

## **PART 1 - GENERAL**

### **1.1 GENERAL CLAUSES**

- .1 General Clauses and Complementary General Clauses apply to works described in this section.

### **1.2 RELATED WORKS**

- .1 Concrete reinforcement – Section 03 20 00
- .2 Cast-in-place concrete – Section 03 30 00

### **1.3 REFERENCE STANDARDS**

- .1 Unless otherwise noted, do concrete formwork in accordance with latest following standards:
  - .1 National Building Code.
  - .2 AC1 347 "Recommended Practice for concrete formwork".
  - .3 CAN3-A23 Series.
  - .4 CSA 0121.

### **1.4 SCOPE OF WORK**

- .1 Work will include all execution, necessary materials, equipment, tools, installation and services to complete all works relative to formwork for cast-in-place concrete (including concrete work indicated on mechanical/ electrical drawings), as established by drawings and defined by the present document. This includes scaffolding, braces, shores and struts, fasteners, templates, sleeves, openings, installation of anchors and steel structure bolts and installation of inserts in concrete. Installation of electrical and plumbing sleeves is included in the works of the present section.

### **1.5 DRAWING COORDINATION**

- .1 Check all details and dimensions shown on drawings and ensure conformity with architectural drawings. Report any omission or mistake before beginning work.
- .2 Advise structural Engineer of mechanical/electrical sleeves or opening location not shown on his drawings.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- .1 B.C. cedar plywood, grade "B", to CSA 0121 and CAN3-A23, with a minimum thickness of 20 mm in five (5) layers, must be used for formworks. A sheet of triplex of 6 mm thick is required for lining. Plywood may be epoxy painted (US Product Standard PS 1-66).
  - .2 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.
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- .3 Form ties: removable of snap-off metal ties, of fixed or adjustable length, free of devices leaving holes larger than 25 mm in diameter in concrete surface. The ties must have a resistance of 13 kN and will be designed so as to break inside the concrete, at 25 mm from the surface. In no case shall a twisted metal wire be used.

## **PART 3 - EXECUTION**

### **3.1 TYPE, STRENGTH, STIFFNESS AND FORM ALIGNMENT**

- .1 Except where otherwise noted on drawings, formworks will be made of 20 mm thick plywood, without patches, for exposed horizontal surfaces.
- .2 Strength and stiffness of formworks must be sufficient to support all concrete and wind loads and shall support forces caused by construction method, considering pouring speed. Ensure that finished concrete will conform to shapes, lines and dimensions of members indicated on drawings.
- .3 Formworks will produce a dense concrete surface, exempt of honeycombs, depressions or bulges.
- .4 Arch formworks to conform to structure condition requirements.
- .5 If necessary, special camber will be indicated on drawings.
- .6 Check and correct corners and shoring, horizontally and vertically, during concrete placing. For wall concrete placing, provide a control steel wire, parallel to wall plan. Assign at least one competent carpenter to continually check formwork alignment during concrete placing.

### **3.2 SHORING AND BRACING**

- .1 Formworks stability system must be continually maintained by sufficient bracing according to safety standards of rule No 1390 relative to shoring of concrete formworks.
- .2 Support, shore or reinforce all completed constructions where new construction loads will be applied.
- .3 Where shoring has to be maintained in place until a later date, do formworks to permit dismantling without removing shores.

### **3.3 JOINTS IN FORMWORKS**

- .1 All joints must be watertight so as to prevent all concrete leaks. Reduce number of joints in formwork to a minimum.
- .2 Clean all sides and contact surfaces before assembling.

### **3.4 TONGUED-AND- GROOVED CORNERS AND DETAIL**

- .1 Make corners as detailed on Engineer's drawings. Except otherwise noted, corners will be at right angle and not rounded.
  - .2 Slits, mortises, openings, drips and recesses must conform to indications on drawings.
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### **3.5 FORMWORK CLEANING**

- .1 Clean all formworks before placing concrete. Completely remove sawdust, snow, ice or other foreign material by compressed air or by steam.
- .2 Use of sodium chloride to melt snow or ice is strictly forbidden.

### **3.6 SLEEVES**

- .1 Install sleeves only where indicated on structural drawings or as required by mechanical/electrical Engineer during work. In the latter case, position and dimensions must be checked and approved by structural Engineer.

### **3.7 FORMWORK SURFACES TREATMENT**

- .1 Use untreated formworks if concrete is to receive plaster of stucco finishing. If formworks are susceptible to be affected by shrinkage or water absorption, wet interior surfaces. Keep formworks wet before placing concrete.

### **3.8 MULTIPLE USE OF FORMWORKS**

- .1 Plywood and steel formworks can be re-used after all nails are removed and all contact surfaces are cleaned and restored. Conform to CAN3-A23.

