete Forming and Accessories.
- .2 Section 03 20 00 – Concrete Reinforcing.

### **1.2 ALLOWANCES**

- .1 Inspections and Testing paid for by Cash Allowance. Refer to Section 01 21 00 Allowances.

### **1.3 REFERENCES**

- .1 American Society for Testing and Materials (ASTM).
  - .1 ASTM C150/C150M-09, Standard Specification for Portland Cement.
  - .2 ASTM C260-06, Standard Specification for Air-Entraining Admixtures for Concrete.
  - .3 ASTM C295-08, Standard Guide for Petrographic Examination of Aggregates for Concrete.
  - .4 ASTM C309-07, Standard Specification for Liquid Membrane – Forming Compounds for Curing Concrete.
  - .5 ASTM C494/C494M-08a, Standard Specification for Chemical Admixtures for Concrete.
  - .6 ASTM D412-06ae2, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
  - .7 ASTM D624-00(2007), Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
  - .8 ASTM D1751-04(2008), Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).
  - .9 ASTM D1752-04a(2008), Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
- .2 Canadian Standards Association (CSA).
  - .1 CSA A23.1-09/A23.2-09, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
  - .2 CSA A3000-08, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
- .3 American Concrete Institute (ACI).
  - .1 ACI 309R-05, Guide for Consolidation of Concrete.

### **1.4 QUALITY ASSURANCE**

- .1 Certificates.
  - .1 Provide certification that mix proportions selected will produce concrete of quality, yield and strength as specified in concrete mixes and will comply with CAN/CSA A23.1/A23.2. Provide mix designs to Contract Administrator for review prior to commencement of work.
  - .2 Provide certification that plant, equipment and all materials to be used in concrete comply with CAN/CSA A23.1/A23.2.

### **1.5 SITE CONDITIONS**



- .1 Conform to cold/hot weather requirements of CAN/CSA A23.1/A23.2.
- .2 Cold Weather Requirements.
  - .1 When air temperature is at or below 5 degrees C, or when there is possibility of temperature falling to that limit within 24 hours of placing, meet requirements of CAN/CSA A23.1/A23.2.
  - .2 Ensure concrete when deposited, between 16 to 32 degrees C.
  - .3 Ensure site preparations and special supplementary equipment is ready while placing concrete in cold weather.
  - .4 Provide protection by adequate supplementary insulation, by enclosing concrete surfaces with raised tarpaulins, or other approved enclosures for heating such that air circulation is maintained.
  - .5 Provide for introduction of heat into enclosure.
  - .6 Maintain temperatures with heat for period specified.
  - .7 Provide means to humidify air within enclosed space if dry type heat used.
  - .8 Vent heaters outside enclosed space.
  - .9 Do not use heaters which release products of combustion into enclosed space.
  - .10 Ensure combustion gases do not contact green concrete surfaces.
  - .11 Do not place concrete on or against surface at temperature less than 5 degrees C.
  - .12 Protect concrete from alternate freezing and thawing for 14 days.
  - .13 Maintain concrete above freezing temperature for minimum 7 days.
  - .14 Withdraw protection and heating gradually so that air temperature around concrete does not drop more than 10 degrees C per day until outside air temperature achieved.
  - .15 Protect slabs, subgrade from frost. Frozen concrete will be rejected.
- .3 Hot Weather Concrete Work.
  - .1 When air temperature in shade is at or above 23 degrees C, or when there is possibility of temperature rising to that limit within 24 hours of placing, meet requirements of CAN/CSA A23.1/A23.2.
  - .2 Concrete temperature at time of placing in hot weather not to exceed limits in CAN/CSA A23.1/A23.2 specifications. In event that limits are exceeded, suspend concrete operations until constituent materials of concrete cool.
  - .3 Use retarding admixtures only if approved by Contract Administrator prior to use in concrete.
  - .4 Use of ice may be required to lower the temperature of concrete for large pours.
  - .5 Prepare as required for expected temperatures, type of work.
- .4 Maintain temperature of concrete surfaces not less than 21 degrees C for 3 days and not less than 10 degrees C for 5 days after placing.
- .5 Protect floor slab, exposed concrete surfaces, surfaces to have applied finishes from grease, oil, other contaminants that affect appearance, impair topping, finish materials bond.

## **Part 2 Products**

### **2.1 MANUFACTURERS**

- .1 Acceptable Products.
  - .1 Air Entraining Admixture.
    - .1 Grace Darex AEA.

- .2 Sika AER.
- .3 Sternson NVR.
  
- .2 Water Reducing Agent.
  - .1 Grace WRDA Type A.
  - .2 Master Builders' Pozzoloth.
  - .3 Sternson Porzite.
  
- .3 Accelerating Agent.
  - .1 Grace Darex Set Accelerator.
  
- .4 Non-shrink Grout.
  - .1 CPD Non Shrink Grout.
  - .2 Grace In-Pakt.
  - .3 Meadows CG-86
  - .4 Meadows V-3 Grout.
  - .5 Sika Grout 212.
  - .6 Sternson M-Bed.
  
- .5 Curing Sealing Compound.
  - .1 CPD Chlorinated Rubber Cure and Seal.
  - .2 Meadows 700 Chlorinated Rubber.
  - .3 Sealtight CS-309.
  - .4 Sternson Florseal.
  
- .6 Penetrating Sealer.
  - .1 Hydrozo Silane 40 VOC.
  - .2 Master Builders Masterseal SL 40 VOC.
  - .3 Sil Act ATS 42 Silane Sealer VOC.
  - .4 Sonneborn Penetrating Sealer 40 VOC.
  - .5 Tamms Baracade Silane 40 IPA VOC.
  
- .7 Waterstop.
  - .1 Volclay Waterstop RX Bentonite Strip.
  
- .2 Requests for substitutions will be considered in accordance with Section 00 26 00.

## **2.2 MATERIALS**

- .1 Portland Cement: to ASTM C150/C150M-09 and CSA A3000, normal Type 10.
- .2 Water and Other Concrete Materials: in accordance with CAN/CSA A23.1/A23.2.
- .3 Aggregates: to CAN/CSA A23.1/A23.2. Coarse aggregates to be normal density.
  - .1 Submit proof that aggregates meet criteria of non-expansive aggregates as per Figure 1 of CAN/CSA A23.2-26A using tests conforming to ASTM C295 and CAN/CSA A23.2-25A.
- .4 Air Entraining Admixtures: to ASTM C260.

- .5 Chemical Admixtures: to ASTM C494/C494M. Contract Administrator to approve accelerating or set retarding admixture during cold and hot weather placing.
- .6 Non-shrink Grout: premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents, capable of development of 40 MPa at 28 days.
- .7 Curing Sealing Compound: to CAN/CSA A23.1/A23.2, white and to ASTM C309, Type 1-chlorinated rubber.
- .8 Premoulded Joint Fillers.
  - .1 Bituminous impregnated fiber board: to ASTM D1751.
  - .2 Sponge rubber: to ASTM D1752, Type I, flexible or firm grade as required.
- .9 Waterstops: extruded PVC of sizes indicated.
  - .1 Tensile strength: to ASTM D412.
  - .2 Elongation: to ASTM D412.
  - .3 Tear resistance: to ASTM D624.
- .10 Bituminous Dampproofing: in accordance with Section 07 11 13.
- .11 Under Slab Vapour Barrier: 15 mil Stego Wrap in accordance with Section 07 26 00.

