

**CONSTRUCTION SPECIFICATION FOR
CONCRETE CURB AND CONCRETE CURB AND GUTTER**

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TS 3.50.01 SCOPE

This Specification covers the requirements for the construction of plain or reinforced cast-in-place Portland cement concrete curb, concrete curb and gutter, mountable curb and gutter and dropped curb and gutter for entrances and disability access.

TS 3.50.02 REFERENCES

This Specification refers to the following specifications and publications:

Ontario Provincial Standards

OPSS 180 – Management and Disposal of Excess Material

OPSS 408 – Construction Specification for Adjusting or Rebuilding Maintenance Holes, Catch Basins, Ditch Inlets, & Valve Chambers

OPSS 919 – Formwork and Falsework

City of Toronto Standard Specifications

TS 4.50 – Construction Specification for Utility Adjustments

TS 501 – Amendments to OPSS 501 – Construction Specification for Compacting

TS 1010 – Amendments to OPSS 1010 – Material Specification for Aggregates – Granular A, B, M, and Select Subgrade Material

TS 1350 – Amendments to OPSS 1350 – Material Specification for Concrete – Material and Production

City of Toronto Standard Drawings

T-310.010-3 – Concrete Sidewalk with Retaining Curb

T-216.02-5 – Utility Isolation in Composite Pavement

Canadian Standards Association (CSA)

CSA A23.1 – Concrete Materials and Methods of Concrete Construction

TS 3.50.03 DEFINITIONS

For the purposes of this specification the following definitions apply:

Base Course: means a layer of specified or selected materials of planned thickness constructed on the subgrade for drainage and to distribute pavement loads.

Contraction Joint: means a cut or formed joint to regulate the location and degree of cracking in the plane of the curb or curb and gutter.

Expansion Joint: means a physical separation between the concrete and appurtenances, or between parts of the curb or curb and gutter, which allows both horizontal and vertical movement.

Geotextile: means a permeable geosynthetic comprised solely of textiles.

Slipform: means the placing, consolidating and extruding of plastic concrete in a machine without the use of fixed side forms.

Subgrade: means the soil prepared and compacted to support a structure or pavement.

TS 3.50.04 SUBMISSION AND DESIGN REQUIREMENTS

TS 3.50.04.01 General

Any required submissions shall be in writing. All submissions shall be submitted to the City at least three weeks prior to the beginning of the work.

The requirements for submissions and design requirements are given in TS 1350.

TS 3.50.04.02 Materials

Prior to starting the work, the Contractor shall supply the City with material safety data sheets (MSDS) for all the materials to be incorporated in the work.

The Contractor shall be responsible for selecting the concrete materials and for the mix design for the concrete. The concrete mix proportions shall meet the requirements of CSA A23.1 and this Specification.

The certificate of ready mix facilities and/or the certificate of mobile mix concrete production facilities along with the City of Toronto Form A or B (concrete mix details) shall be submitted as required by Specification TS 1350.

Details of the method of curing and curing materials (including manufacturers' literature, where applicable) shall be submitted to the City.

One copy of the concrete delivery ticket shall be submitted to the City for each load of concrete delivered.

TS 3.50.05 MATERIALS

TS 3.50.05.01 Supply of Materials

Unless otherwise specified in the Contract, the Contractor shall supply all materials necessary for the execution and completion of the work.

TS 3.50.05.02 Concrete

TS 3.50.05.02.01 General

The materials for and the production of concrete curb and concrete curb and gutter shall meet the requirements of TS 1350 and the following:

1)	Cement type	Normal Portland GU
2)	Minimum 28 day compressive strength	32 MPa
3)	Class of exposure	C-2
4)	Maximum nominal size of coarse aggregate	19 mm
5)	Slump at point of discharge	80 ± 30 mm
6)	Air content	6.5 ± 1.5%
7)	Maximum water/cementing materials ratio	0.45

TS 3.50.05.03 Reinforcement

Reinforcement shall meet the requirements of TS 1350.

Unless otherwise specified, all reinforcement detailed on the plans or as directed by the City for incorporation in the curb and concrete curb and gutter, shall be 15M bars.

TS 3.50.05.04 Granular Base and Curb Backfill

Granular base and curb backfill, if required, shall be 19 mm crusher run limestone and shall meet the requirements of TS 1010.

TS 3.50.05.05 Expansion Joint Material

Expansion joint material shall be bituminous fibreboard having a minimum thickness of 12 mm and shall meet the requirements of TS 1350.

TS 3.50.06 EQUIPMENT

TS 3.50.06.01 Forms

Forms shall be steel, wood or metal plate forms and shall meet the requirements of OPSS 919. They shall be of sufficient cross section and strength, and so secured as to resist the pressure of the concrete when placed, and the impact and vibration of any construction equipment they support, without springing or settlement.

Forms shall be pinned or staked in place with not less than 3 pins for each 3 m length, and with a pin at each side of each form butt joint. The top surface of the formwork shall comply with the specified tolerances. The inside face of the form shall be vertical. The form shall deviate from grade by no more than 3 mm in 3 m, and in alignment by no more than 6 mm in 3 m.

Forms shall be cleaned and coated with form oil before each use.

TS 3.50.06.02 Slipform Equipment

Guidelines shall be provided at a constant height above, and at a constant horizontal distance from the edge of the proposed curb and concrete curb and gutter. The guidelines may be either wire or heavy-duty string.

The paver shall have automatic horizontal and vertical controls to be used in conjunction with at least one guideline. The equipment shall be equipped with internal vibrators of sufficient number, size and frequency to provide uniform consolidation to the entire cross section. The vibrators shall not operate while the equipment is stopped.

