USE IN ALL BRIDGE TENDERS
SPECIFYING PRECAST CONCRETE UNITS

0.1 AMENDMENTS TO SECTION 7, PRECAST CONCRETE UNITS, OF THE SPECIFICATIONS FOR BRIDGE CONSTRUCTION

Subsection 7.2, Supply and Manufacture, is revised as follows:

i) The last paragraph of Subsection 7.2.2, Qualification, is replaced with the following:

The fabricator shall operate a recognized precast concrete fabricating plant and be fully certified by the Canadian Precast/Prestressed Concrete Institute (CPCI) Certification Program.

ii) The following is added as the second paragraph of Subsection 7.2.3.4, Concrete and Grout Mix Design:

The sampling and testing of aggregates, and the concrete mix design shall be completed by an independent CSA certified and qualified concrete testing laboratory which shall have a permit to practice in the Province of Alberta. Concrete mix designs, including sampling and testing of aggregates, may be completed by the concrete supplier, with the condition that documentation is stamped by a Professional Engineer registered in the Province of Alberta. For either situation, the mix design, including sampling and testing, shall be reviewed and stamped for compliance with the respective specifications by an independent CSA certified and qualified concrete testing laboratory having a permit to practice in the Province of Alberta. For either case, the testing laboratory shall provide an engineering opinion that the concrete aggregate and mix designs are suitable for the intended use and are expected to perform to specified standards.

iii) The following is added as the last paragraph of Subsection 7.2.3.6, Chemical Admixtures:

Acceptable admixtures are air-entraining agents, superplasticizers, and water-reducing agents.

iv) The following is added at the end of the paragraph in Subsection 7.2.5.1, Forms:

For all beam members, the forms shall be designed to be removed without damaging the beam. For all "I" or "T" beam members, the side forms shall be removed horizontally away from the beam by a method that prevents any contact of the form with the top flange after release of the form. The top flange shall not be subjected to a vertical force at any time.

v) Subsection 7.2.5.3, Stressing Strand, is revised as follows:

- The following is added as the last sentence of the first paragraph:
Stressing strand splices shall not be placed within a precast concrete unit.

- The following is added as the first sentence of the third paragraph:

  Stressing strands shall not be stressed more than 36 hours prior to being encased in concrete.

- The following is added as the last sentence of the third paragraph:

  Changes in strand temperature and slippage at strand anchorages shall be monitored between stressing and concrete encasement, and any changes in strand stress due to these effects shall be accounted for in the design.

vi) The following is added as the last sentence of the paragraph in Subsection 7.2.5.6, Concrete Measuring, Mixing and Placing:

  The elapsed time between placement of concrete onto previously placed concrete shall not exceed 30 minutes.

vii) The following is added as the last sentence of the last paragraph of Subsection 7.2.5.9, Camber Hubs:

  The Contractor shall record the girder camber at the midpoint of each girder within 24 hours of girder destressing.

viii) The contents of Subsection 7.2.5.11, Curing, are replaced in their entirety with the following:

  All prestressed concrete units shall be cured at an elevated temperature. The curing of prestressed concrete units shall essentially be in accordance with CSA A23.4 unless otherwise specified. The ambient curing temperature shall be increased at a rate not exceeding 20°C per hour until a maximum temperature of not more than 60°C is attained. After curing, the temperature of the units shall not be reduced at a rate exceeding 10°C per hour until the temperature of the concrete has fallen to within 10°C of the outside air temperature.

(a) **Prestressed Concrete**

(i) **Curing in the Form**

  The initial application of heat shall commence only after the last of the freshly placed concrete has attained its initial set, normally two to four hours after casting. Heat shall not be applied directly to the concrete, but by a method that will produce a consistent ambient temperature throughout the entire form and enclosure. The increase in temperature and the holding temperature shall be monitored and permanently recorded on a chart at a minimum of 3 quarter points along the form.

(ii) **Curing after Removal from the Form**

  Upon removal from the forms the units shall be cleaned, patched, and finished within a period not exceeding 12 hours. The units shall be placed in a manner that will facilitate any clean up or repair work, and that will allow full inspection of all surfaces. Within 24 hours of removal from the form, the
units shall be placed within a suitable enclosure, for curing.

The curing enclosure shall provide a minimum of 150 mm of free air space between the concrete surfaces and the coverings. Flexible coverings shall be secured to prevent any moisture loss.

The difference in ambient air temperature adjacent to the concrete at different locations within the enclosure shall not exceed 10 °C at any time.

The curing process shall be continued for a period of four days with one of the following methods:

1) Steam Curing

Steam jets shall not directly impinge on the concrete surfaces. The steam shall be in a saturated condition maintaining an atmosphere of 100% relative humidity and a uniform ambient temperature of 50 °C to 60 °C.