### **2.3 CONCRETE MIXES**

- .1 Proportion normal density concrete in accordance with CAN/CSA A23.1/A23.2, Alternative (1) to give following properties for concrete as indicated on drawings.
  - .1 Cement Type: Portland cement as shown on drawings.
  - .2 Minimum Compressive Strength at 28 Days: as shown on drawings.
  - .3 Minimum Cement Content: as required to produce specified compressive strengths to suit class of exposure.
  - .4 Class of Exposure: Class C-2 for exterior paving and slabs; Class F-2 for exterior beams and walls, Class N for interior concrete, unless noted on drawings.
  - .5 Nominal Size of Coarse Aggregate: as shown on drawings.
  - .6 Slump at Time and Point of Discharge: consistent with application and method of placement and as agreed upon with Contract Administrator.
  - .7 Air Content: as shown on drawings.
- .2 Architectural Concrete, as indicated on drawings.
  - .1 Concrete: Agilia Architectural
  - .2 Self-consolidating concrete with 750 mm flow (+/- 100 mm).
  - .3 Minimum Compressive Strength at 28 Days: 50 MPa.
  - .4 Minimum Cement Content: as required to produce specified compressive strengths to suit class of exposure.
  - .5 Class of Exposure: Class F-2 for exterior concrete, unless noted on drawings.
  - .6 Nominal Size of Coarse Aggregate: as per manufacturer's instructions.
  - .7 Slump at Time and Point of Discharge: consistent with application and method of placement and as agreed upon with manufacturer.
  - .8 Air Content: 5-8%
  - .9 Forms as per Section 03 10 00.
  - .10 Pre-pour meeting with supplier is required

- .11 Finish: Penetrating Sealer as specified.

### **Part 3 Execution**

#### **3.1 PREPARATION**

- .1 Obtain Contract Administrator's approval before placing concrete. Provide 48 hours notice prior to placing of concrete.
- .2 Pumping of concrete is permitted only after Contract Administrator's approval of equipment and mix.
- .3 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .4 Prior to placing of concrete obtain Contract Administrator's approval of proposed method of protection of concrete during placing and curing in adverse weather.
- .5 Maintain accurate records of poured concrete items to indicated date, location of pour, quality, air temperature and test samples taken.
- .6 Do not place load upon new concrete until authorized by Contract Administrator.

#### **3.2 CONSTRUCTION**

- .1 Do cast-in-place concrete work in accordance with CAN/CSA A23.1/A23.2.
- .2 When concrete is placed by pump, the initial slurry used to prime the pump must not be incorporated into the overlay. The priming slurry must be collected and disposed of off-site.
- .3 Ensure reinforcing is secure and not disturbed during concrete placement. Reinforcing mesh must be chaired to appropriate height. Lifting of mesh during placement is not permitted.
- .4 Ensure that rate of placing is sufficient to complete proposed placing, finishing and curing operations within scheduled time. Limit batch sizes as required if placing procedures are slower than anticipated.
- .5 Pour concrete continuously between predetermined construction and control joints. Do not break or interrupt successive pours such that cold joints occur. Install a construction dam or bulkhead in case of a delay longer than 60 minutes. During delays between 5 and 60 minutes, protect the end of the placement with damp burlap.
- .6 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .7 Sleeves and Inserts.
  - .1 Sleeves, ducts, pipes, or other openings through joists, beams, or columns not permitted, except where expressly detailed on structural drawings or approved by Contract Administrator.
  - .2 Set sleeves, ties, pipe hangers, and other inserts and openings as indicated or specified elsewhere. Sleeves and openings greater than 100 x 100 mm and not indicated on structural drawings must be approved by Contract Administrator.

- .3 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of all modifications from Contract Administrator before placing of concrete.
- .4 Check locations and sizes of sleeves and openings shown on structural drawings with architectural, mechanical and electrical drawings.
- .5 All mechanical piping to be sleeved through slabs and slab ends. No coring will be permitted through slab bands. Maximum sleeve size to be 300 mm diameter through slabs and 150 mm diameter through slab bands.
- .8 Anchor Bolts.
  - .1 Install anchor bolts into concrete as per manufacturer's specifications.
  - .2 Set anchor bolts to templates under supervision of appropriate trade prior to placing concrete.
  - .3 Only upon approval of Contract Administrator, adhesive anchors are to be drilled after concrete has set. Formed holes to be minimum 100 mm diameter. Drilled hole diameter to comply with adhesive manufacturer's installation instructions.
  - .4 Protect anchor bolt holes from water accumulations, snow and ice build-ups.
  - .5 Fill holes with approved adhesive and set bolts.
  - .6 Locate anchor bolts used in connection with expansion shoes, rollers and rockers with due regard to ambient temperature at time of erection.
- .9 Drainage Holes and Weep Holes.
  - .1 Form weep holes and drainage holes in accordance with Section 03 10 00.
  - .2 If wood forms are used, remove them after concrete has set.
  - .3 Install weep hole tubes and drains as indicated.
- .10 Delivery.
  - .1 Mix and completely discharged concrete within 120 minute time limit.
  - .2 Exceptions to this will only be allowed with special mix design and written approval of Contract Administrator.
  - .3 Water may only be added to concrete trucks by following guidelines of CAN/CSA A23.1/A23.2. Contractor and inspecting agency to document addition of water.
- .11 Grouting.
  - .1 Grout underside of steel column and beam base plates with non-shrinking grout to manufacturer's instructions. Place grout over steel shims left in place.
  - .2 Grout into place, bolts and other items of concrete hardware, that are not placed prior to pouring concrete.
- .12 Finishing.
  - .1 Formed surfaces exposed to view: in accordance with CAN/CSA A23.1/A23.2.
  - .2 Interior floor slabs to be left exposed or to receive carpet, sheet vinyl or other covering requiring smooth surface: initial finishing operations followed by final finishing comprising mechanical floating and steel trowelling as specified in CAN/CSA A23.1/A23.2 to produce hard, smooth, dense trowelled surface free from blemishes; finishing tolerance classification.
    - .1 Finish flatwork to flatness and levelness requirements specified on the drawings. Only concrete finishers experienced in the placement of such floors will be permitted.

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- .2 Use of a floating vibratory screed to consolidate the top surface of the concrete will be mandatory. Move vibrating screed forward as rapidly as possible while allowing proper consolidation and finishing of the concrete surface. Extended use of a vibratory screed may result in segregation of the concrete producing excessive mortar at the surface which can result in a weak surface layer.
  - .3 Where the vibratory screed cannot reach the concrete must be internally vibrated by means of standard immersion “pencil” vibrators meeting the requirements of ACI 309R.
  - .4 Complete finishing processes before the surface of the concrete dries, otherwise extensive cracking will result. Unsatisfactory performance may be cause for rejection.
  - .5 Protect freshly placed concrete from exposure to dust, debris and precipitation.
- .3 Pavements walks, curbs and exposed site concrete: screed to plane surfaces and float using aluminum magnesium, or wood floats. Round edges and provide joint spacings using standard tools. Trowel smooth followed by lightly brushed non-slip finish.
  - .4 Use procedures acceptable to Contract Administrator for those noted in CAN/CSA A23.1/A23.2 to remove excess bleed water. Ensure surface is not damaged.
  - .5 Rub exposed sharp edges of concrete with carborundum to produce 3mm radius edges unless otherwise indicated.
- .13 Waterstops.
    - .1 Install waterstops to provide continuous water seal. Do not distort or pierce waterstop in such way to hamper performance. Do not displace reinforcement when installing waterstops. Use equipment to manufacturer's requirements to field splice waterstops. Tie waterstops rigidly in place.
    - .2 Use only straight heat sealed butt joints in field. Use factory welded corners and intersections unless otherwise approved by Contract Administrator.
    - .3 Swelling bentonite waterstops are acceptable. Provide proposed product to Contract Administrator for review.
- .14 Expansion/Control Joints and Fillers.
    - .1 Refer to structural drawings for joint layouts and details.
    - .2 Form expansion/control joints where indicated.
    - .3 Cut and form control joints in slabs on grade at locations indicated, in accordance with CAN/CSA A23.1/A23.2. Fill with specified joint sealer/filler.
    - .4 Cut 5 mm control joints by saw, minimum one-quarter thickness, maximum one-third thickness, where indicated and as approved by Contract Administrator.
    - .5 Perform control joint cutting minimum 12 hours, maximum 24 hours after placing concrete.
    - .6 Fill cap sawn control joints with sealant in accordance with manufacturer's instructions as indicated.
    - .7 Provide filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Contract Administrator. When more than one piece is required for joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.
    - .8 Locate control joints in exterior paving, sidewalks maximum 1500 mm o. c. where indicated.
    - .9 Use 12 mm thick joint filler to separate slabs-on-grade from vertical surfaces and extend joint filler from bottom of slab to finished slab surface unless indicated otherwise.
- .15 Under Slab Vapour Barrier

