

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 SA 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 Profile and Type, and the use of pre-stressed steel reinforcing is to be designed and installed where necessary, to suit the dimensions of a particular beam Profile and Type; all as provided on the drawings numbered: S1 and S2.
- 3 Design precast elements to carry loads in accordance with current National Building Code of Canada (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. Where beams are to be installed on piers the existing steel support brackets typically may 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.
- 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.
- 7 Precamber Profile 'B' beams as necessary, but ensure that camber is not visible once the beams have been installed on-site with all of the granite markers.
- 8 Design for beam transporting and placing procedures.
- 9 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; Drawing numbered: S2.
- 10 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

Shop Drawings.

- 1 Submit shop drawings in accordance with Section E3 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 D25.
- 2 Contractor hereby warrants that precast elements will not spall or show visible evidence of cracking in accordance with subsection D25 Warranty – of the Supplemental Conditions, but for which one (1) year warranty period is extended to two (2) years.

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 and drawing S1.
- 3 Prestressing steel tendons and bars: in accordance with Section 03 41 00 – Concrete Beam Reinforcing and drawing S1.
- 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 and Drawing S1
- 10 Air entrainment admixtures: to CSA A23.10.
- 11 Shims: plastic.

2.2 MIXES

- 1 Concrete

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 and drawing S1.

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.

Part 1 General

1.2 MEASUREMENT PROCEDURES

- 1 Measure reinforcing steel in kilograms of steel incorporated into Work, computed from theoretical unit mass specified in CSA G30.18 for lengths and sizes of bars as indicated or authorized in writing by Contract Administrator.

1.3 REFERENCES

- 1 American Society for Testing and Materials International (ASTM)
 - 1 ASTM A143/A143M-07, Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.
 - 2 ASTM A416/A416M-06, Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete.
 - 3 ASTM A421/A421M-05, Standard Specification for Uncoated Stress-Relieved Steel Wire for Prestressed Concrete.
 - 4 ASTM A722/A722M-07, Standard Specification for Uncoated High-Strength Steel Bars for Prestressing Concrete.
- 2 Canadian Standards Association (CSA International)
 - 1 CSA A23.1-04/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - 2 CSA A23.3-04, Design of Concrete Structures.
 - 3 CSA A23.4-05, Precast Concrete – Materials and Construction.
 - 4 CSA G30.18-M92(R2002), Billet-Steel Bars for Concrete Reinforcement.
 - 5 CSA G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
- 3 Reinforcing Steel Institute of Canada (RSIC)
 - 1 RSIC-2004, Reinforcing Steel Manual of Standard Practice.

1.4 SUBMITTALS

- 1 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice.
- 2 Submit shop drawings including placing of reinforcement and indicate:
 - 1 Bar bending details.
 - 2 Lists
 - 3 Quantities of reinforcement.
 - 4 Sizes, spacing, and locations of reinforcement with identifying code marks to permit correct placement without reference to structural drawings.

- 5 Indicate sizes, spacing and locations of chairs, spacers and hangers as necessary.
- 6 Indicate galvanized steel where applicable.
- 3 Detail lap lengths and bar development lengths to CSA A23.3.
 - 1 Provide class B tension lap splices, unless otherwise indicated.
- 4 Quality Assurance:
 - 1 Mill Test Report: provide Contract Administrator with certified copy of mill test report for reinforcing steel, minimum 4 weeks prior to beginning reinforcing work.
 - 2 Upon request, submit in writing to Contract Administrator proposed source of reinforcement material to be supplied.

Part 2 Products

2.1 MATERIALS

- 1 Reinforcing steel:
 - 1 Non-prestressing reinforcing steel:
 - 1 Billet steel, grade 400, deformed bars: to CSA-G30, 18 and CSA A23.1, unless indicated otherwise.
 - 2 Hot dipped galvanized: to CSA G164, minimum zinc coating 610 g/m².
 - 1 Protect galvanized reinforcing steel with chromate treatment to prevent reaction with Portland cement paste.
 - 2 If chromate treatment is carried out immediately after galvanizing, soak steel in aqueous solution containing minimum 0.2% by weight sodium dichromate or 0.2% chromic acid.
 - 3 Temperature of solution equal to or greater than 32 degrees and galvanized steels immersed for minimum 20 seconds.
 - 4 If galvanized steels are at ambient temperature, add sulphuric acid as bonding agent at concentration of 0.5% to 1%.
 - 5 In this case, no restriction applies to temperature of solution.
 - 6 Chromate solution sold for this purpose may replace solution described above, provided it is of equivalent effectiveness.
 - 7 Provide product description as described in PART 1 – Submittals.
 - 3 Coating for field touch-ups: two-coat, zinc-rich protective coating for ferrous metals.
 - 2 Prestressing tendon and bar steel:
 - 1 Prestressing reinforcing steel tendons: to CSA A23.3, CSA A23.4, ASTM A416, ASTM A421, and ASTM A722.

- 3 Chairs, bolsters, bar supports, spacers: to CSA A23.1/A23.2, and must be non- corrosive for the galvanized reinforcement steel.

2.2 FABRICATION

- 1 Fabricate reinforcing steel in accordance with CSA A23.1/A23.2, CSA A23.4, and Reinforcing Steel Manual of Standard Practices by the Reinforcing Steel Institute of Canada.
- 2 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

2.3 SOURCE QUALITY CONTROL

- 1 Provide Contract Administrator with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 4 weeks prior to beginning reinforcing work.
- 2 Upon request, inform Contract Administrator of proposed source of material to be supplied.

Part 3 Execution

3.1 PREPARATION

- 1 Galvanizing to include chromate treatment. Duration of treatment to be 1 hour per 25 mm of bar diameter.
- 2 Conduct bending tests to verify galvanized bar fragility in accordance with ASTM A143/A143M.

3.2 FIELD BENDING

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

3.3 PLACING REINFORCEMENT

- 1 Place reinforcing steel in accordance with CSA A23.1/A23.2 and CSA A23.4
- 2 Rebar to oxidize for 6 weeks after Chromation and before casting.
- 3 Prior to placing concrete, obtain approval of reinforcing material and placement by the licensed engineer who has signed and sealed the design calculation and shop drawings.
- 4 Ensure cover to reinforcement is maintained during concrete pour.

3.4 FIELD TOUCH-UP

- 1 Touch up damaged and cut ends of galvanized reinforcing steel to provide continuous coating.