### **3.9 DISMANTLING FORMWORK**

- .1 Submit concrete placing and formwork dismantling schedule to the Engineer before beginning work.
- .2 Obtain permission of Engineer before dismantling formworks or shores. Do not dismantle formworks before concrete strength has attained 70% of the specified strength at 28 days. Be sure that concrete is able to support all dead loads and all construction loads or other loads that may be applied.
- .3 Except otherwise indicated on drawings, walls vertical formworks may be removed only when concrete is able to support its own weight but not before three days after placing concrete. If formwork dismantling is done before the 7th day after concrete placing, apply surface treatment with a protective coating against water evaporation. Refer to section 03300 for coating application.
- .4 Dismantling both sides of a construction joint on a distance equal to one and a half span is not permitted until concrete has attained 70% of its specified strength.
- .5 Forms and shores must be left in place until the concrete has attained sufficient strength to safely support its own weight combined with all construction loads likely to be imposed. Contractor is completely responsible for formwork dismantling and prevention of possible damages due to an early dismantling including possible excessive deflection.

### **3.10 VERTICAL TOLERANCES**

- .1 Relative position of vertical elements will conform to following requirements:
  - .1 The difference between two adjacent vertical elements will not exceed 12 mm, and 25 mm between any two vertical elements.

### **3.11 CONCRETE DIMENSIONS**

- .1 Dimension variation, in relation with theoretical dimensions of any member, will not exceed the following limits:
  - .1 Less than 5 mm or more than 10 mm.
  - .2 Engineer may ask for formwork rectification if dimension variation exceed the limits defined in this document.

### **3.12 FORMWORK TIE HOLES**

- .1 Unless otherwise indicated in architectural documents, fill formwork tie holes with non-shrink mortar.

**END OF SECTION**

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## **PART 1 - GENERAL**

### **1.1 GENERAL CLAUSES**

- .1 General Clauses and Complementary General Clauses apply to works described in this section.

### **1.2 RELATED WORKS**

- .1 Concrete formwork – Section 03 10 00
- .2 Concrete reinforcement – Section 03 20 00
- .3 Testing Laboratory Services – Section 01 41 00

### **1.3 REFERENCE STANDARDS**

- .1 Do cast-in-place concrete work in accordance with CSA/CAN-A23.1, and testing in accordance with CSA/CAN-A23.2, except where specified otherwise.

### **1.4 QUALITY CONTROL**

- .1 Submit proposed quality control procedures for Engineer's approval.

### **1.5 SCOPE OF WORK**

- .1 Provide all necessary labour, materials, equipment and tools for supply, transport, pouring cast-in-place, curing and protection of concrete, as prescribed on drawings and defined in these specifications, including: concrete, chemical admixtures, curing compound, protection, heating and cooling.

### **1.6 COORDINATION**

- .1 Obtain from other trades all necessary information and instructions concerning surface finishing, materials and anchors which could affect work under this section.

### **1.7 INSPECTION**

- .1 Collaborate with inspector and laboratory representative to facilitate their work.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- .1 Portland cement: type GU, to CSA A3001.
  - .2 Water: to CSA/CAN-A23.1.
  - .3 Aggregates: to CSA/CAN-A23.1. Coarse aggregates to be normal density.
  - .4 Air entraining admixture: to CSA/CAN-A3000 and A23.1/A23.2.
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- .5 Chemical admixtures: to CSA/CAN-A3000 and A23.1/A23.2. Engineer to approve accelerating or set retarding admixtures during cold and hot weather placing.
- .6 Dry pack: premixed or non premixed composition of non metallic aggregate, Portland cement with sufficient water for the mixture to retain its shape when made into a ball by hand and capable of developing compression strength of 50 MPa at 28 days.
- .7 Curing compound: to CSA/CAN-A23.1.

## 2.2 MIXING AND DELIVERY

- .1 Except with special authorization from Engineer, all concrete used for this project shall be the product of an approved ready-mix-plant.  
Each load of concrete shall be accompanied by a delivery ticket stating the strength of mix of the concrete, the slump, the maximum size of the coarse aggregate, the admixtures and the time when the ready-mixed concrete was loaded into the delivery truck.  
Measuring, mixing and shipment practices shall conform to the latest CSA A23.1 and ASTM C94 specifications.  
Each class of concrete shall have the required compressive strength at 28 days as specified on structural drawings.
- .2 The water-cement ratio must be determined by taking into consideration the compressive strength at 28 days, the grading of the aggregates, the slump as well as the amount of entrained air. However, unless otherwise noted or approved by Engineer, the water-cement ratio for each class of concrete shall conform to the values recommended in sections 14 and 15 of the latest A23.1 specification. In no case, shall the water-cement ratio exceed 0,60.  
The average of all tests for compressive strength at 28 days for each class of concrete must be greater than or equal to the required strength and not more than 10 per cent of the tests shall have values of less than the required strength.  
The average of any five (5) consecutive strength tests, must be equal to or greater than the specified strength. In no case shall a single test be less than 85% of the required strength.  
If the concrete should fail to meet these requirements, the Engineer shall have the right to order changes in the mix proportions.  
In addition, he may require at the Contractor's expense, the following tests:
  - .1 A core specimen drilled from the structure and tested in accordance with good practice to verify the compressive strength.
  - .2 Load testing of the structural element in accordance with the National Building Code to ascertain if it can carry the load it was designed for.
  - .3 Except where otherwise noted on the drawings or in these specifications, the concrete shall have the following slump:

<u>Type of elements</u>	<u>Slump in mm</u>
Beams, columns and structural slabs:	80
Massive works:	40
Others:	80

The slumps specified above are these obtained by the standard slump test as described in specification A23.2-5C.

Permissible tolerances in slump are 20 mm more or less than the specified value. Concrete not satisfying these standards shall be refused.

- .4 No addition of water to ready-mix concrete will be tolerated at the building-site. All concrete to which water has been added, shall be refused.
- .5 Concrete submitted to conditions of severe weathering such as exterior walls, slabs or stairs, shall contain an amount of 6% of entrained air.  
An air entraining agent shall be added to the mix in a manner that the concrete will reach the required air content at the building-site.  
A variation of 1% more or less in tests for air content shall be acceptable.
- .6 A set retarding admixture may be added to the mix only when specified on the drawings or in this specification or with the Engineer's approval. However, when the ambient temperature is warm or when the placing of concrete conditions are difficult or delicate, the Engineer may require that a set-retarding agent be added to the mix in order to ease the placing of concrete.

## **2.3 CONCRETE MIX PROPORTIONS**

- .1 Approvals will not free Contractor from responsibility for manageability and final strength of each class of concrete.
- .2 Contractor must change concrete mix proportions if strength, slump, air content or/and hardening do not conform to establish values.
- .3 All mix proportions will provide a uniform, malleable concrete with strength, slump, air content and hardening that conform to limits indicated in the present document.
- .4 Aggregates maximum size shall conform to A23.1.
- .5 Strength shall be as indicated on structural drawings.
- .6 Reducing water admixture, if required, will be added to mix, according to approved percentage.

## **PART 3 - EXECUTION**

### **3.1 WORKMANSHIP**

- .1 Concrete placing shall conform to this specification and the latest CSA/CAN-A23.1 and ACI specifications. Concrete placing shall be done by qualified and experienced workmen.
  - .2 Do not start concrete placing before formwork and reinforcing steel have been inspected by the Engineer. Notify Engineer at least 24 hours in advance.
  - .3 Place concrete with adequate mechanical equipment, in order to control the concreting sessions.
  - .4 Flush all equipment used in transporting and placing of the concrete with water before and after each use. Discharge water used for this purpose outside the forms.
  - .5 Deposit concrete in the forms in layers not exceeding 450 mm and as near as possible to its final position to avoid segregation.
  - .6 Free dropping of concrete for heights exceeding 1.5 m will not be permitted. Use chutes for heights exceeding 1.5 m.
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Chute length shall not exceed 4.5 m. The slope shall range between 1 vertical in 3 horizontal to 1 vertical in 1 horizontal.

- .7 Perform concrete placing continuously between any two construction joints. Prepare a concreting program for the day. Execute construction joints at the locations shown on the structural drawings. Obtain Engineer's approval to add or remove one or several construction joints. When concreting is finished, level the surface of the joint and clean protruding reinforcing.  
Construction joints in visible concrete shall be straight, level will coincide with formwork joint and with details shown on structural drawings. In cases where joints are not shown in drawings, check with Engineer for appropriate location.  
At Engineer's request, Contractor to supply and install, at Contractor's expense, keys and dowels in construction joints not indicated on drawings.  
A minimum of two (2) hours delay shall elapse between the pouring of walls or columns and the pouring of beams and slabs supported by the former.
  - .8 Compact concrete with internal vibrators as soon as the concrete is placed.  
At least one vibrator will be required for each ready-mix truck delivering concrete. One spare vibrator shall be kept at hand in case of breakdown.  
Internal vibrator should be operated at a minimum frequency of 7000 cycles per minute and should be operated by skilled and experienced men. Insert vibrators vertically in the fresh concrete at intervals of about 300 mm and shall penetrate a few inches in the previous layer.  
Execute consolidation of concrete at a regular rate and each square meter of concrete surface shall receive a minimum of 4 minutes of vibration, taking into account the overlapping influence of vibrators.  
In no case shall vibrators be used to move concrete horizontally in the forms or in the chutes.  
Exercise care to avoid excessive vibration, disturbing reinforcing steel, segregation or vibration of concrete that has already started its initial set.
  - .9 Finish horizontal surfaces such as floors, sidewalks and stairs as specified on the Architect's drawings and specifications.  
Level and brush surfaces that are to receive a concrete topping to remove excess water, laitance and impurities and to provide a rough surface ("wooden trowel surface").
  - .10 Cure all concrete for at least 7 days. Cover exposed concrete surfaces with tarpaulins or wetted burlap and formwork shall be sprinkled frequently. For curing of slabs, Contractor may use a polyethylene membrane installed as soon as concreting is finished with a minimum of 250 mm overlap at joints.  
Use curing compounds with the Engineer's approval. Do not use curing compound on slabs to be finished with a concrete topping or other finishing product.  
Start curing treatment as soon as possible after concrete has sufficiently set, generally 4 hours after the end of the pouring session.
  - .11 The pouring of concrete, placing of expansion or sawed joints as well as the finish of walks shall conform to the Engineer's and the Architect's drawings and specifications.
  - .12 Hot weather concrete placing  
The temperature of fresh concrete placed when the outside temperature is above 27o C shall not exceed 30o C.  
Concrete shall not stay in the ready-mix trucks for more than one hour. All concrete with an initial set shall be rejected.  
Place concrete as fast as possible to avoid cold joints, honeycombing and other defects.
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Start curing as soon as the concrete can support the weight of a man to avoid the drying of the concrete and shrinkage cracks. During the first 24 hours, the only acceptable method will be water curing.