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- .1 Install Under Slab Vapour Barrier over compacted granular fill, over void form, under exterior slabs, sidewalks, aprons, etc. before placing reinforcing, concrete. Install sheet dampproofing under concrete slabs-on-grade inside building.
  - .2 Lap sheet dampproofing minimum 150 mm at joints and seal.
  - .3 Seal punctures in sheet dampproofing before placing concrete. Use patching material at least 150 mm larger than puncture and seal.
- .16 Curing.
- .1 Immediately after final finishing, protect exposed surface against plastic shrinkage by means of a fog spray, or evaporation reducer, until the concrete has enough strength to support the placement of the wetted burlap. When an evaporation reducer is used, intermittent reapplication may be required if the film evaporates before initiation of the wet cure.
  - .2 Burlap to be thoroughly presoaked by immersing it in water for a period of at least 24 hours immediately prior to placement.
  - .3 Commence wet curing with burlap or approved curing blanket and water as soon as the surface will support the weight of the wetted burlap without deformation. Burlap to be applied in one layer with strips overlapping at least 76 mm and be securely held in place without marring the concrete surface.
  - .4 Wet curing with burlap and water must be maintained for a minimum period of 7 days.
    - .1 Day 1: Keep continuously wet by means of a mechanical sprinkling system. The sprinklers shall be activated such that the water does not interfere with the concrete placing operations, or damage the surface of the freshly placed concrete.
    - .2 Days 2 through 6: Maintain burlap in a continuously wet condition throughout the curing period. Periodic rewetting by means of a soaker hoses, sprinklers, or other suitable methods approved by the Contract Administrator may be necessary.
    - .3 Day 7: Discontinue re-wetting procedures allowing burlap to dry naturally.
  - .5 Workers shall not be allowed on the slab for 12 hours after placement.
  - .6 Do not place load upon new concrete until authorized by Contract Administrator.
- .17 Patching and Repairing.
- .1 Remove, cut-off metal ties extending from face permanently exposed concrete minimum 19 mm deep immediately after removal of forms.
  - .2 Remove loose concrete, honeycombed surfaces, embedded debris.
  - .3 Fill holes, stone pockets, and other defects with 1:3 cement, sand, and mortar matching colour adjoining concrete.
  - .4 Apply bonding adhesive to manufacturer direction. Mix and place mortar, as dry as possible, finish flush with adjacent surface.
  - .5 Rub surfaces smooth, cut off fins, rough places.
  - .6 Grind down "curled" edges, repair floor slabs acceptable for application resilient flooring, carpets, etc. after design deflection, shrinkage occurs.
  - .7 Do not patch any surface until examination by Contract Administrator, permission given.
  - .8 Cut out surface defects not impairing structural strength, refill with fresh concrete.
  - .9 Make cuts minimum 25 mm deep and apply bonding adhesive to manufacturer's direction.

- .10 Fill cuts with stiff consistency concrete, mix approximately same as adjoining work.
- .11 Compress, rub, produce finish similar in texture, colour to adjoining work.
- .18 Penetrating Sealer.
  - .1 Install 2 coats penetrating sealer on all exterior concrete stairs and sidewalks.

### **3.3 FIELD QUALITY CONTROL**

- .1 Inspection and testing of concrete and concrete materials will be carried out by CSA certified testing laboratory approved by Contract Administrator in accordance with CAN/CSA A23.1/A23.2.
- .2 Inspection or testing by Contract Administrator will not augment or replace Contractor quality control nor relieve him of his contractual responsibility.
- .3 Provide free access to all portions of work and cooperate with inspection agency.
- .4 Concrete Cylinder Tests.
  - .1 Make at least one set of 3 cylinders for each day's concreting or for each 35 cubic meters of concrete placed, for each type of concrete mix.
  - .2 Take cylinders at point of deposit of concrete.
  - .3 For each test: slump and air content will be taken and 3 standard cylinders will be prepared and cured under laboratory conditions.
  - .4 One cylinder from each test will be broken at 7 days and remaining cylinders at 28 days.
  - .5 When temperatures are below 5°C, prepare one additional field cured cylinder to verify that adequate strength is attained.
  - .6 When either air or slump measurements are not within specified limits, reject concrete load. Undertake testing of subsequent concrete load to ensure conformance to specifications.
  - .7 Deliver test results directly from test laboratory to Contract Administrator and to Contractor.
- .5 Test reports to include:
  - .1 Project name.
  - .2 Date and time of sampling.
  - .3 Supplier, truck and departure time.
  - .4 Specified strength and admixtures.
  - .5 Cement type.
  - .6 Exact location in structure.
  - .7 Slump and air content.
  - .8 Maximum aggregate size.
  - .9 Test strength and age at time of test.
  - .10 Date cylinder received by lab.
  - .11 Testing technician identification.
  - .12 Weather and temperature information.
- .6 If any tests reveal concrete does not meet specification, Contract Administrator may enforce one or more remedial procedures such as:
  - .1 Change in mix design.
  - .2 Change in concrete supplier.
  - .3 Additional testing by coring or impact hammer.
  - .4 Replacement of work.
  - .5 Other procedures as necessary.



- .7 Pay costs of remedial work to make concrete meet specifications.

**END OF SECTION**

## **Part 1 General**

### **1.1 RELATED SECTIONS**

- .1 Section 03 20 00 - Concrete Reinforcing
- .2 Section 03 30 00 - Cast-in-Place Concrete
- .3 CW 3110 – R19 - Sub-grade, Sub-base and Base Course Construction

### **1.2 REFERENCES**

- .1 American Society for Testing and Materials International (ASTM)
  - .1 ASTM C117-04, Standard Test Method for Materials Finer than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
  - .2 ASTM C136-05, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .3 ASTM D698-07 Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft<sup>3</sup>) (600 kN-m/m<sup>3</sup>).
- .2 Canadian Standards Association (CSA International)
  - .1 CSA-A23.1-04/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

### **1.3 SUBMITTALS**

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Inform Contact Administrator of proposed source of materials and provide access for sampling at least 2 weeks prior to commencing work.
- .3 If materials have been tested by independent testing laboratory within previous month and have passed tests equal to requirements of this specification, submit test certificates from testing laboratory showing suitability of materials for this project.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Concrete mixes and materials: in accordance with Section 03 30 00 - Cast-in-Place Concrete.
- .2 Reinforcing steel: in accordance with Section 03 20 00 - Concrete Reinforcing.
- .3 Joint filler in accordance with Section 03 30 00 - Cast-in-Place Concrete.
- .4 Granular base: material to CW 3110 – R19 - Sub-grade, Sub-base and Base Course Construction
- .5 and following requirements:
  - .1 Crushed stone or gravel.
  - .2 Gradations: within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1.
- .6 Non-staining mineral type form release agent: chemically active release agents containing compounds that react with free lime to provide water-soluble soap.

- .7 Fill material: to Section 31 22 13 - Rough Grading and following requirements:
  - .1 Type 1 clean fill: excavated material from site or approved equal in accordance with B6
  - .2 Crushed stone or gravel.
  - .3 Gradations: within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1.

### **Part 3 Execution**

#### **3.1 GRADE PREPARATION**

- .1 Do grade preparation work in accordance with CW 3110 – R19 - Sub-grade, Sub-base and Base Course Construction
- .2 Place fill in maximum 150mm layers and compact to at least 95% of maximum dry density to ASTM D698.

#### **3.2 GRANULAR BASE**

- .1 Obtain Contract Administrator's approval of subgrade before placing granular base.
- .2 Place granular base material to lines, widths, and depths as indicated.
- .3 Compact granular base in maximum 150 mm layers to at least 100% of maximum density to ASTM D698.

#### **3.3 FORMING**

- .1 Obtain Contract Administrator's approval of forming prior to installing concrete.

