



Lafarge/CPCI Guide Specification

## **SPECIFICATION**

### **Section 03410 - Structural Precast / Prestressed Concrete**

#### **1.0 General**

##### 1.1 Description

.1 The General conditions of the Contract and Supplementary General Conditions apply to this Division, except as qualified herein and/or excluded.

.2 Refer to drawings and specifications.

##### 1.2 Work Included

.1 Design, supply, delivery and installation of:

Spec Note: *This section includes structural precast/prestressed concrete units including the following:*

- \* Double tee slab units
- \* Parking structures
- \* Structural framing units
- \* Structural precast/prestressed concrete

Spec Note: *This section specifies products of standard or special shapes that are reinforced using steel reinforcement, pretensioning or post-tensioning and through application become an integral structural part of the project.*

.1 The specifications cover precast/prestressed structural concrete construction.

.2 This section includes product design, manufacture, transportation, erection and other related items such as anchorage, bearing pads, inserts and similar accessories required for work under this contract.

.3 Take delivery and cast into precast work boxes/inserts/openings required and supplied by other trades only if supplied prior to casting.

.2 Supply information required for the installation of bracing, supports, inserts and similar accessories required for the work under this contract supplied and to be installed by others.

### 1.3 Related Work

.1 Section 03300 - Cast-in-Place Concrete

.2 Section 03300 - Cast-in-Place Concrete: Setting only of insert or anchors unless otherwise noted on Structural Drawings

.3 Section 03410 - Hollow Core Precast/Prestressed Concrete

.4 Section 03450 - Architectural Precast Concrete and/or Insulated Precast Concrete Wall Panels

.5 Section 05100 - Structural Metal Framing

Spec Note: *For parking structures add reference to concrete topping and deck waterproofing.*

### 1.4 Reference Standards

Spec Note: *Latest standards are listed. Specifier to update specifications to latest edition.*

.1 CSA A23.1-00, Concrete Materials and Methods of Concrete Construction

.2 CSA A23.2-00, Methods of Test for Concrete

.3 CSA A23.3-94, Design of Concrete Structures

.4 CSA A23.4-00, Precast Concrete-Materials and Construction

.5 CSA A251-00, Qualification Code for Architectural and Structural Precast Concrete Products

.6 CSA A266.4-M78, Guidelines for the Use of Admixtures in Concrete

.7 CSA A266.5-M1981, Guidelines for the Use of Superplasticizing Admixtures in Concrete

.8 CSA A283-1980, Qualification Code for Concrete Testing Laboratories

.9 CSA G30.5-M, Weld Steel Wire Fabric for Concrete Reinforcement

.10 CSA G30.15-M, Welded Deformed Steel Wire Fabric for Concrete Reinforcement

.11 CAN/CSA G30.18, Billet Steel Bars for Concrete Reinforcement

- .12 CAN/CSA G40.21, Structural Quality Steel
- .13 CAN/CSA-G164-M92, Hot Dip Galvanizing of Irregularly Shaped Articles
- .14 CSA W186-M1997, Welding of Reinforcing Bars in Reinforced Concrete Construction
- .15 W47.1-97, Certification of Companies for Fusion Welding of Steel Structures
- .16 ASTM A775/A 775M [94d], Specification for Epoxy-Coated Reinforcing Steel Bars
- .17 ASTM 412-[92], Test Method for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension
- .18 ASTM 2240-[95], Test Method for Rubber Property - Durometer
- .19 CAN/CGSB-1.40-[M89], Primer, Structural Steel, Oil Alkyd Type
- .20 CAN/CGSB-1.181-[92], Ready Mixed Organic Zinc - Rich Coating
- .21 CAN/CGSB-51.20-[M87], Thermal Insulation, Polystyrene, Boards and Pipe Covering

## 1.5 Qualifications of Manufacturer

.1 Fabricate precast/prestressed concrete elements certified by the Canadian Standards Association in the appropriate category(ies) according to CSA Standard A23.4-00 "Precast Concrete - Materials and Construction". The precast concrete manufacturer shall be certified in accordance with the CSA Certification program for Structural Precast/Prestressed Concrete prior to submitting a tender and must specifically verify as part of his tender that he is currently certified in the appropriate category(ies):

[Spec Note: *Delete the categories that do not apply.*]

(A) Precast Concrete Products - Architectural

(I) Non-Prestressed or (II) Prestressed

(B) Precast Concrete Products - Structural

(I) Non-Prestressed or (II) Prestressed

(C) Precast Concrete Products - Specialty

(I) Non-Prestressed or (II) Prestressed

Only precast concrete elements fabricated by certified manufacturers are acceptable to the Owner. Certification must be maintained for the duration of the fabrication and erection for the project. Fabricate precast concrete elements in accordance with \_\_\_\_\_(Provincial) Building Code requirements.