2) Curing with Continuous Misting and Heat

A sufficient number of atomizing misting nozzles shall be strategically located to produce a fine mist with 100% relative humidity in the enclosure. The water shall be preheated to a temperature which will produce a misting temperature compatible with the ambient temperature. The enclosure shall be heated with radiant heaters to a temperature of 50 °C to 60 °C. Dry heat shall not touch the concrete surface at any time. A control system shall be installed to shut off the heat when the humidity level drops below 90% in the enclosure. Should the temperature in the concrete rise above 40 °C without the misting, the unit will be rejected.

Two continuously recording thermometers and two continuously recording hygrometers shall be provided for each curing enclosure to monitor the concrete and curing rates. All time-temperature and time-humidity recordings shall be clearly shown on the graph.

(b) Non-Prestressed Concrete

Curing of all non-prestressed concrete shall be in accordance with one of the following methods:

(i) Elevated Temperature Curing

Upon removal from the forms, the units shall be cleaned, patched, finished and elevated temperature cured for four days in accordance with Subsection 7.2.5.11(a) Prestressed Concrete.

(ii) Moist Curing

The units may be moist cured in lieu of elevated temperature curing in accordance with the following.
Upon removal from the forms, the units shall be cleaned, patched, finished, and ready for inspection within a period not exceeding 12 hours. Patching shall be performed with an approved product and at an ambient temperature of 15°C to 30°C. After completion of patching and finishing and within 24 hours of removal from the form, the units shall be placed under two layers of light colored filter fabric (Nilex C-14 or approved equivalent) or burlap, at an ambient temperature of not less than 15°C. The filter fabric or burlap shall be kept in a continuously wet condition throughout the curing period by means of a soaker hose or other means acceptable to the Department. Curing with filter fabric or burlap and water shall be maintained for a minimum period of seven days.

ix) The following is added after the existing paragraph of Subsection 7.2.5.13, Repairing Damaged Concrete:

Repairs to defects including cracks, honeycombs or spalls, shall be carried out in accordance with the following requirements. Any unacceptable cracks, honeycombs or spalls will result in rejection of the affected unit.

All repair procedures shall be developed by a Professional Engineer registered in the Province of Alberta, and reviewed by the Department prior to the commencement of the repair. All repairs shall be completed prior to curing of the unit at an ambient temperature of 15°C to 30°C.

For the following, the bearing area of a girder is defined as the portion of the girder bottom flange extending from the end of the girder to the inside edge of the girder bearing. It does not include the transition between the bottom flange and the web. The anchorage area is defined as the full height portion of the girder that is less than two times the girder depth from the end of the girder but is not in the bearing area.

(a) Cracks

Cracks in the bearing area of a girder are unacceptable unless they are less than 0.1 mm in width and are initiated by a stress raiser, e.g. a formed hole in the girder. Unacceptable cracks in the bearing area will result in rejection of the unit.

Cracks in the anchorage area of a girder exceeding 1.5 mm in width are unacceptable and will result in rejection of the unit. All cracks in the anchorage area 0.2 mm to 1.5 mm in width shall be repaired by epoxy injection in accordance with the manufacturer's instructions. If requested by the Department, coring shall be carried out to confirm the penetration of the epoxy into the cracks.

Cracks outside of the girder bearing and anchorage areas that are wider than 0.1 mm or longer than 300 mm are unacceptable and will result in rejection of the unit.

(b) Honeycombs and Spalls

Honeycombs or spalls in the bearing areas of a girder are unacceptable and will result in rejection of the unit.

Major honeycombs and spalls in the anchorage areas of a girder are unacceptable and will result in rejection of the unit. Major honeycombs and spalls are described as honeycombs and spalls that are more than 30 mm deep or more than 0.1 m² in
area. Repairs of minor honeycombs and spalls in the anchorage areas of a girder may be made after destressing of the girder.

Repairs of honeycombs and spalls outside of the bearing or anchorage areas of a girder may be made using cementitious material prior to destressing of the girder.

x) The following Subsection is added:

7.2.6.8 Fabrication of Prestressed/Precast Units in Cold Weather

The Contractor shall accept full responsibility for the protection of precast concrete units when fabricating in adverse weather conditions.

When the ambient temperature is, or is expected to be, below 5°C during fabrication, the following provisions for cold weather casting shall be implemented:

(a) The Contractor shall construct an enclosure capable of maintaining an ambient temperature within the structure of between 15°C and 30°C. The enclosure shall be sufficiently sized to accommodate steel forms, workers and the casting equipment. The enclosure temperature shall be constantly monitored, and shall be maintained within the specified range.

(b) The heating system shall be designed to provide uniform distribution of heat, and the combustion by-products shall be kept out of the enclosure.

(c) Before casting concrete, adequate preheat shall be provided to raise the temperature of the formwork, reinforcing steel, stressing strand, miscellaneous iron, etc. to a minimum of 10°C.

(d) The fabricated units shall be kept in the enclosure until they are patched, repaired and transferred to the curing enclosure.