CANADIAN PRECAST/PRESTRESSED CONCRETE INSTITUTE

STRUCTURAL PRECAST CONCRETE

SPECIFICATIONS

Section 03 41 00

Part 1 General

1.1 SECTION INCLUDES

.1 Columns and walls, and other structural framing units.

.2 Beams, spandrels, girders, purlins.

.3 Floor [[single] [double] [quad] tees.] [inverted tee beam.] [channel slabs.]

.4 Grout packing.

.5 Connection [and supporting] devices.

.6 Lintels [and bond beams].

.7 [Perimeter and] intermediate joint seals.

1.2 RELATED SECTIONS

.1 Section [_____-_____]: Foundation concrete work.

.2 Section 03 30 00 - Cast-in-Place Concrete: Building structural frame.

.3 Section 03 38 00 - Post Tensioned Concrete: Building structural frame.

.4 Section 03 41 13 - Precast Concrete Hollow Core Planks.

.5 Section 03 45 00 - Architectural Precast Concrete.

.6 Section 03 52 16 — Lightweight Insulating Concrete.

.7 Section 03 54 00 - Self-leveling Underlayment.

.8 Section 07 92 00 - Joint Sealants: Caulking of butt joints of precast units at [exposed underside of floor members.] [_____ .]

.9 Section [_____- _____]: Exterior applied finish.

.10 Section [_____- _____]: Placement of anchorage [and connection] devices.

.11 Section [_____- _____]: Placement of lintels [and bond beams].

1.3 REFERENCES

.1 ASTM International (ASTM):

.1 ASTM A108-18 Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished

.2 ASTM A123/A123M-17 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

.3 ASTM A153M-23 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

.4 ASTM A307-21 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.

.5 ASTM A416/A416M-18 Standard Specification for Low-Relaxation, Seven-Wire Steel Strand for Prestressed Concrete

.6 ASTM A555/A555M-22 -Standard Specifications for General Requirements for Stainless Steel and Wire Rods.

.7 ASTM A666-23 - standard specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

.8 ASTM A1064/A1064M-22 -standard specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.

.9 ASTM C260/C260M-10a (2016) - Standard Specification for Air-Entraining Admixtures for Concrete

.10 ASTM C494/C494M-19e1 -standard specification for Chemical Admixtures for Concrete.

.11 ASTM C881/C881M-20a -standard specification for Epoxy-Resin-Base Bonding Systems for Concrete.

.12 ASTM D2240 – 15(2021) -standard Test Method for Rubber Property - Durometer Hardness.

.13 ASTM D7957/D7957M-22 - Standard Specification for Solid Round Glass Fiber Reinforced Polymer Bars for Concrete Reinforcement.

.14 ASTM F3125/F3125M-22-standard specification for High Strength Structural Bolts and assemblies, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength

.2 CSA Group (CSA):

.1 CSA A23.1-19/A23.2-19 - Concrete Materials and Methods of Concrete Construction / Test Methods and Standard Practices Test for Concrete.

.2 CSA A3000-18 - Cementitious Materials Compendium.

.3 CSA G30.18:21 – Carbon steel bars for concrete reinforcement

.4 CSA G40.20-13/G40.21-13 (R2023) - General Requirements for Rolled or Welded Structural Quality Steel /Structural Quality Steel.

.5 CSA A23.3:19 - Design of Concrete Structures.

.6 CSA A23.4-16 (R2021)- Precast Concrete - Materials and Construction.

.7 CSA W47.1:19 - Certification of Companies for Fusion Welding of Steel.

.8 CSA W48:23 - Filler metals and allied materials for metal arc welding

.9 CSA W59-18 (R2023) - Welded Steel Construction (Metal Arc Welding).

.10 CSA W186:21 - Welding of Reinforcing Bars in Reinforced Concrete Construction.