#### **3.4 CONCRETE**

- .1 Obtain Contract Administrator's approval of granular base and reinforcing steel prior to placing concrete.
- .2 Arrange for concrete testing per Section 01 21 00 – Allowances.
- .3 Do concrete work in accordance with Section 03 30 00 - Cast-in-Place Concrete.
- .4 Determine broom finish locations and directions on site with Contract Administrator prior to pouring concrete.
- .5 Immediately after floating, give sidewalk surface uniform broom finish to produce regular corrugations not exceeding 2mm deep, by drawing broom in direction normal to centre line perpendicular to the general path of travel.
- .6 Provide edging where indicated on the drawings with 25mm radius edging tool.

#### **3.5 TOLERANCES**

- .1 Finish surfaces to within 3mm in 3m as measured with 3m straightedge placed on surface.

### **3.6 EXPANSION AND CONTRACTION JOINTS**

- .1 Install tooled transverse contraction joints after floating, when concrete is stiff, but still plastic, as shown on drawings.
- .2 Install expansion joints at maximum 6m a shown on drawings.
- .3 When sidewalk is adjacent to curb, make joints of curb, gutters and sidewalk coincide.

### **3.7 ISOLATION JOINTS**

- .1 Install isolation joints around manholes and catch basins and along length adjacent to concrete curbs, catch basins, buildings, or permanent structure.
- .2 Install joint filler in isolation joints in accordance with Section 03 30 00 - Cast-in-Place Concrete.
- .3 Seal isolation joints with clear silicone sealant approved by Contract Administrator's.

### **3.8 CURING**

- .1 Cure and protect concrete in accordance with CSA-A23.1.
- .2 Apply curing and sealing compound evenly to form continuous film, in accordance with manufacturer's requirements and to ASTM C309.
- .3 Cover newly poured concrete during curing period if inclement weather or cold weather conditions are imminent.

### **3.9 BACKFILL**

- .1 Allow concrete to cure for 7 days prior to backfilling.
- .2 Backfill to designated elevations with material as shown on the drawings.
  - .1 Compact and shape to required contours as shown on the drawings.

### **3.10 DEFECTIVE WORK**

- .1 Remove and re-pour area showing checking, slumping, cracking or honeycombing.
- .2 If honeycombing is minimal parge concrete as directed by Contract Administrator

### **3.11 CLEANING**

- .1 Proceed in accordance with Section 01 74 00 – Cleaning and Waste Processing.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment. Leave site clean.

**END OF SECTION**

**Part 1            General**

**1.1                SECTION INCLUDES**

- .1        Concrete sealers.

**1.2                SUBMITTALS FOR REVIEW**

- .1        Section 01 33 00: Submission procedures.
- .2        Product Data: Provide data on materials and application requirements.

**1.3                DELIVERY, STORAGE, AND PROTECTION**

- .1        Section 01 61 00: Transport, handle, store, and protect products.
- .2        Store containers to manufacturer's written instructions.
- .3        Protect materials from freezing.

**1.4                WASTE MANAGEMENT AND DISPOSAL**

- .1        Separate waste materials for recycling in accordance with Section 01 74 20 – Waste Management and Disposal.

**Part 2            Products**

**2.1                MATERIALS**

- .1        Water Repellent Sealer: Water-based acrylic curing and sealing compound; non-yellowing, clear, meeting the following requirements:
  - .1        ASTM C 309, Type 1, Class B
  - .2        AASHTO M 148, Type 1, Class B
  - .3        ASTM C 1315, Class A, Section 6.4.1 – non-yellowing
  - .4        ASTM C 1315, Section 6.6 – exceed 50 MPa adhesion requirements
  - .5        Does not discolour substrate.
- .2        Water: Potable.

**Part 3            Execution**

**3.1                EXAMINATION**

- .1        Section 01 70 00: Verify existing conditions before starting work.
- .2        Ensure surfaces are clean, dry and free of contaminants.
- .3        Ensure new concrete has cured minimum 28 days.
- .4        Ensure ambient temperature is minimum 10 deg C, and substrate temperature is minimum 4 deg C.

**3.2                PREPARATION**

- .1        Clean substrate surfaces to manufacturer's written instructions.

**3.3           INSTALLATION**

- .1       Protect adjacent work from spills and overspray. Remove overspray on adjacent surfaces immediately before dry.
- .2       Apply materials where indicated and allow to cure according to manufacturer's written instructions.
- .3       Do not dilute or mix materials with other sealers.
- .4       Apply sealer in two coats with brush, roller or low pressure airless sprayer.
- .5       Apply even coats allowing for and observing adequate penetration. Do not allow surface to dry between coats.
- .6       Clean substrate and equipment with potable water.

**END OF SECTION**

**Part 1            General**

**1.1            RELATED SECTIONS**

- .1    Section 03 10 00 – Concrete Forming and Accessories.
- .2    Section 03 20 00 – Concrete Reinforcing.
- .3    Section 03 41 13 – Precast Concrete Hollowcore Planks.

**1.2            REFERENCES**

- .1    Canadian Standards Association (CSA)
  - .1    CSA-A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
  - .2    CAN/CSA-A3000-08, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005)
  - .3    CSA A283-06, Qualification Code for Concrete Testing Laboratories.
- .2    American Concrete Institute (ACI)
  - .1    ACI 309R-96, Guide for the Consolidation of Concrete.
- .3    American Society for Testing and Materials International (ASTM)
  - .1    ASTM C260/C260M-10a, Specification for Air-Entraining Admixtures for Concrete.
  - .2    ASTM C494/C494M-10a Standard Specification for Chemical Admixtures for Concrete.

**1.3            CERTIFICATES**

- .1    Provide certification that mix proportions selected will produce concrete of quality, yield and strength as specified in concrete mixes, and will comply with CSA-A23.1. Certification letter to be sealed by an engineer registered in the Province of Manitoba.
- .2    Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CSA-A23.1. Certification letter to be sealed by an engineer registered in the Province of Manitoba.

**1.4            ABBREVIATIONS**

- .1    Cement: hydraulic cement or blended hydraulic cement (XXb - where b denotes blended).
  - .1    Type GU or GUb - General use cement.
  - .2    Type CI - with CaO content ranging from 8 to 20%.
- .2    SCM – Supplemental cementing materials.
- .3    SSD - Saturated surface dry.
- .4    WRA – Water reducing agent.

**1.5            DELIVERY, STORAGE AND HANDLING**

- .1    Concrete hauling time: maximum allowable time for concrete to be delivered to site of Work and discharged not to exceed 120 minutes after batching.
  - .1    Modifications to maximum time limit must be agreed to Contract Administrator and concrete producer as described in CSA A23.1/A23.2.
  - .2    Deviations to be submitted for review by Contract Administrator.
- .2    Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

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**Part 2 Products**

**2.1 MATERIALS**

- .1 The concrete constituents shall comply with the following standards:
  - .1 Cement: to CAN/CSA-A3001.
  - .2 Blended Hydraulic cement: to CAN/CSA-A3001.
  - .3 Supplementary cementing materials: to CAN/CSA-A3001.
  - .4 Water: To CSA-A23.1.
  - .5 Aggregates: to CSA-A23.1. Coarse aggregates to be normal density.
  - .6 Air entraining admixture: ASTM C260.
  - .7 Chemical admixtures: ASTM C494/C494M. Contract Administrator to approve accelerating or set retarding admixtures during cold and hot weather.

**2.2 MIX REQUIREMENTS**

- .1 Proportion normal density concrete in accordance with CSA-A23.1, Table 5, Alternative 1 to obtain the following performance:
  - .1 Bonded Concrete Overlay.
    - .1 Class of exposure: N
    - .2 Minimum compressive strength at 28 days: 32 MPa.
    - .3 Water:cementitious ratio: max. 0.45
    - .4 Air category: None
    - .5 Supplemental Cementing Materials (SCM): Class CI Fly-Ash.
    - .6 Volume of SCM: Normal (less than 30% replacement).
    - .7 Nominal size of coarse aggregate: 20 mm.
    - .8 Slump at point of discharge: consistent with placement and consolidation methods, equipment, and site conditions and as approved by Contract Administrator.