Loosen forms and allow water to run between concrete and form.

Avoid drying of concrete between water applications. Cover all exposed concrete surfaces with tarpaulins or burlap.

Use a set-retarding admixture in the concrete only when specified or allowed by the Engineer.

### 3.2 FINISHING

- .1 Finish concrete in accordance with CSA/CAN-A23.1 and with Architect's or Engineer's specifications.
- .2 "Non visible" concrete finishing  
In case of "non visible" concrete, finishing will be smooth and uniform. If case arises, execute work as following:
  - .1 Repair cavities and honeycombs according to the state of the art and considering safety of structure.
  - .2 Cut and break surfaces to be repaired up to sound concrete.
  - .3 Flood surfaces to be repaired and spread mortar in successive layers.
  - .4 In case of 25 mm deep holes and more, use a mortar with same color and composition as concrete for repairs.
  - .5 Fill cavities with mortar and repair surfaces.
  - .6 Do not begin concrete finishing before permitting initial shrinkage.
  - .7 Fill formwork tie holes with mortar, after washing surface with detergent and water.

### 3.3 FIELD QUALITY CONTROL

- .1 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory designated by Engineer.
- .2 Submit to the laboratory for testing small and coarse aggregate samples as well as the mixing formulae as per CSA/CAN-A23.2.
- .3 For each pouring and for each class of concrete used, a series of three (3) standard 150 x 300 mm cylinders will be sampled as per the following table:

1 to 50 m <sup>3</sup> :	1 series
1 to 100 m <sup>3</sup> :	2 series
More than 100 m <sup>3</sup> :	2 series plus one series for each additional 100 m <sup>3</sup> or fraction of 100 m <sup>3</sup> .

Sample will be carried out in accordance with specification A23.2-1C and 3C.
- .4 Compression test shall be performed according to specification A23.2-9C. One specimen will be tested at 7 days and the two others at 28 days. One supplementary cylinder per series shall be taken during cold weather concrete placing. This cylinder shall be kept in construction site conditions and shall be tested at 7 days. The report for the compression tests shall be submitted directly and with as little delay as possible to the Engineer.
- .5 For each set of 3 samples taken, one slump test will be performed according to specification A23.2-5C. The concrete used for this test shall not be used in the cylinders.

- .6 When air-entrained concrete is specified, one air content test will be performed for each series of 3 cylinders taken.  
This test shall conform to specification A23.2-4C.  
The concrete used for this purpose shall not be used in the cylinders.
- .7 Owner will pay costs of tests.

**END OF SECTION**

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## **PART 1 – GENERAL**

### **1.1 RELATED REQUIREMENTS**

- .1 Section 02 41 99 - Demolition for minor works.
- .2 Section 03 42 25 – Adjustable pedestals for prefabricated concrete elements.
- .3 Section 05 50 00 – Metal fabrications
- .4 Section 07 19 00 – Water repellent
- .5 Section 07 62 00 – Sheet metal flashing and trim
- .6 Section 07 90 00 – Joint sealant
- .7 Structure – Refer to engineer

### **1.2 MEASUREMENT AND PAYMENT**

- .1 Measure precast elements in units supplied, delivered, stored and erected.
- .2 Precast elements measured as individual units, will include cost, supply, delivery, storage and erection of bearing assemblies, anchor bolts, removal and patching of erection devices. Refer to structural for dismantling and anchors.

