

Part 1 General

1.2 REFERENCES

- 1 Canadian Standards Association (CSA)
 - 1 CSA A23.1/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standards Practices for Concrete.
 - 2 CSA A23.3-04, Design of Concrete Structures.
 - 3 CSA A23.4-05, Precast Concrete – Materials and Construction.
 - 4 CSA G40.20/G40.21-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - 5 CSA W47.1-03 , Certification of Companies for Fusion Welding of Steel.
 - 6 CSA W481-06, Filler Metals and Allied Materials for Metal Arc Welding.
 - 7 CSA WI86.MI990(R2007), Welding of Reinforcing Bars in Reinforced Concrete Construction.

1.3 DESIGN REQUIREMENTS

- 1 Design precast elements to CSA A23.3 and CSA A23.4 to carry handling stresses. Design shall include resistance to creep, shrinkage and temperature effects.
- 2 All precast concrete elements are to be designed by a qualified professional engineer registered or licensed in the Province of Manitoba. All beams are to be designed with the dimensions shown for each beam type on the drawings, and the use of pre-stressed steel reinforcing is to be designed and installed where necessary to suit the dimensions of a particular beam type.
- 3 Design precast elements to carry loads in accordance with National Building Code of Canada 2005 (NBC) for snow load, plus live load considerations for visitors, landscape maintenance equipment, etc., and design precast elements for individual granite marker service weight of 0.7 kN.
- 4 Design support bearing stresses for support locations indicated on the drawings. Existing support conditions may vary from the drawings, and verification of site measurements, existing conditions and existing support locations are to be conducted in accordance with Part 3 of this Section. The existing steel support brackets typically do not extend the full width of the beam. Contractor is responsible for all site verifications prior to new beam fabrication.
- 5 Design beams to be simply supported at the ends of the beams. Do not design as grade beams.
- 6 Design for a maximum allowable deflection limit of $L/975$ for dead load of beams and markers, where L = unsupported span length of beam. Precamber beams as necessary, but ensure that camber is not visible once the beams have been installed on-site with all of the granite markers.

- 7 Design for beam transporting and placing procedures.
- 8 Locate all reinforcing steel such that steel will not interfere with locations of the pin connections for the granite marker mounting. Refer to the drawings for locations of granite markers.
- 9 Ensure that no embedded lifting steel exists on the top or side surfaces of the beam. All embedded lifting steel is to be located on the underside of the beam only, and is to be removed after beam placement on site is complete. Where the lifting steel is cut, the concrete surface is to be patched with a repair mortar to ensure that steel is not left exposed.

1.4 PERFORMANCE REQUIREMENTS

- 1 Tolerance of precast elements to CSA A23.4

1.5 SUBMITTALS

- 1 Submittals in accordance with Section 01 00 10 – General Instructions.
- 2 Shop Drawings.
 - 1 Submit shop drawings in accordance with Section 01 00 10 – General Instructions and in accordance with CSA A23.3 and CSA A23.4
 - 2 Include the following items:
 - 1 Design calculations for items designed by manufacturer, including summary of applied loading.
 - 2 Details of pre-stressed and non-pre-stressed members, reinforcement and their connections.
 - 3 Precast beam dimensions, including cross-section details.
 - 4 Dimensions for locations of granite markers. Include locations of marker pins and dowelling depth in the beams, to ensure no interference with the beam reinforcing steel.
 - 5 Camber and deflection design criteria.
 - 6 Concrete strength and classification.
 - 7 Finishing schedules.
 - 8 Methods of handling, transporting and installation.
 - 9 Openings, sleeves, inserts and related reinforcement, where applicable.
 - 3 Ensure each drawing submitted bears stamp and signature of qualified professional engineer registered or licensed in province of Manitoba.

1.6 QUALIFICATIONS

- 1 Precast concrete elements to be fabricated and erected by manufacturing plant certified by CPCI.

- 2 Precast concrete manufacturer to be certified in accordance with CPCI procedures for precast concrete plants, that plant is currently certified in appropriate categories, Structural and Prestressed (CA4).
- 3 Only precast elements fabricated in such certified plants to be acceptable to Contract Administrator, and plant certification to be maintained at Tender for duration of fabrication, installation, and until warranty expires.
- 4 Welding companies certified to CSA W47.1.