.2 The precast concrete manufacturer shall be a member in good standing with the Canadian Precast/Prestressed Concrete Institute (CPCI) and have a proven record and satisfactory experience in the

design, manufacture and erection of precast concrete facing units of the type specified. The company shall have adequate financing, equipment, plant and skilled personnel to detail, fabricate and erect the work of this Section as required by the Specification and Drawings. The size of the plant shall be adequate to maintain the required delivery schedule.

*Spec Note: CPCI Members have access to the latest information and technology. CPCI Members are dedicated to providing the highest levels of quality and customer service. For a current list of CPCI Members, see: <http://www.cpci.ca/activemember.html>.*

## 1.6 By-Laws and Codes

.1 Conform to applicable requirements of \_\_\_\_\_(Provincial) Building Code, National Building Code and local authorities having jurisdiction.

.2 Design and provide reinforcement, anchors and supports as required by codes and to Consultant's approval. Submit relevant design data prepared by a professional engineer registered in the province of Ontario for approval if so requested by the Consultant.

## 1.7 Allowable Tolerances

.1 Conform to the requirements of CSA A23.4-Section 10.

.2 Refer to related Sections of this Specification and fabricate work to accommodate the specified tolerances.

## 1.8 Source Quality Control

.1 Make available copies of quality control tests related to this project as specified in CSA 1-A23.4.

.2 Inspect prestressed concrete tendons in accordance with CSA-A23.4.

.3 Make available records from in-house quality control program based upon plant certification requirements for inspection and review.

.4 Make available certified copy of mill test reports of steel reinforcement supplied, showing physical and chemical analysis.

.5 In addition to quality control, an independent inspection and testing company may be appointed by the owner to verify compliance with this Specification.

.6 Cooperate with Inspector to facilitate his work.

.7 Cost of an independent inspection is to be paid for by the owner.

## 1.9 Shop Drawings

*Spec Note: It is not the Precast Manufacturer's responsibility to confirm and correlate dimensions at the job site. Precast concrete is a prefabricated material. Site dimensioning would require the foundation/ structure to be complete before fabrication could commence.*

.1 Prepare and submit shop drawings of precast/prestressed structural concrete elements in accordance with the General Conditions of the contract, CSA-A23.4 and CSA-A23.3, and as specified below. Submit in accordance with Section 01330.

.2 Submit fully detailed and dimensioned drawings showing and including but not limited to the following:

.1 Design calculations for items designed by manufacturer.

.2 Typical details of prestressed and non-prestressed members, reinforcement and connections.

.3 Estimated Camber.

.4 Finishing Schedules.

.5 Methods of handling and erection.

.6 Openings, sleeves, inserts and related reinforcement.

.3 Show the exact location of inserts and anchors required to be cast into precast/prestressed units for interface elements.

.4 Show the system of identifying units for erection purposes on shop drawings and apply a similar mark on all units at the time of manufacture.

.5 Provide the Shop Drawings to obtain approvals from the Authorities having jurisdiction prior to fabrication of structural precast/prestressed units.

.6 If requested provide drawings of all precast members.

## 1.10 Finishes of Formed Surfaces

.1 Finishes shall be (a) Commercial Grade, (b) Standard Grade, (c) Finish Grade B, or (d) Finish Grade A in accordance with clause 24 of CSA A23.4 as shown on the contract drawings.

.2 Finishes shall be (a) Commercial Grade, or (b) Standard Grade unless otherwise noted.

## 1.11 Warranty

.1 Provide standard CPCI warranty with a duration of one (1) year in accordance with the General Conditions. Warranty shall be in writing and shall warrant work under this Section to be free from defects for the period stipulated.

## 1.12 Delivery, Storage and Protection

.1 Accept full responsibility for delivery, handling and storage of units.

.2 Deliver, handle and store precast/prestressed units using methods approved by the manufacturer. Do not permit units to contact earth or staining influences or to rest on corners.

## 1.13 Design

.1 Requirements: Design and fabricate precast/prestressed structural concrete elements, brackets and anchorage devices so that when installed they will:

.1 Compensate for allowable construction tolerances in the structure to which they are secured.

