CONSTRUCTION SPECIFICATION FOR
CONCRETE BARRIERS

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740.01 SCOPE

This specification covers the requirements for the construction of permanent concrete barriers and temporary concrete barriers.

740.01.01 Specification Significance and Use

This specification has been developed for use in provincial- and municipal-oriented Contracts. The administration, testing, and payment policies, procedures, and practices reflected in this specification correspond to those used by many municipalities and the Ontario Ministry of Transportation.

Use of this specification or any other specification shall be according to the Contract Documents.
740.02 Appendices Significance and Use

Appendices are not for use in provincial contracts as they are developed for municipal use, and then, only when invoked by the Owner.

Appendices are developed for the Owner’s use only.

Inclusion of an appendix as part of the Contract Documents is solely at the discretion of the Owner. Appendices are not a mandatory part of this specification and only become part of the Contract Documents as the Owner invokes them.

Invoking a particular appendix does not obligate an Owner to use all available appendices. Only invoked appendices form part of the Contract Documents.

The decision to use any appendix is determined by an Owner after considering their contract requirements and their administrative, payment, and testing procedures, policies, and practices. Depending on these considerations, an Owner may not wish to invoke some or any of the available appendices.

740.02 REFERENCES

When the Contract Documents indicate that provincial-oriented specifications are to be used and there is a provincial-oriented specification of the same number as those listed below, references within this specification to an OPSS shall be deemed to mean OPSS.PROV, unless use of a municipal-oriented specification is specified in the Contract Documents. When there is not a corresponding provincial-oriented specification, the references below shall be considered to be to the OPSS listed, unless use of a municipal-oriented specification is specified in the Contract Documents.

When the Contract Documents indicate that municipal-oriented specifications are to be used and there is a municipal-oriented specification of the same number as those listed below, references within this specification to an OPSS shall be deemed to mean OPSS.MUNI, unless use of a provincial-oriented specification is specified in the Contract Documents. When there is not a corresponding municipal-oriented specification, the references below shall be considered to be the OPSS listed, unless use of a provincial-oriented specification is specified in the Contract Documents.

This specification refers to the following standards, specifications or publications:

**Ontario Provincial Standard Specifications, Construction**

- OPSS 301 Restoring Unpaved Roadway Surfaces
- OPSS 310 Asphaltic Concrete, Hot Mix, Hot Laid and Hot Mix Patching
- OPSS 314 Untreated Granular Subbase, Base, Surface, Shoulder and Stockpiling
- OPSS 501 Compacting
- OPSS 904 Concrete Structures
- OPSS 919 Formwork and Falsework

**Ontario Provincial Standard Specifications, Material**

- OPSS 1010 Aggregates - Granular A, B, M, and Select Subgrade Material
- OPSS 1150 Asphaltic Concrete, Hot Mix and Hot Laid
- OPSS 1305 Moisture Vapour Barriers
- OPSS 1306 Burlap
- OPSS 1308 Joint Filler (Concrete)
- OPSS 1315 White Pigmented Membrane Curing Compounds for Concrete
- OPSS 1350 Concrete (Materials and Production)
740.03 DEFINITIONS

Asymmetric: refers to the barrier placed where the pavement elevations on each side of the barrier differ.

740.04 DESIGN AND SUBMISSION REQUIREMENTS

740.04.01 General

Where the Contractor wishes to use a concrete barrier design other than as called for in the contract, he shall request permission from the Authority, at least four weeks prior to starting any work affected by his proposed change.

740.05 MATERIALS

740.05.01 Concrete - General

The concrete mix design for all concrete barriers shall be the responsibility of the Contractor.

740.05.02 Concrete for Cast-in-place Barrier

The concrete for cast-in-place concrete barrier shall be a minimum strength of 30 MPa, except that the Tall Wall Concrete Barrier, shall be a minimum strength of 35 MPa, and shall conform to OPSS 1350 using a nominal maximum size aggregate of 19.0 mm. All coarse aggregate used for slip formed Tall Wall concrete barrier shall have all faces crushed.

740.05.03 Precast Concrete Barrier

Precast concrete barrier shall conform to OPSS 1352.

740.05.04 Concrete Pad for Precast Concrete Barrier

The concrete pad under the precast concrete barrier shall be a minimum strength of 30 MPa and shall conform to OPSS 1350.

740.05.05 Curing

Membrane curing compound shall conform to OPSS 1315. Burlap shall conform to OPSS 1306 moisture vapour barrier shall conform to OPSS 1305.
740.05.06 Joint Filler
Joint filler for permanent concrete barrier shall conform to OPSS 1308.