.3 Canadian Institute of Steel Construction and the Canadian Paint Manufacturers Association (CISC/CPMA):

.1 CISC/CPMA Standard 2-75 - Quick-drying Primer for Use on Structural Steel

.4 Canadian Precast/Prestressed Concrete Institute (CPCI):

.1 CPCI (Canadian Precast/Prestressed Concrete Institute) Design Manual – 5th Edition. *Details - Order Offline*

.2 CPCI (Canadian Precast/Prestressed Concrete Institute) – Total Precast Concrete High-Rise Building Example. *Total Precast Concrete High-Rise Building Design Example*

.3 CPCI (Canadian Precast/Prestressed Concrete Institute) – Infrastructure Solutions Technical Guide. *Infrastructure Solutions Technical Guide*

.4 CPCI (Canadian Precast/Prestressed Concrete Institute) Structural Solutions Technical Guide. *Structural Solutions Technical Guide*

.5 CPCI (Canadian Precast/Prestressed Concrete Institute) Structural Floor and Roof Technical Guide. *Structural Floor And Roof Technical Guide*

.6 CPCI (Canadian Precast/Prestressed Concrete Institute) Colour and Texture Selection Guide. *Colour and Texture Selection Guide*

.7 Engineer of Record & Engineering Roles & Responsibilities for Precast Concrete Design. *Engineer of Record (EOR) Roles and Responsibilities (2023)*

.5 Precast/Prestressed Concrete Institute (PCI):

.1 MNL 116-21 - Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products.

.2 MNL 135 - Tolerance Manual for Precast and Prestressed Concrete Construction, 1st Edition.

1.4 ADMINISTRATIVE REQUIREMENTS

.1 The roles and responsibilities of the Engineer of Record and the Precast Engineer should be set according to the CPCI publication: Engineer of Record & Engineering Roles & Responsibilities for Precast Concrete Design.

1.5 SUBMITTALS FOR REVIEW

.1 Product Data: Indicate standard component configurations, design loads, deflections, cambers and bearing requirements.

.2 Shop Drawings: Indicate layout, unit locations, fabrication details, [unit identification marks,] reinforcement, connection details, support items, dimensions, openings, and relationship to adjacent materials [, and sealed by a Professional Structural Engineer registered in Province of Work]. Indicate design loads, deflections, cambers, bearing requirements, and special conditions.

.3 Installation Data: Precast Concrete Manufacturer's special installation requirements, indicating special procedures, crane and truck access locations, perimeter conditions requiring special attention, and [_____].

1.6 SUBMITTALS FOR INFORMATION

.1 Refer to Section 01 33 00: Submission procedures.

.2 Design Data: If requested, submit design data reports indicating calculations for loadings and stresses of fabricated, designed framing.

1.7 QUALITY ASSURANCE

.1 Perform work in accordance with the latest CSA A23.1/A23.2, CSA A23.3, CSA A23.4, PCI MNL-116, PCI MNL-117, and CPCI Design Manual.

.2 Welding: to CSA W59 and CSA W186.

.3 Welders: Certified to CSA W47.1. Certificates for welders doing the work shall be provided upon request.

.4 Fabricator:

.1 Precast concrete manufacturers to be certified to Canadian Precast Concrete Quality Assurance (CPCQA) Certification Program in [Precast and Prestressed Bridge Products, B,] [Subcategory] [B1] [BA1] [B2] [BA2] [B3] [BA3] [B4] [BA4] [Commercial Precast and Prestressed Concrete Products (Structural), D,] [Subcategory] [C1] [CA1] [C2] [CA2] [C3] [CA3] [C4] [CA4] [Precast Concrete Drainage Products, D,] [Subcategory] [D1] [Standard Products, S] prior to the time of bid. *CPCI can provide additional clarification of subcategory if uncertain.*

.2 Precast fabrication to meet the requirements of CSA-A23.4 [PCI MNL-116 and 117] and CPCQA certification requirements.

.3 Only precast elements fabricated under the CPCQA plant certification program to be acceptable, and plant certification is to be maintained for the duration of fabrication, [erection,] and until warranty expires.

.5 Erector: Provide documented experience for Company specializing in performing the work in erecting structural precast concrete products

.6 Design precast concrete members under the direct supervision of a Precast Engineer experienced in the design of this Work and licensed to practice engineering in the province where the Project is located.

1.8 DELIVERY, STORAGE, AND PROTECTION

.1 Deliver, handle and store precast concrete components in a method approved by the Precast Concrete Manufacturer.

.2 Blocking and Lateral Support during Transport and Storage: Clean, non-staining spacers, that do not cause harm to exposed surfaces, shall be placed between each unit. Temporary lateral supports should be provided to prevent bowing and warping.

.3 Protect precast concrete components to prevent staining, chipping, or spalling of concrete. Protect holes and reglets from water and ice during freezing weather.

.4 Mark precast concrete components with identification tag in accordance with CPCQA requirements

PART 2 Products

2.1 DESIGN AND PERFORMANCE REQUIREMENTS

.1 Design components and connections to withstand design loads as calculated in accordance with applicable codes. Submit relevant design data prepared by a qualified professional Precast Engineer in the province/state where the work is being done for approval if requested by the Consultant.