.2 Tolerate a structural deflection of span/360 due to live load.

.3 Adequately sustain themselves, and superimposed loads, specified by the engineer, without exceeding deflection of 1/360.

.4 Design loads shall be as specified by the \_\_\_\_\_(Provincial) Building Code.

## 1.14 Special Surface Treatments

Spec Note: *1.14 applies to specifications for parking structures. Edit accordingly.*

.1 All anchors, plates, etc. exposed to the elements (less than 1 1/2" concrete cover) to be hot dipped galvanized, except for inserts and treated items which shall be electro-zinc plated.

.2 Hardware protected from exposure to the elements or by a minimum of 1 1/2" concrete shall be shop coated with grey oxide primer.

.3 Double tee side weld plates, where exposed to the elements, shall be stainless steel.

## 2.0 Products

### 2.1 Materials

.1 Reinforcing steel: to CSA-A23.1.

.2 Forms: to CSA3-A23.4.

.3 Hardware and miscellaneous materials: to CSA-A23.1.

*Spec Note: Re 2.1.4: Type 400W is weldable structural grade steel having a yield strength of 400 MPa. Refer to CSA-G40.21 for other grades and yield strengths available.*

.4 Anchors and supports: to CSA-G40.21, Type [400] [(epoxy coated)(galvanized)(primed after fabrication)]

.5 Welding materials: to CSA W47.1-97 and CSA W186-[M1997].

.6 Steel primer: to CGSB 1-GP-40M.

.7 Air entrainment admixture: to CSA-A266.4.

.8 Bearing pads: neoprene, [60] durometer hardness to ASTM D2240, and [17] MPa minimum tensile strength to ASTM D412, molded to size or cut from molded sheet. (Random oriented fiber-reinforced neoprene.)

.9 Shims: [plastic] [steel].

.10 Zinc-rich primer: to CGSB 1-GP-181M.

.11 Surface retardant: to CSA-A266.2.

### 2.2 Concrete Mixes

.1 Unless otherwise noted or specified, use concrete mix designed to produce a minimum of 35 MPa compressive cylinder strength at 28 days, with a maximum water/cement ratio to CSA A23.4.

.2 Use cement and supplementary cementing materials which conform to CSA A23.1.

.3 Air Entrainment of Concrete Mix: Refer to CSA-A23.1

.4 Use of calcium chloride not permitted.

### 2.3 Reinforcement and Anchors

.1 Attach anchors securely in accordance with CSA W.186.70.

.2 Galvanize anchors after fabrication and touch up anchors with zinc rich primer after welding.

.3 Reinforcing Steel: To CSA G30.16, CSA G30.12, CSA G30.18 [epoxy coated]

### 2.4 Fabrication

.1 Fabricate precast/prestressed concrete units to CSA - A23.4.

.2 Mark each precast/prestressed unit to correspond to identification mark on shop drawings for location.

.3 Mark each precast/prestressed unit with date cast.

.4 Cast members in accurate rigid moulds designed to withstand high frequency vibration. Set reinforcing anchors and auxiliary items to detail. Cast in anchors, blocking and inserts supplied by other Sections as required to accommodate their work. Vibrate concrete during casting until full thickness is reached. Provide necessary holes and sinkages for flashings, anchors, cramps, etc. as indicated. Separately and accurately batch cement and aggregates uniformly by weight to ensure maintenance of even and uniform appearance.

.5 Anchors, lifting hooks, shear bars, spacers and other inserts or fittings required shall be as recommended and/or designed by manufacturer for a complete and rigid installation. Each shall conform to requirements of local building by-laws. Lift hooks shall be adequately sized to safely handle panels according to member dimension and weight. Anchors/inserts shall be concealed where practical.

.6 Burn off lift cables paint and fill in recesses if required.

*Spec Note: If special architectural finish is required for exposed structural precast, use the appropriate paragraph from Section 03450 Architectural Precast Concrete. Identify surfaces requiring these specific finishes.*

### 2.5 Finishes

.1 Finish units to [commercial grade] [standard grade] [finish grade A] [finish grade B] to CSA A23.4 Clause 24.

## 2.6 Parking Structures

.1 Precast/prestressed floor and roof units shall be double tee components with prestressed reinforcement as required by design. The finish of the underside of the double tees shall be a standard form finish.