### **1.3 REFERENCES**

- .1 ASTM International
  - .1 ASTM A 123/A 123M-09, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - .2 ASTM A 775/A 775M-07b, Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
  - .3 ASTM D 412-06ae2, Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension.
  - .4 ASTM D 2240-05(2010), Standard Test Method for Rubber Property - Durometer Hardness.
  - .5 ASTM C 494/C 494M-[11], Standard Specification for Chemical Admixtures for Concrete.
- .2 CSA International
  - .1 CSA A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Test Methods 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 CAN/CSA-A3000-08, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
  - .5 CSA G30.5-M1983 (R 1998), Welded Steel Wire Fabric for Concrete Reinforcement.
  - .6 CSA G30.18-[09], Carbon and Steel Bars for Concrete Reinforcement.
  - .7 CSA G40.20/G40.21-[04(R2009)], General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .8 CSA W47.1-09, Certification of Companies for Fusion Welding of Steel Structures.
  - .9 CSA W48-06(R2011), Filler Metals and Allied Materials for Metal Arc Welding.
  - .10 CSA W59-03(R2008), Welded Steel Construction (Metal Arc Welding).

- .11 CSA W186-M1990 (R2007), Welding of Reinforcing Bars in Reinforced Concrete Construction.

#### 1.4 DESIGN CRITERIA

- .1 Calculate prefabricated elements in accordance with CSA-A23.3 and CSA-A23.4, in view that they are required to resist handling, stacking, transportation and assembling constraints.
- .2 Calculate prefabricated concrete elements in a way that they may support loads indicated by the consultant (refer to structural), or indicated loads, in accordance with the NBC or provincial code. Calculate, so that they resist creep, shrinkage, temperature, as well as wind overloads.
- .3 Calculate ties and connections in order to allow for prefabricated elements to resist loads or strengths indicated by consultant, and compensate for any unevenness or any dimensional discrepancies of the structural elements, to which they are fixed.
- .4 Tolerate a structural deflection of span/360 caused by surcharges and structural distortion of the building, caused by conception criteria, without enforcing any charge on panels.
- .5 Provide to structural consultant, conception calculations and detailed calculations related to the prefabricated concrete elements, and to the typical fastenings elements for examination.

#### 1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for concrete mixes and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Quebec, Canada.
  - .2 Submit shop drawings to CSA A23.4 and CAN/CSA-A23.3.
  - .3 Submit 2 copies of detailed calculations and design drawings for typical precast elements and connections for Departmental Representative for approval 4 weeks prior to manufacture.
  - .4 Indicate on drawings:
    - .1 Design calculations for items designated by manufacturer.
    - .2 Tables and bending diagrams of reinforcing steel.
    - .3 Camber.
    - .4 Finishing schedules.
    - .5 Methods of handling and erection.
    - .6 Openings, sleeves, inserts and related reinforcement, including embedded handling hardware.
- .4 Samples:
  - .1 Produce, deliver and erect where directed by Departmental Representative on project site, 1 full size sample of each type of precast concrete units showing details, color, finish and quality for approval of Departmental Representative.
    - .1 Begin production of precast units after receipt of Departmental Representative written approval.
- .5 Submit evidence of welding certification including welding procedures before commencing work.

## **1.6 QUALITY ASSURANCE**

- .1 Fabricate and erect precast concrete elements using manufacturing plant certified by CSA International in appropriate categories to CSA A23.4.
- .2 Precast concrete manufacturer to be certified to 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, such as architectural precast concrete products, namely prefabricated concrete pavement and planting boxes walls.
- .3 Only precast elements fabricated in such certified plants to be acceptable to owner, and plant certification to be maintained for duration of fabrication, erection until warranty expires.
- .4 Welder Qualification: certified to CSA W47.1 and for weld type required.
- .5 Submit evidence of welding certification including welding procedures before commencing work.
- .6 The prefabricated concrete manufacturer must have a good reputation and must possess a sufficient experience in design, fabrication and setting-up of the architectural prefabricated concrete elements as indicated. The company must have the financing, the equipment, the plant and the required qualified personnel to proceed to the execution details, to the fabrication and the set-up of the planned work, described in the current section. The size of the plant must permit to maintain the delivery schedule, as required.

## **1.6 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address. Accept full responsibility for delivery, handling and of storage of the prefabricated concrete elements. Existing panels to be dismantled are included in this statement.
- .3 Storage and Handling Requirements:
  - .1 Deliver, handle and prefabricated concrete elements in an almost vertical plan and according to the methods approved by the manufacturer. Make certain that the prefabricated concrete elements do not get into contact with the ground, do not get stained and are not resting on their corners. Avoid to stack defective elements by removing them from the site.
  - .2 Fabricate supports to stack the prefabricated concrete elements and insert non staining spacers between each prefabricated element. Wrap wood used for this with polyethylene.
  - .3 Store and protect precast panels from damage.
  - .4 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and return by manufacturer of packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Renovation/Demolition (CRD) Waste Management and Disposal.