**2.3 BONDING SLURRY**

- .1 The bonding slurry shall consist of a cement/sand grout mixed in a 1:1 ratio by weight to a maximum water/cement ratio of 0.45 in accordance with CSA-A23.1 and as follows:
  - .1 1.0 kg Type GU to CSA A3001.
  - .2 1.0 kg SSD concrete sand to CSA A23.1.
  - .3 0.40 kg Water to CSA A23.1.
  - .4 High range water reducing agent to ASTM C494/C494M as required and approved by Contract Administrator.
  - .5 Volume batching will be permitted provided the volumes are calibrated by weight prior to batching. The measuring containers shall be clearly labelled, indicating material type, calibrated weight of material, and calibrated volume. The Contract Administrator reserves the right to randomly check batch weights.
  - .6 Shovel batching is strictly prohibited.
- .2 Alternative Method: Plastic concrete from same mix utilized for overlying concrete. Scrub plastic concrete. Scrub plastic concrete into substrate with stiff bristled broom or brush to produce a uniform thickness of 1/8" (3 mm) over entire area. Collect and remove all coarse aggregate prior to placement of the overlay.

**2.4 ACCESSORIES**

- .1 Evaporation reducer: Acceptable Product:
  - .1 MasterKure ER 50 formerly (Confilm) by BASF Building Systems at a minimum application rate of 4.9 m<sup>2</sup>/L.



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**2.5 REINFORCEMENT**

- .1 Reinforcing Mesh: as per drawings.
- .2 Provide chairs of suitable height to hold mesh in centre of new overlay. Chair spacing not to exceed 18" on-centre in each direction or as required to support the weight of placing personnel with minimal deflection.

**Part 3 Execution**

**3.1 CONCRETE SURFACE PREPARATION**

- .1 Within 24 hours prior to placement, shot blast the substrate to texture the concrete and remove loose deteriorated concrete, laitance, dust, dirt, oil, and any other material that could interfere with the bond of the new concrete. Prepare vertical surface by sandblasting, grinding, bush hammering, or other suitable method. Provide a uniform surface profile of ICRI-CSP-5 or better. Sample surfaces are available for inspection in the Contract Administrator's office. These samples will be used as the standard of acceptance.
- .2 Surface preparation applies equally to any horizontal or vertical concrete surfaces to which the concrete is to bond.
- .3 Vacuum clean surface and/or air blast with oil free compressed air to remove residue and spent media created by surface preparation.
- .4 After all surface preparation is complete the Contractor shall request an inspection from the Contract Administrator to review the substrate.
- .5 Maintain substrate in a clean condition using polyethylene film until the overlay is ready to be placed.
- .6 Saturate substrate for a period of not less than 6 hours prior to infilling. Do not allow the concrete surface to dry. If the concrete surface becomes wet and subsequently dries, the surface preparation and cleaning procedure must be repeated.
- .7 Final cleaning: High pressure waterblast substrate at minimum 4,000 psi to remove any residual dust, dirt, debris, or other materials which could reduce bond.
- .8 Prior to placement remove standing water from all depressions and allow substrate to become saturated, surface-dry (SSD) with no standing water and dry to the touch. A SSD substrate typically exhibits a colour change of dark grey to light grey. Remove any standing water by vacuuming.

**3.2 MIX PRODUCTION**

- .1 Concrete to be mixed, delivered and placed in accordance with CSA A23.1.
- .2 Concrete to be batched and mixed at a ready mix plant and delivered to site in ready to place form.
- .3 Control of slump on the job site to be in accordance with CSA-A23.1 except as otherwise specified below:
  - .1 The addition of water to increase slump is strictly prohibited unless prior written permission from concrete supplier is obtained.
  - .2 The use of WRA may be required to aid in placement of the concrete and obtain adequate consolidation in heavily reinforced sections.
  - .3 WRA addition shall occur at the batch plant or on site. Site addition of WRA will be the responsibility of the concrete supplier.
- .4 Slump and air must be measured both before and after addition of WRA.
- .5 The addition of water to the concrete to increase slump and aid in pumping is strictly forbidden

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### 3.3 PLACEMENT

- .1 Obtain Contract Administrator's approval before placing concrete. Provide 24 hours notice prior to placing of concrete.
- .2 Provide temporary bridging as required to permit access to all areas during placement, finishing and curing.
- .3 Bonding Slurry Application:
  - .1 Apply the specified bonding slurry to a SSD substrate.
  - .2 Scrub plastic slurry into substrate with stiff bristled broom or brush to produce a uniform thickness of 1/8" (3 mm) over entire area. Collect and remove all coarse aggregate prior to placement of the concrete.
- .4 Place concrete while the slurry is still plastic. Do not apply more slurry than can be covered with concrete before it dries. Do not retemper. If the bonding slurry dries prior to placement of the repair material, removal of the dried slurry will be required. The concrete substrate will then be cleaned and prepared in accordance with the requirements described in the previous sections.
- .5 Place concrete work in accordance with CSA-A23.1.
- .6 When concrete is placed by pump, the initial slurry used to prime the pump shall not be incorporated into the topping. The slurry shall be trapped and disposed off-site.
- .7 Ensure that rate of placing is sufficient to complete proposed placing, finishing and curing operations within scheduled time. Limit batch sizes as required if placing procedures are slower than anticipated.
- .8 Pour concrete continuously between predetermined construction and control joints. Do not break or interrupt successive pours such that cold joints occur. Install a construction dam or bulkhead in case of a delay longer than 60 minutes. During delays between 5 and 60 minutes, protect the end of the placement with damp burlap.
- .9 The concrete must be internally vibrated by use of a floating vibratory screed to consolidate the top surface. Move vibrating screed forward as rapidly as possible while allowing proper consolidation and finishing of the concrete surface. Extended use of a vibratory screed may result in segregation of the concrete producing excessive mortar at the surface which can result in a weak surface layer.
- .10 Continuously consolidate and finish to specified elevations.
- .11 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .12 Protect freshly placed concrete from exposure to dust, debris and precipitation.

### 3.4 FINISHING

- .1 Finish concrete in accordance with CSA-A23.1.
- .2 Finishing:
  - .1 Immediately after concrete has been placed and consolidated, bull-float slab surface to a smooth uniform surface.
  - .2 Use of hand trowels will be required to hand finish areas the finishing machine cannot reach.
  - .3 Surface free of all trowel marks and ridges.

### 3.5 CURING

- .1 Immediately after final finishing, protect exposed surface against plastic shrinkage by means of a fog spray and/or application of an evaporation reducer, until the concrete has enough strength

to support the placement of the wetted burlap. When an evaporation reducer is used, intermittent reapplication may be required if the film evaporates before initiation of the wet cure.

- .2 Bonded concrete overlays to be wet cured with burlap for a minimum of 7 days at 10°C. Provide supplemental heat and hoarding as required throughout curing period.
- .3 Burlap to be thoroughly presoaked by immersing it in water for a period of at least 24 hours immediately prior to placement.
- .4 Commence wet curing as soon as the surface will support the weight of the wetted burlap without deformation. Burlap to be applied in one layer with strips overlapping at least 3" (75 mm) and be securely held in place without marring the concrete surface.
  - .1 Days 1 through 6: Maintain burlap in a continuously wet condition throughout the curing period. Periodic rewetting by means of a soaker hoses, sprinklers, or other suitable methods approved by the Contract Administrator may be necessary.
  - .2 Day 7: Discontinue re-wetting procedures allowing burlap to dry naturally.
- .5 Workers shall not be allowed on the overlay for 12 hours after placement. Do not place load upon new concrete until curing period is over.

### **3.6 JOINTS**

- .1 Control joints and construction joints shall be formed, tooled, or sawcut via specialized dry-process cutting (eg. "Soff-Cut"). Sawcutting 24 hours following placement will not be permitted.
  - .1 Sawcut to a minimum of one 1 1/2" (38 mm) or one-quarter of the depth of the slab, whichever is greater, following initial set of concrete.
  - .2 Timing of the saw cutting will vary with weather conditions however are typically completed within 1 to 4 hours after final finishing. Timing of the saw cutting will be the responsibility of the Contractor.
- .2 Location and frequency of control joints to be site determined.