740.05.07 Formwork
Formwork for permanent concrete barrier shall conform to OPSS 919.

740.05.08 Reinforcing Steel
All reinforcing steel in permanent precast concrete barriers shall be epoxy coated conforming to OPSS 1442.
Epoxy patching compound shall be applied to all welds of epoxy coated reinforcing steel.
Reinforcing steel in temporary concrete barriers shall conform to OPSS 1440.

740.05.09 Asphaltic Concrete
Asphaltic concrete shall conform to OPSS 1150.

740.05.10 Granular
Granular foundation material shall conform to OPSS 1010.

740.05.11 Interlocking Components
Hollow structural steel and wide flange steel sections used in permanent precast concrete barrier shall be 350W grade conforming to CAN/CSA G40.21 and shall be hot dip galvanized after fabrication conforming to CSA G164.

740.07 CONSTRUCTION

740.07.01 Concrete Barrier
The work shall include foundation preparation, placement of the concrete barrier or precast concrete barrier units, expansion joints, construction joints, curing of the concrete, surface finish and treatment at bridge piers.

Construction of permanent concrete barrier shall be by use of the following methods:

1. conventional wooden or steel formwork;
2. slip-form;
3. precast concrete barrier units.

Permanent concrete barrier constructed by methods 1. and 2. above shall conform to OPSS 904 and 919 except as otherwise stated in this specification.

Precast concrete barrier containing the I-Lock connection, may be used in permanent installations. The precast concrete barrier shall be secured in place with 50 mm of asphalt placed on both sides of the barrier as shown on the contract drawings.
740.07.01.01 Foundation Preparation

Preparation of the granular foundation shall conform to OPSS 314 and 301, as appropriate. Immediately ahead of placing concrete, the Contractor shall wet down the subgrade by means of a uniform spray of water sufficient to wet the subgrade thoroughly without leaving standing water.

Placement of asphaltic concrete pavement beneath and adjacent to the precast concrete barrier shall conform to OPSS 310.

The concrete pad for the precast barrier shall conform to OPSS 904 and shall be placed in such a manner and to such width and thickness as to ensure that there are no voids between the concrete pad and the barrier and that the barrier is set to the correct line and grade.

740.07.01.02 Tolerances

The dimensions of the completed barrier shall not deviate by more than 10 mm from the dimensions specified.

The horizontal alignment shall not deviate more than 10 mm from the required lines indicated in the contract.

When a 3 m long, straight edge is placed on the top and faces of the cast-in-place concrete barrier surface, the surface of the concrete shall not vary more than 6 mm from the edge of the straight edge.

When the slipformed concrete barrier does not conform to the tolerances, the Contractor may correct to the required tolerances, using a magnesium float, while the concrete is still plastic, providing the surface and/or the barrier is not damaged during such adjustments.

740.07.01.03 Surface Finish

The surface of the concrete barrier placed with conventional forms shall be given a basic treatment and Class "B" finish conforming to OPSS 904.

The slip-formed barrier surface shall not be brushed. Offsets and fins shall be removed immediately by light trowelling. Surface blemishes 10 mm or less in diameter shall be left untouched. If surface blemishes larger than 10 mm diameter occur, adjustments in the operation shall be made to correct the condition. If the adjustments do not correct the condition within 10 m, the operation shall be halted until the condition is corrected either by adjustments to the operation or to the concrete mix.

The use of water on the completed barrier to correct imperfections shall not be permitted.

740.07.01.04 Curing

Curing for unformed surfaces of cast-in-place slip form concrete barrier shall conform to OPSS 904 for unformed surfaces.

Curing for formed surfaces shall conform to OPSS 904 for formed surfaces.

When joints are made after the application of curing compound the exposed face of the barrier in the vicinity of the joint shall be retreated with curing compound.

When white pigmented membrane is used as curing compound on slip formed barrier, it shall also be used on adjacent preformed barrier sections for colour uniformity.
Cold Weather Concreting

Concrete shall not be placed by slip-forming when the air temperature is below 0°C.

Placing concrete by slip-forming shall not be carried out when the air temperature is below 5°C unless the concrete at the time of placing is between 15°C and 30°C. Concrete placed by slip-forming when the air temperature is below 5°C or concrete subject to temperatures below 5°C during the first 7 days shall conform to OPSS 904.

Expansion Joints

Expansion joints 12 mm min. in width shall be installed where concrete barrier abuts a structure, adjacent to piers, over existing deck expansion joints and at the locations indicated in the contract. The expansion joint shall be filled with Type 'A' expansion joint filler.