## **1.7 WARRANTY**

- .1 For spalling and cracking of precast elements 12 months warranty period prescribed is extended to 24 months.
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## **PART 2 – PRODUCTS**

### **2.1 MATERIALS**

- .1 Cement, colouring material, aggregates, water, admixtures: to CSA A23.4 and CSA A23.1/A23.2.
- .2 Exposed aggregate to match selected finish sample, and to match existing.
- .3 Use same brands and source of cement and aggregate for entire project to ensure uniformity of coloration and other mix characteristics.
- .4 Reinforcing steel: to CSA G30.18.
- .5 Prestressing steel: to CAN/CSA-S6 and CSA G279.
- .6 Welded wire fabric: to CSA G30.5.
- .7 Forms: to CSA A23.4.
- .8 Hardware and miscellaneous materials: to CSA A23.4.
- .9 Anchors and supports: to CSA G40.20/G40.21, Type 350 W, galvanized after fabrication.
- .10 Welding materials: to CSA W48.
- .11 Galvanizing: hot dipped galvanizing with one coat minimum zinc coating of 610 g/m<sup>2</sup> to CAN/CSA G164.
- .12 Steel primer: to CAN/CGSB-1.40.
- .13 Air entrainment admixtures: to CSA A23.1
- .14 Chemical admixtures: to CSA A23.1.
- .15 Bearing pads: smooth, high impact plastic or steel.
- .16 Bearing pads: neoprene, 60 durometer hardness to ASTM D 2240, and 17 MPa minimum tensile strength to ASTM D 412, moulded to size or cut from moulded sheet.
- .17 Shims: plastic or steel.
- .18 Zinc-rich primer: to MPI #18.
- .19 Surface retardant: to ASTM C 494/C 494M water based, low VOC, solvent free. Do not allow moisture of any kind to come in contact with the retarder film.
- .20 Curing compound: not permitted without prior approval of Departmental Representative.
- .25 Sealers: refer to Section 07 19 00 Water repellents.

### **2.2 CONCRETE MIXTURES**

- .1 Normal density concrete mix to: CSA A23.4, variant 1, to confer the following properties:
  - .1 Type 10 portland cement.
  - .2 Minimum compressive strength of 35 MPA at 28 days.
  - .3 Exposure class F-2.

- .4 Nominal size of coarse aggregate: 12mm.
  - .5 Water-cement ratio: 0.40
  - .6 Air content between 4 to 7%.
- .2 Calcium chloride : not permitted.

## **2.3 NON SHRINK GROUT**

- .1 Non shrink grout to be used in existing cavities at top of precast concrete wall panels, for rebar to secure prefabricated concrete caps at top of walls:
- .1 Set time between 20 and 30 minutes.
  - .2 Flexural strength to ASTM C 348, 28 days, 900 psi.
  - .3 Compressive strength to ASTM C 109.
  - .4 Water absorption 9,8%, to ASTM C 632
  - .5 Color: concrete gray.

## **2.4 PERFORMANCE REQUIREMENTS**

- .1 Tolerance of precast elements: to CSA A23.4 .

## **2.5 FABRICATION – PREFABRICATED ELEMENTS**

- .1 Manufacture units to CSA A23.4.
- .2 Mark each precast unit to correspond to identification mark on shop drawings for location with date cast on part of unit which will not be exposed.
- .3 Design and attach anchors and inserts to precast concrete elements to carry design loads.
- .4 Galvanize anchors and steel embedments after fabrication and touch up with zinc-rich primer after welding.
- .5 Fabricate panels facing down in appropriately dimensioned rigid forms designed to resist high frequency vibrations. Place reinforcing anchor and other auxiliary items as required from other sections. Sink in anchors, inserts, and other pieces as required for the execution of the work. Ensure continuous vibration of the concrete during the fabrication until full thickness is achieved. Provide for holes and recesses for flashing, anchors, as indicated and required. Mix separately and with precision the cement and aggregates uniformly according to the weight, in order to assure an aspect constant and uniform.
- .6 Anchors, lifting hooks, shearing bars, dividers and other fittings or coupling devices must follow the recommendations and/or be fabricated by Manufacturer, in order to assure a complete rigid installation. Lifting hooks must be dimensioned to assure securely the handling of the panels according to their dimensions and weight. As much as possible anchor and other elements must be concealed.
- .7 Burn lifting cables, paint and seal as required, if element has been damaged following this operation.

## **2.6 FINISHES**

- .1 Finish and colour of precast units to match colour of existing precast concrete elements. A copy of the approved sample will be kept in Departmental Representative's office.
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- .2 Exposed aggregate finish:
  - .1 Apply uniform coat of retardant to inside face of forms.
  - .2 Expose coarse aggregate by washing and brushing away surface mortar.
  - .3 Expose aggregate to conform to approved samples and must look similar to the existing panels.
- .3 Protect fluted, smooth or exposed surfaces with 2 coats of sealer as approved in writing by Departmental Representative.