[OR]

Engage a Precast Concrete Manufacturer who utilizes a professional Precast Engineer registered in the province of work to prepare calculations, shop drawings, and other structural data for structural precast products that comply with the requirements of this Section.

.1 Design precast concrete components to withstand specified loads including superimposed dead loads, live loads, wind, and thermal loads.

.2 Design structural precast products to resist handling, transportation, and erection stresses.

.3 Seismic Loads: Design and size components to withstand seismic loads and sway displacement as calculated in accordance with [_____] code.

.4 Maximum Allowable Deflection: [1/180] [1/240] [1/360] [____] span.

.5 Design system to accommodate construction tolerances, deflection of other building structural members and clearances of intended openings, as specified in CSA A23.4 and PCI MNL-135.

.6 Design and fabricate structural precast products, brackets and anchorage devices to tolerances as specified in CSA-A23.4 and PCI MNL-135.

2.2 MATERIALS

.1 Portland cement, portland limestone cement, supplementary cementitious materials, aggregates, water and admixture: CSA A3000, Concrete Materials: in accordance with [CSA A23.4] [and] [CSA A23.1/A23.2]

.2 Reinforcing Steel Bars: [CSA G30.18, deformed steel, unfinished, grade 400W] [ASTM A555/A555M, stainless steel,] [ASTM D7957/D7957M, Glass fiber reinforced polymer (GFRP)] strength and size commensurate with precast unit design.

.3 Welded Steel Wire Fabric: ASTM A1064/A1064M, welded steel wire fabric, in [unfinished.] [hot dip galvanized.]

.4 Tensioning Steel Strands: [ASTM A416/A416M,] [ASTM A421/A421M,] Grade [1860 MPa] [270 ksi]

.5 Concrete admixtures in accordance with CSA A23.1/23.2

2.3 SUPPORT DEVICES

.1 Connecting and Supporting Devices: conforming to [CSA G40.20-13/G40.21 carbon steel;] [ASTM A666 stainless steel;] [ASTM A123/A123M hot dip galvanized] plates, angles, [items cast into concrete,] [items connected to steel framing members,] and inserts; fasteners to ASTM F3125/F3125M.

.2 Miscellaneous Plates, Angles, Inserts: CSA A23.1/A23.2.

.3 Protective Finish: [Prime painted.] [Hot-dip galvanized [to ASTM A123/A123M].] [Electroplated.] [Unfinished.]

.4 Bolts, Nuts, and Washers: [ASTM A307,] [ASTM F3125/F3125M] [galvanized to ASTM /A153M.]

.5 Prime Paint: [CISC/CPMA Standard 2-75 - Quick-drying Primer for Use on Structural Steel]

.6 Welding materials: CSA W48.

.7 Epoxy Anchor Hole Filler: ASTM C881/C881M, 100 percent solids, sand-filled non-shrinking, non-staining of type, class, and grade to suit application.

2.4 ACCESSORIES

.1 Bearing Pads: [High density plastic,] [Steel,] [Vulcanized elastomeric compound molded to size,] [Neoprene (Chloroprene), to ASTM D2240, Shore A Durometer [_____],] [Tetrafluoroethylene (TFE),] <[3] [_____] mm> <<[1/8] [_____] inch>> thick, smooth both sides.

.2 Shims: [Plastic.] [Steel.] [Stainless Steel]

.3 Recessed Reglets: [Stainless steel] [Plastic], shaped and flanged to remain in place once cast, [foam plastic filled] [taped closed] to eliminate wet concrete intrusion.

.4 Sealant: Sealant shall be specified by the Precast Concrete Manufacturer.

.5 Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place according to PCI MNL 117.

.6 Grout Materials shall be specified by the Precast Concrete Manufacturer.

2.5 CONCRETE MIXES

.1 Concrete mixes: design to CSA A23.4 .

[OR]

.2 Design mixes may be prepared by qualified precast plant personnel at the Precast Concrete Manufacturer or a qualified testing agency.

.3 Limit water soluble chloride ions to the maximum percentage by weight of cement permitted by CSA standard.

2.6 FABRICATION

.1 Fabricate precast concrete products in accordance with CSA A23.4.

.2 Maintain plant records and quality control program during production of precast concrete components in accordance with CPCQA requirements.