### **3.7 FIELD QUALITY CONTROL**

- .1 Concrete tests consisting of slump, air, and 3 cylinders for compressive strength to be completed at not less than one test per 50 cubic metres of concrete placed and not less than one test for each day of placement.
- .2 The bond strength between the overlay and substrate will be measured in accordance with CSA-A23.2-6B. The minimum acceptable bond strength between the overlay and substrate is 1.0 MPa at 28 days
- .3 Direct pull-out tensile tests to determine bond strength will be completed as follows:
  - .1 Minimum (3) tests will be completed within the first phase of repairs.
  - .2 Not less than one (1) bond test will be completed in each subsequent phase.
  - .3 Infilling of the core hole will be the responsibility of the General Contractor. Unless otherwise directed by the Contract Administrator, repair in accordance with this Section.
- .4 Testing agency to submit copies of concrete test reports directly to The City and Contract Administrator.
- .5 Inspection or testing by Contract Administrator will not augment or replace Contractor quality control nor relieve contractual responsibility.

### **3.8 DEFECTIVE CONCRETE**

- .1 Defective concrete: bond strengths below minimum specified value, cracking, spalling, scaling and concrete not conforming to required lines, details, dimensions, tolerances, finishes or specified requirements.
- .2 Repair or replacement of defective concrete will be determined by the Contract Administrator, based on the specifications and the above guidelines.

- .3 Do not patch, fill, touch up, repair or replace exposed concrete except upon express direction of Contract Administrator for each individual use.

**END OF SECTION**

**Part 1            General**

**1.1                SECTION INCLUDES**

- .1            Ground polished concrete finish on floors.

**1.2                RELATED REQUIREMENTS**

- .1            Section 03 30 00 - Concrete Topping

**1.3                DEFINITIONS**

- .1            Finish:
  - .1            Level 2 - Medium Gloss: Gloss Reading not less than 55 according to ASTM E430 before application of polish sealer.
- .2            Depth of Grind:
  - .1            Class B – Fine Aggregate (Salt and Pepper) Finish: 1.6 mm, with fine aggregate exposure with no or only small amount of medium aggregate at random locations.

**1.4                REFERENCE STANDARDS**

- .1            ASTM International (ASTM)
  - .1            ASTM E430-05, Standard Test Method for Measurement of Gloss of High-Gloss Surfaces by Abridged Goniophotometry
  - .2            ASTM F710-08, Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
  - .3            ASTM F1869-10, Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
  - .4            ASTM F2170-09, Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes
- .2            Pre-Installation Meeting:
  - .1            Conduct meeting at project site to comply with requirements in Division 01.
  - .2            Conduct meeting before placing concrete to discuss concrete placing and finishing requirements, including tolerances and flatness, with respect to polished concrete finishes.
  - .3            Meeting attendees to include: concrete producer, concrete placer, concrete finisher, manufacturer's representative of liquid applied densifier, Contract Administrator, and Contractor.
  - .4            Meeting agenda shall include, but not be limited to:
    - .1            Discussion and evaluation of substrate conditions, surface preparations, sequence of procedures, and other preparatory work.
    - .2            Protecting concrete floor surfaces until polishing work begins.
    - .3            Details of each step of grinding, honing, and polishing operations.
    - .4            Application of liquid applied products.
    - .5            Protection of polished concrete after polishing work is complete.

- .3 Coordination:
  - .1 Provide complete, uninhibited concrete slab for application prior to concrete floor finishing application.
  - .2 Protect concrete scheduled for polishing from stains.

**1.5 SUBMITTALS FOR REVIEW**

- .1 Section 01 33 00: Submission procedures.
- .2 Product Data:
  - .1 Manufacturer's specifications and test data.
  - .2 Description of products, giving manufacturer's name and product name for specified material proposed.
  - .3 Technical data sheet giving descriptive data, curing time, and application requirements.

**1.6 SUBMITTALS FOR INFORMATION**

- .1 Section 01 33 00: Submission procedures.
- .2 Installer qualifications, including manufacturer's certification.

**1.7 QUALITY ASSURANCE**

- .1 Installer Qualifications:
  - .1 Minimum three years experience and adequate number of skilled workers who are thoroughly trained and experienced.
  - .2 Familiar with specified requirements and methods needed for proper performance of Work.
  - .3 Certified by polished concrete finish manufacturer.
- .2 Manufacturer's Certification:
  - .1 Provide letter of certification from manufacturer stating that installer is certified applicator, and is familiar with proper procedures and installation requirements required by manufacturer.
- .3 Mock-ups:
  - .1 Apply mock-ups of each type finish, to demonstrate typical joints, surface finish, colour variation (if any), and standard of workmanship.
    - .1 Prepare mock-ups approximately 5 sq. m in location indicated on site as directed by Contract Administrator.
    - .2 Use same personnel that will perform work.
    - .3 Notify Contract Administrator seven days in advance of dates and times when mock-ups will be constructed.
    - .4 If Contract Administrator determines that mock-ups do not meet requirements, apply special concrete finish in other area on site as directed by Contract Administrator until mock-ups are approved.
    - .5 Maintain mock-ups during construction in an undisturbed condition as a standard for judging completed work.
    - .6 Protect and maintain approved mock-ups during construction in an undisturbed condition as a standard for judging completed work.
    - .7 Mock-ups will be in non-public areas.

- .8 Mock-up will be reviewed for:
  - .1 Compliance with approved submittals.
  - .2 Uniformity of exposed aggregate.
  - .3 Uniformity of sheen.

## **1.8 CLOSEOUT SUBMITTALS**

- .1 Provide maintenance data for polished concrete for incorporation into manual specified in Section 01 78 10 - Closeout Submittals.
  - .1 Include methods and frequency of recommended cleaning, and precautions against maintenance practice or materials, which may damage or disfigure finished flooring.

## **1.9 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver materials in original containers, with seals unbroken, bearing manufacturer labels indicating brand name and directions for storage.
- .2 Dispense material from factory in numbered and sealed containers. Maintain record of container numbers.

## **1.10 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for recycling in accordance with Section 01 74 20 – Waste Management and Disposal.

## **1.11 SITE CONDITIONS**

- .1 Comply with manufacturers written instructions for substrate temperature and moisture content, ambient temperature and humidity, ventilation, and other conditions affecting application and performance.
  - .1 Concrete: cured minimum 45 days or as directed by manufacturer before concrete floor finishing can begin.

## **Part 2 Products**

### **2.1 DESIGN CRITERIA**

- .1 Room perimeter and field areas: same level of grind and finish.

### **2.2 EQUIPMENT**

- .1 Equipment approved by system manufacturer, to achieve specified finish and depth of grind.

### **2.3 MATERIALS AND MANUFACTURERS**

- .1 Densifier:
  - .1 Sodium-silicate densifiers: Induroshine System including Liqui-Hard densifier and Bellatrix enhancer by W.R. Meadows, 1-800-342-5976; Retro-Plate 99, by Advanced Floor Products, Inc., P.O. Box 50533, Provo, Utah 84605, 801-812-3420.
- .2 Cleaner: specifically formulated, residue-free floor cleaner designed to clean concrete treated with densifier, and approved by densifier manufacturer.

- .3 Sealer/Enhancer: non-film forming, stain and soil inhibitor, penetrating sealer as recommended by densifier manufacturer, and compatible with densifier.
- .4 Patching Compound: composed of 40% Portland cement, 45% limestone, and 15% vinyl acetate copolymer, when mixed with dust salvaged from grinding process forms a paste that hardens when surface imperfections are filled.
- .5 Grout Material: Clear modified silicate sealant, containing no pore clogging latex, when mixed with dust salvaged from grinding process forms a paste that reacts with calcium hydroxide in concrete that hardens when surface imperfections are filled.
- .6 Water: Potable.