## **2.7 SOURCE QUALITY CONTROL**

- .1 Provide Departmental Representative with certified copies of quality control tests related to this project as specified in CSA A23.4.
- .2 Inspect prestressed concrete tendons to CSA G279.
- .3 Provide records from in-house quality control programme based upon plant certification requirements to Departmental Representative for inspection and review.
- .4 Upon request provide Departmental Representative with certified copy of mill test report of reinforcing steel supplied, showing physical and chemical analysis.
- .5 Precast plants should keep complete records of supply source of concrete material, steel reinforcement, prestressing steel and provide to Departmental Representative for review upon request.

## **PART 3 – EXECUTION**

### **3.1 GENERAL**

- .1 Do precast concrete work to CSA A23.4 and CAN/CSA-A23.3 and CAN/CSA-S6.

### **3.2 EXAMINATION**

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for precast concrete installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Visually inspect prefabricated concrete elements that are to be dismantled, stored and reinstalled. A second inspection will be required at the time of their reinstallation.
  - .3 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .4 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

### **3.3 ERECTION**

- .1 Erect precast elements within allowable tolerances.
  - .2 Non-cumulative erection tolerances in accordance with CSA A23.4.
  - .3 Set elevations and alignment between units to within allowable tolerances before connecting units.
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- .4 Fasten precast panels in place as indicated on reviewed shop drawings.
- .5 Secure bolts with lock washers or tack-weld nut to bolt.
- .6 Uniformly tighten bolted connections with torque indicated.
- .7 Do not weld or secure bearing plates at sliding joints.
- .8 Set units dry, without mortar, attaining specified joint dimension with plastic or steel shims.
- .11 Clean field welds with wire brush and touch-up galvanized finish with zinc-rich primer.
- .12 Remove shims and spacers from joints of non-load bearing panels after fastening but before sealant is applied.
- .13 Apply sealers to precast panels to manufacturer's recommendations unless specified otherwise.

### **3.5 WELDING**

- .1 Weld to CSA W59 for welding to steel structures and to CSA W186 for welding of reinforcement.

### **3.6 CLEANING**

- .1 Obtain approval of cleaning methods from Departmental Representative before cleaning new and existing reused soiled precast concrete surfaces.
- .2 Progress Cleaning: clean in accordance with Section [01 74 11 - Cleaning].
  - .1 Leave Work area clean at end of each day.
- .3 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .4 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Renovation/Demolition (CRD) Waste Management and Disposal.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

### **3.7 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by precast concrete installation.

**END OF SECTION**

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## **PART 1 - GENERAL**

### **1.1 RELATED REQUIREMENTS**

- .1 Section 03 45 00 - Precast architectural concrete.
- .2 Section 07 55 63 - Vegetated protected membrane roofing.

### **1.2 REFERENCES**

- .1 Belgium (CRIF) Centre De Recherches Scientifiques et Techniques de l'Industrie Des Fabrications: Test Report N°. GT 7660/01.

### **1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for adjustable pedestal and include product characteristics, performance criteria, physical size, preparation instructions and recommendations, storage and handling requirements and installation instructions.
  - .2 Submit two copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.
- .3 Method Statement: Prior to the installation of adjustable pedestal systems, Contractor shall submit an installation 'method statement' setting out the installation procedure for approval.
- .4 Engineering calculations:
  - 1. Dead load and live load Calculations: Indicating that structure is designed to carry dead load and live load weights specific to application.
  - 2. Density of Insulation: sufficient to resist crushing and damaging waterproofing membrane.
- .5 Shop Drawings:
  - .1 Submit design and installation drawings, stamped and signed by a professional engineer registered or licensed in Quebec, Canada.
  - .2 Drawings must include plans, elevations, sections, installation, method of anchorage, interface of the work if this section with the work of adjacent trades and indicating dimensions, tolerances, material and finishes.
- .6 Samples: For each assembly type, two complete sets of samples representing manufacturer's full range of available product assembly types.

### **1.4 QUALITY ASSURANCE**

- .1 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.
  - .2 Certifications: submit product certificates signed by Buzon Canada, the manufacturer, certifying materials comply with specified performance characteristics and criteria and physical requirements.
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- .3 Single Source Requirements: To the greatest extent possible, provide pedestals and ancillary products specified in this section from a single manufacturer: Buzon Canada.
- .4 Installer Qualifications: successfully engaged in installation of adjustable pedestal systems for at least 2 years; capable of estimating, building from working AutoCAD details or plans, determining elevations and properly handling materials in pedestal assembly systems.  
  