.3 Ensure reinforcing steel, anchors, inserts, plates, angles, and other cast-in items are embedded and located as indicated on [shop drawings] [Drawings].

.4 Tension prestressing tendons as required to achieve design load criteria.

.5 Exposed Ends at Stressing Tendons: Fill recess in accordance with precast manufacturer recommendation.

2.7 FINISHES

.1 Precast Concrete Surface Finish: A typical concrete finish may contain small surface holes caused by air bubbles, minor chips or spalling at edges or ends, without major discoloration.

2.8 FABRICATION TOLERANCES

.1 Fabrication Tolerances conform to CSA-A23.4.

2.9 SOURCE QUALITY CONTROL [AND TESTS]

.1 Provide concrete test reports and mill certificates as required by Contract Documents.

.2 Frequency of testing in accordance with CSA A23.4.

PART 3 Execution

3.1 EXAMINATION

.1 Refer to Section 01 70 00: Verification of existing conditions prior to beginning work.

.2 Erect precast work in accordance with CSA-A23.4.

.3 General Contractor to verify site conditions and supporting materials are ready to receive work and field measurements are as indicated on approved Shop Drawings.

.4 Precast manufacturer to supply anchors required for installation of the precast concrete components. Provide such items in ample time to meet the construction program. Supply layout drawings locating all cast-in items to be installed by other Sections.

.5 [Engineer of Record] [General Contractor] to sign off on structural stability prior to precast erection.

3.2 PREPARATION

.1 Provide and install sufficient temporary bracing to brace precast concrete components adequately, at all stages of construction, so that precast components will safely withstand loads to which they may be subjected. This temporary bracing shall remain in position until required connections have been completed.

3.3 ERECTION

.1 Erect precast concrete components without damage to shape or finish.

.2 Erect precast concrete components level, square and plumb within allowable tolerances (CSA A23.4 and PCI MNL-135).

.3 Align and maintain uniform horizontal and vertical joints, as erection progresses.

.4 When precast concrete components require adjustment beyond design or tolerance criteria, discontinue affected work; advise [Engineer of Record] [and General Contractor]

.5 [Fasten] [and] [Weld] component securely in place. [Perform welding in accordance with CSA W59 for welding to steel structures and CSA W186, for welding of reinforcement. Welds shall be performed by a certified CWB welder]. Where bolts are used for installation, tighten with equal torque. Secure bolts with lock washers, jam nuts, or tack-weld nut to bolt, or crimp threads of bolt after nut is installed.

.6 Touch up [field welds and] scratched or damaged [primed painted] [galvanized] surfaces.

.7 Adjust differential camber between precast members to tolerance according to [CSA A23.4 and PCI MNL-135] [or contract document] before final attachment.

.8 Grout as per approved shop drawings.

3.4 CLEANING

.1 Section 01 74 00: Cleaning installed work.

.2 Connections for precast concrete components should be clean and unobstructed prior to erection. Any cleaning of the precast after the installation and acceptance of work is the responsibility of the general contractor.

.3 Clean weld marks, dirt, or blemishes from surface of exposed precast concrete components, caused by erection work

.4 Clean field welds with wire brush and touch up with [primer] [galvanized] paint.

.5 Upon completion of the work in this Section, all surplus materials and debris shall be removed from this site.

3.5 PROTECTION OF FINISHED WORK

.1 Section 01 78 40: Protecting installed work.

.2 Protect precast concrete components from damage caused by field welding or erection operations performed by work of this trade. Protection of work after the precast erection is completed is to be the responsibility of the General Contractor.

END OF SECTION

BODY OF **KNOWLEDGE**

CPCI, NPCA and PCI are the leading technical resources (Body of Knowledge (BOK)) for the precast concrete industry in North America. From the BOK, building codes, design guides, educational programs, certification, sustainability programs, and new research ideas and derived. The joint industry initiative develops, maintains, and disseminates the BOK necessary for designing, fabricating, and constructing sustainable and resilient precast concrete structures.

Canadian Precast/Prestressed Concrete Institute www.cpci.ca

National Precast Concrete Association www.precast.org

Precast/Prestressed Concrete Institute www.pci.org

For additional technical information

www.cpci.ca/en/resources/technical_publications

Canadian Precast/Prestressed Concrete Institute
PO Box 24058 Hazeldean, Ottawa, Ontario, Canada, K2M 2C3
Tel: **(613) 232-2619** TF: **877 937 2724**