**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Examine substrate, with installer present, for conditions affecting performance of finish. Correct conditions detrimental to timely and proper Work. Do not proceed until unsatisfactory conditions are corrected.

**3.2 PREPARATION**

- .1 Protect adjacent surfaces not designated to receive densifier application.
- .2 Prepare and clean concrete surfaces, free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, paint splatter, and other contaminants incompatible with liquid applied products and polishing.

**3.3 APPLICATION**

- .1 General:
  - .1 Start floor finish application in presence of manufacturer's technical representative.
- .2 Finish:
  - .1 Level 2 - Medium Gloss.
  - .2 Procedure: minimum five-step process with full refinement of each diamond pad up to 800 grit resin bonded pad with one application of densifier.
- .3 Initial Grinding:
  - .1 Use grinding equipment with metal bonded grinding pads.
  - .2 Begin grinding in one direction using sufficient size grit pad.
  - .3 Make sequential passes with each pass perpendicular to previous pass using finer grit pad with each pass, up to 150 grit.
  - .4 Achieve maximum refinement with each pass before proceeding to finer grit pads.
  - .5 Vacuum floor using squeegee vacuum attachment after each pass.
  - .6 Continue grinding until aggregate exposure matches approved field mock-ups.
- .4 Treating Surface Imperfections:
  - .1 Mix patching compound and grout material with dust created by grinding operations to match colour of adjacent concrete surface.



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- .2 Fill surface imperfections including, but not limited to, holes, surface damage, small and micro cracks, air holes, pop-outs, and voids.
  - .3 Work compound and treatment until colour differences between concrete surface and filled surface imperfections are not easily noticeable when viewed from 3 m away under lighting conditions that will be present after construction.
  - .5 Liquid Densifier:
    - .1 Apply undiluted to point of rejection in accordance with manufacturer's instructions.
    - .2 Remove excess liquid.
    - .3 Allow to cure according to manufacturer's instructions.
  - .6 Grout Grinding:
    - .1 Use grinding equipment and appropriate grit grinding pads.
    - .2 Apply fresh grout material and grind concrete in direction perpendicular to initial grinding to remove scratches.
    - .3 Vacuum floor using squeegee vacuum attachment after each pass.
  - .7 Honing:
    - .1 Use grinding equipment with resin bonded grinding pads.
    - .2 Grind concrete in one direction starting with 50 grit pad and make as many sequential passes required to remove scratches, each pass perpendicular to previous pass, up to 400 grit pad reaching maximum refinement with each pass before proceeding to finer grit pads.
    - .3 Auto scrub or vacuum floor using squeegee vacuum attachment after each pass.
  - .8 Polishing:
    - .1 Use polishing equipment with resin bonded polishing and burnishing pads.
    - .2 Begin polishing in one direction starting with 800 grit pad.
    - .3 Make sequential passes with each pass perpendicular to previous pass using finer grit pad with each pass.
    - .4 Achieve maximum refinement with each pass before proceeding to finer grit pads.
    - .5 Auto scrub or vacuum floor using squeegee vacuum attachment after each pass.
    - .6 Continue polishing until gloss appearance matches approved field mock-ups.
  - .9 Cleaner and Sealer/Enhancer:
    - .1 Apply cleaner in accordance with manufacturer's recommendations.
    - .2 Apply sealer/enhancer in accordance with manufacturer's recommendations, and allow to cure before final polishing.
  - .10 Final Polish: Using burnishing equipment and finest grit burnishing pads, burnish to uniform sheen matching approved mock-up.

### **3.4 CLEANING**

- .1 Keep premises clean and free of debris.
- .2 Remove spatter from adjoining surfaces.
- .3 Repair damages to surfaces caused by cleaning operations.

- .4 Remove debris from jobsite. Dispose of materials in separate, closed containers in accordance with local regulations.

**3.5 PROTECTION**

- .1 Protect finished work until fully cured in accordance with manufacturer's recommendations.
- .2 Close areas to traffic during floor application and after application, for time period recommended in writing by manufacturer.
- .3 Do not tape floor protection to floor surfaces.

**3.6 SCHEDULE**

Finish designation	Depth of grind	Finish
PC	Class B	Level 2

**END OF SECTION**

**Part 1            General**

**1.1                RELATED SECTIONS**

- .1        Section 03 10 00 – Concrete Forming and Accessories.
- .2        Section 03 20 00 – Concrete Reinforcing.
- .3        Section 03 30 00 – Cast-In-Place Concrete.

**1.2                REFERENCES**

- .1        American Society for Testing and Materials (ATSM).
- .1        ASTM A123/A123M-12, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .2        ASTM A497/A497M-07, Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete.
- .3        ASTM A775/A775M-07b, Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
- .4        ASTM A882/A882M-04a(2010), Standard Specification for Filled Epoxy-Coated Seven-Wire Prestressing Steel Strand.
- .5        ASTM A910/A910M-10, Standard Specification for Uncoated, Weldless, 2- and 3-Wire Steel Strand for Prestressed Concrete.
- .6        ASTM D412-06ae2, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
- .7        ASTM D2240-05(2010), Standard Test Method for Rubber Property - Durometer Hardness.
  
- .2        Canadian Standards Association (CSA).
- .1        CSA A23.1-09/A23.2-09, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
- .2        CAN/CSA A23.3-04 (R2010), Design of Concrete Structures.
- .3        CSA A23.4-09, Precast Concrete - Materials and Construction.
- .4        CSA G30.18-09, Carbon Steel Bars for Concrete Reinforcement.
- .5        CSA G40.20-G40.21-13, General Requirements for Rolled or Welded Steel/Structural Quality Steels.
- .6        CSA W47.1-09, Certification of Companies for Fusion Welding of Steel Structures.
- .7        CSA W48-06 (R2011), Filler Metals and Allied Materials for Metal Arc Welding.
- .8        CSA W59-13 , Welded Steel Construction (Metal Arc Welding).
- .9        CSA W186-M1990 (R2012), Welding of Reinforcing Bars in Reinforced Concrete Construction.
  
- .3        Canadian General Standards Board (GCSB).
- .1        CAN/CGSB-1.40-97, Anticorrosive Structural Steel Alkyd Primer.
- .2        CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
  
- .4        National Building Code of Canada, 2010 (NBCC).

**1.3                DESIGN REQUIREMENTS**

- .1        Design precast elements to CAN/CSA A23.3 and CSA A23.4, and to resist carry handling, stockpiling, shipping and erection stresses.

- .2 Design precast elements and connections to carry loads specified by Consultant and in accordance with NBCC. Design to include resistance to creep, shrinkage, and to anticipated temperature changes and load requirements to meet NBCC requirements.
- .3 Design units to withstand other dead, wind and live loads. Maximum allowable deflection of floor planks  $L/360$  or less, cambered to achieve flat surface under dead load.
- .4 Design connections/attachments of precast elements to load/forces specified by Consultant. Design grouted keys to be capable of transmitting a factored horizontal shear force of  $30\text{kN/m}$  minimum, or as required by supplier's design.
- .5 Submit copies of detailed calculations and design drawings for typical precast elements and connections for Consultant review prior to manufacture.
- .6 Design components to accommodate construction tolerances, deflection of other building structural members and clearances of intended openings.
- .7 Calculate structural properties of framing members in accordance with CSA A23.3.
- .8 Utilize the CPCI Design Manual.

#### **1.4 TOLERANCES**

- .1 Tolerance of precast elements to CSA A23.4.
- .2 Length of precast elements not to vary from design length by more than plus or minus 5 mm.
- .3 Cross sectional dimensions of precast elements not to vary from design dimensions by more than plus or minus 3 mm.
- .4 Deviations from straight lines not to exceed 3 mm in 3 m.
- .5 Precast elements not to vary by more than plus or minus 5 mm from true overall cross sectional shape as measured by difference in diagonal dimensions.
- .6 Maximum variation from design camber shall be  $L/1000$  but at no point greater than 20mm. Differential camber between adjacent slabs shall be a maximum of  $L/600$  but at no point greater than 25 mm.