Installer may be one supplied by Buzon Canada or one hired directly from the Contractor, who complies with the requirements stated above, in which case he would receive training from the manufacturer: Buzon Canada.
  - .1 Method Statement Submission: Prior to the installation of the adjustable pedestal systems, the installer shall submit an installation 'method statement' setting out the installation procedure for approval.
- .5 Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
  - .1 Location designated by Architect.
  - .2 Do not proceed with remaining work until workmanship is approved by Architect.
  - .3 Rework mock-up area as required to produce acceptable work.

## 1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials indoors in a dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Inspect delivery material upon arrival to ensure they are undamaged, in good condition and as specified. Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management related to Work of this Section.
- .5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURER

- .1 Acceptable Manufacturer: Buzon Canada : 8151, boul. Montréal-Toronto, suite 102 Montréal-Ouest, Québec, H4X 1N1. Tél. : 514-381-0098; Fax 514-381-6496. Contact name Ahmad Jolani; email address: a.jolani@buzoncanada.ca
  - .2 Substitution or equivalent: not permitted.
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## 2.2 ADJUSTABLE PEDESTALS (DPH SERIES)

- .1 Adjustable Pedestals: Buzon Canada, DPH Series screwjack Pedestals, height adjustable pedestal components including supporting head surfaces, spacer tabs, slope correctors ranging from 0 to 5% (with 0.5% intervals), as manufactured by Buzon Canada.
- .2 Pedestal Component Materials: Standard, talc-loaded polypropylene copolymer with minimum 80 percent recycled CCP material, 20 percent Talc, 2 percent UV, Master Batch black, 100 percent recyclable; suitable for use in temperatures from -30 degrees C to 120 degrees C (-22 degrees F to 250 degrees F).
- .3 Range of application: to accommodate the prefabricated concrete pavement and prefabricated walls, as approved by Manufacturer.
- .4 Height of pedestals : As provided by Buzon Canada, on their engineered plans and configuration.
  - .1 17 mm - DPH-0
  - .2 28mm - DPH-1
  - .3 25-36mm - DPH-02
  - .4 35-53mm - DPH-2
  - .5 50-78mm - DPH-3
  - .6 74-110mm - DPH-4
  - .7 100-175mm - DPH-5
  - .8 175-285mm - DPH-6
  - .9 285-400mm - DPH-7
  - .10 355-515mm - DPH-8
  - .11 465-625mm - DPH-9
  - .12 545-740mm - DPH-10
  - .13 645-850mm - DPH-11
  - .14 720-960mm - DPH-12
  - .15 830-1070mm - DPH-13
- .5 Attachment of material to pedestal: gravity laid.
- .6 Component: Including but not limited to separation blades, shims, slab supporting heads, slope correctors, height adjusters/couplers, ring clamps for adjustment, locking and unlocking keys to fix pedestal position and supporting bases/stands as follows:
  - .1 Supporting Head Surfaces: adjustable angle from 0 to 5 percent.
  - .2 Slope Correctors: Patented PH5 slope corrector; adjustable at head with click-rotation.
  - .3 Spacer Tabs: Clip-fixed into top of pedestal, to obtain open joints.
  - .4 Rubber Shims: To fit over spacer tabs, made of reinforced (Shore 60) EPDM in 1 and 2 mm thicknesses.
  - .5 Couplers: Height adjusters provide additional height.
  - .6 Adjustment Ring Clamps:
  - .7 Supporting Bases:
  - .8 Locking and Unlocking Keys: Once desired height achieved individual keys used at bases, ring adjusters, extender couplers and tops; prevent rotational movement caused by traffic or vibration.
  - .9 Integrated Tabs: Allow for mechanical fixing or cross-bracing.
  - .10 Stop pins, to prevent overextension.

## **PART 3- EXECUTION**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for adjustable pedestal installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.
  - .4 Prior the commencement of any installation, get a validation for the distribution methods for the point loads (circulation and machinery), submit this validation to the Departmental Representative for final approval.

### **3.2 PREPARATION**

- .1 Prepare substrates using the methods recommended by the manufacturer for achieving best results. Verify elevations, pedestal heights and layouts. Establish accurate and level lines and patterns
- .2 Do not proceed with installation until substrates have been prepared using the methods recommended by the manufacturer. Commencement of installation constitutes acceptance of conditions.

### **3.3 INSTALLATION**

- .1 Install products in accordance with manufacturer's instructions.
  - .1 Larger installations: pedestals to be pre-sorted and pre-set to proper elevation and placed in position prior to installation of prefabricated concrete pavement and walls.
  - .2 Limitations: Pedestal system shall not be used for decks over which wheeled or vibrating machinery are to be used.
  - .3 Point Loads: such as planters, seating, furniture or heavy objects should be supported by additional pedestals.
  - .4 Refer to 1.4.4 for installer required qualifications.

### **3.4 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Renovation/Demolition (CRD) Waste Management and Disposal.
  - .1 Remove recycling containers and bins from site. Dispose of materials at appropriate facility.

### **3.9 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by pedestal installation.

**END OF SECTION**

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