If forming the joint is performed before the concrete has hardened, the adjacent portions of the barrier shall be supported firmly to ensure the design shape of the barrier wall is constructed as specified.

Construction Joints

Construction joints located at the end of a days placement shall be squared.

Continuity between adjacent sections of the construction joint shall be achieved by installing three horizontal epoxy coated reinforcing bars, size 25 mm x 1 m long, placed 500 mm on each side of the joint. The three bars shall be located on the barrier centreline placed 150 mm from the top and equally spaced at 150 mm.

Tall Wall concrete barrier, Type E design, shall contain five horizontal epoxy coated reinforcing bars, spaced as above, at each construction joint.

Treatment at Bridge Piers

Granular A material with asphalt surface shall be used to fill the area between concrete barriers where separation occurs at bridge piers or at other locations where separation of the barriers is required. Compaction of granular shall conform to OPSS 501. The asphalt surface shall conform to OPSS 310.

Temporary Concrete Barrier

The work shall include foundation preparation, placement of the precast concrete barrier units, placement of construction markers and removal of the barrier and barrier debris from the contract site upon completion of the contract.

Construction of temporary concrete barrier shall be by use of precast concrete barrier units.

The precast units shall be installed with interlocking devices properly engaged. Each run of precast concrete barrier shall consist of units having the same type of connecting device including the end treatments.

Repaired precast concrete barrier units may be used providing the structural integrity of the unit conforms to OPSS 1352.
740.07.02.01 Restrictions on Use of Connections

For contracts awarded on or before December 31, 1992, Contractors may use precast concrete barrier units with one of the following connections:

I-Lock
Concrete Key
Hook & Eye

For contracts awarded after December 31, 1992, Contractors shall use only precast concrete barrier units with I-Lock connection on:

a. divided roadways with two or more lanes in each direction, and

b. on other roadways with posted speeds of 80 km/h or greater.

For contracts awarded on or before December 31, 1995, Contractors may continue to use one of the three above connections on:

c. roadways with posted speeds of less than 80 km/h.

For contracts awarded after December 31, 1995, only the I-Lock connection shall be permitted on all roadways.

740.07.02.02 Foundation Preparation

Temporary concrete barrier shall be installed on a solid foundation having a slope of up to 6% maximum measured perpendicular to the installation. Two days shall be allowed between the placement of final asphalt surface and placement of temporary concrete barrier. Temporary concrete barrier shall be in place prior to the opening of traffic operations.

Drainage shall be maintained under the temporary concrete barrier.

740.07.02.03 Tolerances

The horizontal and vertical alignment at the junction of each barrier section shall be within 15 mm. The maximum radius on which the barrier may be placed shall be as specified for each interlocking design.

740.07.02.04 Construction Markers

Construction markers shall be placed in advance of the temporary precast concrete barrier installation to assist in directing the traffic away from the flared approach end treatment. "Lane Closure Taper Length" and "Maximum Distance Between Markers" shall conform to the M.U.T.C.D.

740.07.02.05 On Site Storage

Temporary concrete barrier being stored on site for re-use on the same contract shall be stored:

a. with protection by means of a standard temporary concrete barrier installation placed at a minimum of 1.0 m from the edge of the driving lane.
b. without protection, storage shall be offset from the edge of the driving lane conforming to the following:

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740.07.03 Temporary Concrete Barrier, Relocation

The work shall include the relocation of temporary concrete barrier and shall conform to subsection 740.07.02. Removal of the barrier units from the Contract site upon completion of the Contract is included with the item “Temporary Concrete Barrier”.

740.07.04 Reflectors

Reflectors placed on temporary and permanent concrete barrier shall conform to the M.U.T.C.D.

740.07.05 Management of Excess Material

Management of excess material shall be according to the Contract Documents.

740.08 QUALITY ASSURANCE

740.08.01 Acceptance Criteria for Precast Concrete Barrier

Final inspection of the precast units will not be made until they have been installed.

Precast units damaged in transit or during placement shall be replaced by the Contractor at his own expense.