#### **1.5 SUBMITTALS**

- .1 Shop Drawings:
  - .1 Indicate plank locations, unit identification marks, connection details, edge conditions, bearing requirements, support conditions, dimensions, openings, openings intended to be field cut, camber, finishing schedules, methods of handling and erection, sleeves, inserts, and relationship to adjacent materials.
  - .2 Ensure each drawing submitted bears stamp and signature of qualified professional engineer licensed in province of Manitoba, Canada.
  - .3 Indicate design loads, deflections, and cambers.
- .2 Mock-up: Consultant to be notified when first plank is cast to review surface finish.
- .3 Fabricator's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

**1.6 QUALITY ASSURANCE**

- .1 Maintain plant records and quality control program during production of precast planks. Make records available upon request.

**1.7 QUALIFICATIONS**

- .1 Precast concrete elements to be fabricated and erected by manufacturing plant certified by Canadian Standards Association in appropriate categories according to CSA-A251.
- .2 Precast concrete manufacturer to be certified in accordance with CSA's certification procedures for precast concrete plants prior to submitting Bid and to specifically verify as part of Bid that plant is currently certified in appropriate categories: Structural Prestressed.
- .3 Only precast elements fabricated in such certified plants to be acceptable to The City, and plant certification to be maintained for duration of fabrication, erection, and until warranty expires.
- .4 Welding companies certified to CSA-W47.1.
- .5 Design precast concrete members under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the Province of Manitoba.

**1.8 REGULATORY REQUIREMENTS**

- .1 Conform to CSA 23.3 and the National Building Code of Canada 2010 amended by the Manitoba Building Code and any other applicable Codes and documents.

**1.9 DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver, store, protect and handle products to site.
- .2 Lifting or Handling Devices: Capable of supporting member in positions anticipated during manufacture, storage, transportation, and erection.

**1.10 COORDINATION**

- .1 Coordinate the Work of framing components not post tensioned but directly associated with the Work of this section.
- .2 Coordinate field cut openings with affected section.
- .3 Coordinate location of hanger tabs and devices for mechanical and electrical work.

**1.11 WARRANTY**

- .1 Contractor hereby warrants that precast element will not spall or show visible evidence of corrosion of embedded steel and cracking, except for normal hairline shrinkage cracks, in accordance with General Conditions, but for 10 years.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Cement, aggregates, water, admixtures, colouring admixture: to CAN/CSA- A23.1 and CAN3-A23.4.
- .2 Cementitious materials: to CAN/CSA-A3000.

- .3 Use same brands and source of cement and aggregate for entire project to ensure uniformity of colouration and other mix characteristics.
- .4 Reinforcing steel: to CAN/CSA-G30.18, ASTM A775/A775M.
- .5 Prestressing steel tendons to CSA-G279.
- .6 Welded wire fabric: to ASTM-A185.
- .7 Hardware and miscellaneous materials: to CAN/CSA-A23.1.
- .8 Forms: to CAN/CSA-A23.4/ A251.
- .9 Anchors and supports: to CAN/CSA G40.21, Type 350 W.
- .10 Welding materials: to CSA-W47.1.
- .11 Welding electrodes: to CSA-W48.1 and certified by Canadian Welding Bureau.
- .12 Galvanizing: hot dipped galvanizing with minimum zinc coating of 610 g/m<sup>2</sup> to CAN/CSA-G164.
- .13 Steel primer: to CAN/CGSB-1.40.
- .14 Zinc-rich primer: to CAN/CGSB-1.181.
- .15 Bearing pads: smooth, ultra-high molecular weight polyethylene plastic.
- .16 Air entrainment admixtures: to ASTM C260. The use of chloride containing admixtures is strictly forbidden.
- .17 Chemical admixtures: to ASTM C494/C494M.
- .18 Shims: smooth, ultra-high molecular weight polyethylene plastic.
- .19 Weephole tubes: purpose made plastic.

## **2.2 MIXES**

- .1 Concrete.
  - .1 Proportion normal density concrete in accordance with CSA-A23.1/A23.2, to give the following properties:
    - .1 Cement: use Type 10 Portland cement.
    - .2 Minimum compressive strength at 28 days: 35 MPa.
  - .2 Grout.
    - .1 Cement grout: 1 parts type 10 Portland cement, 2 parts sand, sufficient water for placement and hydration.
    - .2 Minimum compressive strength: 25 MPa.
    - .3 Shrinkage compensating grout: to Section 03 30 00 - Cast-in-Place Concrete.

## **2.3 MANUFACTURED UNITS**

- .1 Manufacture units in accordance with CAN3-A23.4, and CSA-A251.
- .2 Mark each precast unit to correspond to identification mark on shop drawings for location with date cast on part of unit that will not be exposed.
- .3 Provide hardware suitable for handling elements.

## **2.4 FABRICATION**

- .1 Embed anchors, inserts, plates, angles, and other items at locations indicated.
- .2 Provide openings required by other sections, at locations indicated.

**2.5 COMPONENTS**

- .1 Size as noted on structural drawings.

**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Verify that site conditions are ready to receive work.
- .2 Verify supporting structure is ready to receive work.

**3.2 PREPARATION**

- .1 Prepare support devices for the erection procedure and temporary bracing.

**3.3 ERECTION**

- .1 Do precast concrete work in accordance with CAN3-A23.4 AND CAN3-A23.3.
- .2 Erect members without damage to structural capacity, shape, or finish. Replace or repair damaged members.
- .3 Align and maintain uniform horizontal and end joints, as erection progresses.
- .4 Maintain temporary bracing in place until final connection is made. Protect members from staining.
- .5 Install bearing pads.
- .6 Adjust differential camber between precast members to tolerance before final attachment and grouting.
- .7 Adjust differential elevation between precast members to tolerance before final attachment.
- .8 Grout plank joints, trowel smooth.
- .9 Prevent grout leakage.
- .10 Secure units in place. Perform welding in accordance with CSA W59.

**3.4 ERECTION TOLERANCES**

- .1 Erect members level and plumb within allowable tolerances.

**3.5 PROTECTION OF FINISHED WORK**

- .1 Protect finished Work.
- .2 Protect members from damage caused by field welding or erection operations.
- .3 Provide non-combustible shields during welding operations.

**3.6**

**CLEANING**

- .1 Clean weld marks, dirt, or blemishes from surface of exposed members.

**END OF SECTION**



**Part 1            General**

**1.1                SECTION INCLUDES**

- .1            Architectural precast concrete sidewalk slabs for use in crawlspace

**1.2                REFERENCES**

- .1            CSA-A23.4-09 - Precast Concrete - Materials and construction

**1.3                SUBMITTALS FOR REVIEW**

- .1            Section 01 33 00: Submission procedures.
- .2            Product Data: for pavers.

**1.4                DELIVERY, STORAGE, AND PROTECTION**

- .1            Section 01 61 00: Transport, handle, store, and protect products.
- .2            Handle precast units to position, consistent with their shape and design.
- .3            Protect units to prevent staining, chipping, or spalling of concrete.

**1.5                WASTE MANAGEMENT AND DISPOSAL**

- .1            Separate waste materials for recycling in accordance with Section 01 74 20 – Waste Management and Disposal.

**Part 2            Products**

**2.1                MANUFACTURERS**

- .1            Manufacturer/Product: Barkman; Diamondface Slab.

**2.2                PAVERS**

- .1            Precast concrete, natural colour, non-slip finish, 610 by 610 by 45 mm thick. Provide 175 linear metres of pavers.

**2.3                FABRICATION**

- .1            Fabricate to CSA-A23.4. Use rigid moulds, constructed to maintain precast unit uniform in shape, size, and finish. Maintain consistent quality during manufacture.
- .2            Cure units to develop concrete quality, and to minimize appearance blemishes such as non-uniformity, staining, or surface cracking.
- .3            Minor patching in plant is acceptable.

**Part 3            Execution**

**3.1                INSTALLATION**

- .1            Place units without damage to shape or finish. Replace or repair damaged pavers.

**END OF SECTION**