.2 Precast beams and columns shall be of the dimensions shown on the drawings with prestressed and/or non-prestressed reinforcement.

Architectural finish and colour: (specify)

- A grey cement, standard form finish.

.3 Precast spandrel panels shall have a profile and thickness as shown on the drawings.

Architectural finish and colour: (specify)

- A grey cement, light sandblast finish for the exterior surfaces exposed to view.

- The exposed interior surface of spandrel panel shall have a standard wood float finish.

.4 All other structural components shown on drawings shall have a grey cement, standard form finish.

.5 Prestressing tendons shall be uncoated 7 wire strands conforming to CSA Standard A23.4.

## 2.7 Double Tee Slab Units

.1 Precast/prestressed floor and roof units shall be double tee components with prestressed reinforcement as required by design. The finish of the underside of the double tees shall be a standard form finish.

.2 Prestressing tendons shall be uncoated 7 wire strands conforming to CSA Standard A23.4.

## 2.8 Structural Framing Units

.1 Type: Precast/prestressed concrete structural framing units.

.2 Furnish units free of voids or honeycombs.

.3 Provide standard finish to precast units.

.4 Where ends of strands will not be enclosed or covered, cut flush and cover with a high-strength mortar bonded to unit with an epoxy-resin bonding agent.

.5 Reinforce units to resist transportation and erection stresses.

.6 Include cast-in weld plates where required.

.7 Coordinate with other trades for installation of cast-in items.

### 3.0 Execution

#### 3.1 General

.1 Erect precast/prestressed work in accordance with CSA-A23.4.

*Spec Note: It is not the Precast Manufacturer's responsibility to confirm and correlate dimensions at the job site. Precast concrete is a prefabricated material. Site dimensioning would require the structure to be complete before fabrication could commence.*

.2 Supply anchors for precast units required to be cast into cast-in-place concrete frame to Contractor for installation. Provide such items in ample time to meet construction program. Supply layout drawings locating accurately the position of all cast-in items to be installed by other Sections.

#### 3.2 Installation

.1 Set precast/prestressed concrete units, straight, level and square.

.2 Do welding in accordance with CSA-W59, for welding to steel structures and CSA W186, for welding of reinforcement.

*Spec Note: Select one only of the two following paragraphs.*

.3 Erect precast/prestressed elements within allowable tolerances as [indicated] [specified].

.4 Non-cumulative erection tolerances to be in accordance with CSA3-A23-4, Section [10].

*Spec Note: Where bearing pads are required, specify locations if not clearly indicated on drawings.*

.5 Set elevations and alignment between units to within allowable tolerances before connecting units.

*Spec Note: Check if required. Do not grout under elastomeric pads.*

.6 Grout underside of precast units with shrinkage compensating grout where indicated.

.7 Secure with bolts using [lockwashers] [or] [tack-weld nut to bolt].

.8 Do not weld or secure bearing plates at sliding joints.

.9 Use grout to align elevations at surface of joints in situations where allowable tolerances have been exceeded or as noted on consultant's drawings in critical locations.

.10 Clean field welds with wire brush and touch-up [shop primer with primer] [galvanized finish with zinc-rich primer].

.11 Fasten units in place as per approved connection detail shop drawings. Protect work from damage by weld splatter.

.12 Clean field welds with wire brush and touch up with galvafruid paint or zinc rich primer.

### 3.3 Handling and Erection

.1 Precast/prestressed components shall be handled and erected in accordance with CSA Standard A23.4 and as per the manufacturer's instructions.

.2 Precast/prestressed components shall be delivered and handled in such a manner as to avoid warpage.

.3 Holes and reglets shall be protected from forming of ice during freezing weather.

.4 Lifting devices shall be protected from rusting at all times.

.5 All precast/prestressed components shall be erected by experienced workmen under the supervision of a qualified superintendent with a minimum of five (5) years' experience.

.6 Welding of the precast units shall be performed by certified welders in accordance with CSA Standard A23.4, Clause 32.

.7 Units shall be set plumb and true with joints parallel and uniform.

.8 All necessary precautions shall be taken to prevent weld burn or splatter on to exposed surfaces.

.9 Patch damaged, or chipped components as required.

### 3.4 Cleaning

.1 If required, clean exposed face work by washing and brushing only, as precast is erected. Use approved masonry cleaner if washing and brushing fails to achieve required finish. Remove immediately materials that may set up or harden. This section is not responsible for soiling or damage by others.