All temporary concrete barrier units shall meet each of the following criteria.

a. The elements of each connecting device shall be intact and shall provide an effective connection equivalent in strength to that of a newly manufactured connection.

b. Concrete within 200 mm of each connecting device shall be structurally sound, free of cracks, spalling and breakage, to ensure safe and satisfactory performance of the connection.

c. Concrete breakouts in areas, other than as addressed in (b), shall not exceed 150 mm in diameter in either vertical or longitudinal directions.

d. Individual areas of surface damage including concrete spalls shall not measure more than 150 mm in any direction and shall not exceed a 25 mm depth. (Max. 150 x 150 x 25 mm). The accumulated total surface damage on the traffic side of the unit shall not exceed 10% of the total surface area of the respective side.

e. Other than as addressed by (d) there shall be no exposed coarse aggregate, such as honeycombing. The top and bottom surface of the precast unit are excluded from this condition.

f. Cracks shall not extend through the precast unit.
740.09 MEASUREMENT FOR PAYMENT

740.09.01 Actual Measurement

740.09.01.01 Concrete Barrier
   Tall Wall Barrier
   Asymmetric Concrete Barrier
   Asymmetric Tall Wall Barrier

Measurement will be made in metres along the centreline of the barrier, from end to end of installation, and shall include the length required for lighting pole footings and overhead sign structure footings.

Where two concrete barriers are constructed back to back, Type B or E1, they will be treated as a single installation and the length will be measured only once for payment purposes.

740.09.01.02 Granular

Measurement will conform to OPSS 314.

740.09.01.03 Asphaltic Concrete

Measurement will conform to OPSS 310.

740.09.01.04 Temporary Concrete Barrier

Measurement will be made along the centreline of the barrier in metres from end to end of the installation, including temporary end sections for the supply, installation and removal of the maximum length of barrier required to be in place at any one time during the life of the contract.

740.09.01.05 Temporary Concrete Barrier, Relocation

Measurement will be made along the centreline of the barrier, in metres from end to end including end sections for each relocation.

Barrier that is temporarily surplus for intermediate stages, but will be required for later stages, will be paid as one relocation for the combined moves into and out of on site storage, including any off site storage required due to space restrictions.

740.09.02 Plan Quantity Measurement

740.09.02.01 Concrete Barrier
   Tall Wall Barrier
   Asymmetric Concrete Barrier
   Asymmetric Tall Wall Barrier

Measurement is by Plan Quantity, as may be revised by Adjusted Plan Quantity of the length in metres along the centreline of the barrier, from end to end of the installation, and shall include the length for lighting pole footings and overhead sign structure footings. Where two concrete barriers are constructed back to back, Type B or E1, they will be treated as a single installation for measurement and payment purposes.
740.09.02.02 Temporary Concrete Barrier

Measurement is by Plan Quantity, as may be revised by Adjusted Plan Quantity, of the length in metres along the centreline of the barrier from end to end of the installation, for the supply, installation and removal of the maximum length of barrier required to be in place at any one time during the life of the contract.

740.09.02.03 Temporary Concrete Barrier, Relocation

Measurement is by Plan Quantity, as may be revised by Adjusted Plan Quantity, of the length in metres along the centreline of the barrier from end to end of the installation for each relocation.

Barrier that is temporarily surplus for intermediate stages, but will be required for later stages, will be paid as one relocation for the combined moves into and out of on site storage, including any off site storage required due to space restrictions.

740.10 BASIS OF PAYMENT

740.10.01 Concrete Barrier - Item
   Tall Wall Barrier - Item
   Asymmetric Concrete Barrier - Item
   Asymmetric Tall Wall Barrier - Item

Payment at the contract price for the above item(s) shall be full compensation for all labour, equipment and material required to construct the barriers, including any concrete backfill between Type B or E1 concrete barriers at the location of bridge piers or transitions.

When the Contractor installs precast units as a permanent concrete barrier, the contract price shall include full compensation for placing the concrete pad.

740.10.02 Granular

Granular material used as backfill between concrete barriers shall be paid for at the contract price for the appropriate granular items.

740.10.03 Asphalactic Concrete

Asphalactic concrete laid as a foundation or used as asphalt surface at bridge piers shall be paid for at the contract price for the appropriate hot mix item.

740.10.04 Temporary Concrete Barrier - Item
   Temporary Concrete Barrier, Relocation - Item

Payment at the contract price for the above item(s) shall be full compensation for all labour, equipment and material required to do the work.
Note: This is a non-mandatory Commentary Appendix intended to provide information to a designer, during the design stage of a contract, on the use of the OPS specification in a municipal contract. This appendix does not form part of the standard specification. Actions and considerations discussed in this appendix are for information purposes only and do not supersede an Owner’s design decisions and methodology.

**Designer Action/Considerations**

The designer should specify the following in the Contract Documents:

- Horizontal alignment. (740.07.01.02)

The designer should ensure that the General Conditions of Contract and the 100 Series General Specifications are included in the Contract Documents.

**Related Ontario Provincial Standard Drawings**

No information provided here.