1.7 WARRANTY

- 1 Warranty requirements to be in accordance with Section 01 00 10 – General Instructions.
- 2 Contractor hereby warrants that precast elements will not spall or show visible evidence of cracking in accordance with subsection D21 Warranty – of the Supplemental Conditions, but for which one (1) year warranty period is extended to two (2) years.

Part 2 Products

2.1 MATERIALS

- 1 Cement, aggregates, water, admixtures: to CSA A23.1 and CSA A23.4
- 2 Reinforcing steel: in accordance with Section 03 41 00 – Concrete Beam Reinforcing
- 3 Prestressing steel tendons and bars: in accordance with Section 03 41 00 – Concrete Beam Reinforcing.
- 4 Hardware and miscellaneous materials: to CSA A23.1
- 5 Forms: to CSA A23.4.
- 6 Anchors and supports: to CSA G40.21, galvanized.
- 7 Welding materials: to CSA W48.
- 8 Welding electrodes: to CSA W48 and certified by Canadian Welding Bureau.
- 9 Galvanizing: in accordance with Section 03 41 00 – Concrete Beam Reinforcing.
- 10 Air entrainment admixtures: to CSA A23.10.
- 11 Shims: plastic.

2.2 MIXES

- 1 Concrete
 - 1 Proportion normal density concrete in accordance with CSA A23.1, Alternative 1, to give following properties:
 - 1 Cement: use Type 10 SF Portland cement.

- 2 Minimum compressive strength at 28 days: 40 MPa.
- 3 Maximum water/cement ratio: 0.40.
- 4 Class of exposure: C-1.

- 5 Aggregate:
 1. Normal size of coarse aggregate: no larger than 38 mm, free of organic impurities.
 2. Fine aggregate: mix to consist of natural sand, manufactured sand, or a combination of both, and is to be free of organic impurities.
 3. Aggregates not to react with alkalis in the concrete.
- 6 Air content: 5 – 8%.
- 7 Slump at time and point of discharge: 80 mm.
- 8 Water: to be potable, clear and free of oils, acids, alkalis, soluble chlorides, organic matter and sediment.

2.3 MANUFACTURED UNITS

- 1 Manufacture units in accordance with 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 Provide hardware suitable for handling elements.
- 4 Galvanize anchors and steel embedments after fabrication and touch up with zinc-rich primer after welding, and in accordance with Section 03 41 00 – Concrete Beam Reinforcing.

2.4 FINISHES

- 1 Finish units to finish grade A to CSA A23.4.

2.5 SOURCE QUALITY CONTROL

- 1 Provide Contract Administrator with certified copies of quality control tests related to this project as specified in CSA A23.4.
- 2 Inspect prestressed concrete tendons in accordance with CSA A23.4.
- 3 Provide records from in-house quality control program based upon plant certification requirements to Contract Administrator for inspection and review.
- 4 Precast plants should keep complete records of supply source of concrete material, steel reinforcement, prestressing steel and provide to Contract Administrator for review upon request.

- 5 Independent Inspection and Testing: The Contract Administrator will appoint an independent inspection and testing agency to undertake concrete strength, slump and air content tests. The cost of testing shall be paid by the Contract Administrator. Laboratory curing and testing of samples will be carried out in accordance with CSA A23.1/A23.2 and CSA A23.4. Provide a group of three cylinders for each standard strength test. One specimen will tested at 7 days and two at 28 days. Results will be on the form conforming to CSA A23.2, stating the beam for which tests relate and with comments on abnormal results and conditions, and will be reported to the Contract Administrator.

Part 3 Execution

3.1 INSTALLATION OF NEW PRECAST CONCRETE BEAMS

- 1 Do precast concrete work in accordance with CSA A23.3 and CSA A23.4.
- 2 Place precast elements within allowable tolerances as specified.
- 3 Provide Crane services and operative/s qualified to operate unit and offload and place beams in identified positions. Crane provider to comply with all local Health and Safety legislation as applicable to services provided.