TS 3.50.06.03 Finishing Tools

An aluminum or magnesium float shall be used to float the concrete curb and concrete curb and gutter and a small radius edger shall be used to tool the edges.

TS 3.50.07 CONSTRUCTION

Prior to starting the work, the Contractor shall submit the verification that either the foreman/lead hand or the supervisor of the placing crew has ACI Flatwork Certification.

TS 3.50.07.01 Excavation

Excavation shall be to the lines and grades shown on the contract drawing or as specified by the City. Care shall be taken to prevent damage to appurtenances and utilities which may be in or under the proposed curb and concrete curb and gutter.

At the direction of the City, the Contractor shall make good all damage caused during the course of the work, and return the work to its initial condition.

Excavated material shall be removed from the site in accordance with OPSS 180.

TS 3.50.07.02 Subgrade Preparation

The subgrade shall be compacted to a minimum of 95 percent of the maximum dry density as determined by TS 501.

TS 3.50.07.03 Granular Base Placement

Granular base shall be placed to the required lines and depth as shown on the contract drawings or as specified by the City. The moisture content and compaction of the granular base shall be uniform and shall meet the requirements of TS 1010.

The granular base shall be moistened prior to the placement of concrete, but without any standing water. At the time of placing concrete, the base shall not be wet, soft or frozen.

TS 3.50.07.04 Utility Adjustment

All utility adjustments shall meet the requirements of TS 4.50 and OPSS 408.

TS 3.50.07.05 Utility Isolation

Utility isolations shall be constructed in the concrete curb and concrete curb and gutter by sawcutting the curb or curb and gutter, to depth of 50 mm, at a distance of 300 mm to 400 mm from the outside edge of the frame.

TS 3.50.07.06 Reinforcement

The required reinforcement shall be placed and adequately supported at the locations shown on the drawings.

Unless otherwise indicated, two - 15M longitudinal reinforcing bars, 2 m long shall be placed at each catch basin, one bar 100 mm below the top and one bar 100 mm above the bottom of the curb, centred on the catch basin.

Unless otherwise indicated, two - 15M reinforcing bars shall be placed at the mid-slab depth in the gutter longitudinally across the full width of industrial and commercial driveways. Short bars shall be overlapped by a minimum of 300 mm.

TS 3.50.07.07 Placing Concrete

Concrete shall be placed and consolidated to meet the requirements of CSA A23.1 and the requirements of this Specification. The concrete delivering and spreading operations shall be coordinated to provide a uniform rate of progress of the placing operation.

The concrete shall be placed to the specified thickness, line and grade. The concrete shall be consolidated by 50 mm vibrators and other suitable tools to eliminate voids, honeycombing and entrapped air, especially against the formwork. For concrete placed using slipform equipment, the internal vibrators shall provide the necessary consolidation and no additional vibration will be required.

TS 3.50.07.08 Finishing Concrete

The concrete surface shall be finished while it is still sufficiently plastic to achieve the desired grades, elevation and texture. The surface of the concrete shall not be finished when standing water is present on the surface. The surface shall be uniform, dense and free from undulations and projections.

The top surface shall be screeded to true grade and cross section and finished with a magnesium or aluminum float is recommended.

The surface of the curb and concrete curb and gutter shall have no irregularities exceeding 6 mm in 3 m when tested with a straightedge in any direction. The edge of the curb and concrete curb and gutter shall be edged with a small radius edger.

The final finish for curb and concrete curb and gutter shall have a light brush texture.

TS 3.50.07.09 Joints

Contraction, expansion and construction joints shall be formed or sawcut in the curb and concrete curb and gutter as required. The joints shall coincide with joints in the concrete road base and sidewalks.

TS 3.50.07.09.01 Contraction Joints

Contraction joints shall be constructed by forming or sawcutting to a depth of one quarter of the thickness of the concrete curb and concrete curb and gutter. The maximum distance between contraction joints shall be 6 metres. Joints shall coincide with and be of similar construction to joints in the adjacent sidewalk and road base.

TS 3.50.07.09.02 Expansion Joints

Expansion joints shall be constructed using 12 mm wide bituminous fibre to the full thickness of the curb and concrete curb and gutter as directed by the City.

Full depth (isolation) joints shall be formed around appurtenances extending into and through the curb and concrete curb and gutter. The isolation joints shall be placed perpendicular to the curb between 300 mm and 400 mm from the outside edge of the frame.

The top surface of the bituminous fibre shall be flush with the concrete surface. The fibre shall be vertical and straight in alignment.

TS 3.50.07.09.03 Construction Joints

At the end of each day's work, or in the event of an unavoidable stoppage of concrete placement extending more than 30 minutes, a construction joint shall be formed. Where possible, the construction joint shall coincide with the planned location of a contraction joint.

TS 3.50.07.10 Concrete Curing

Concrete curing shall meet the requirements of TS 1350.

TS 3.50.07.10.01 Curing with Burlap and Water

Burlap mats shall be pre-soaked by immersion in water for at least 6 hours immediately prior to placing. The mats shall cover the entire width and edges of the exposed concrete. The mats shall overlap 300 mm and shall be held down to prevent displacement. The mats shall be maintained in place and kept saturated for a minimum period of 7 days. The Contractor may constantly water the mats or cover them with opaque polyethylene film, or a combination of both, in order to keep the mats saturated.

Alternatively, this method shall be used for a minimum period of 3 days following which the surface shall be cured with curing compound as specified in TS 1350.05.03.02.

TS 3.50.07.10.02 Curing with Geotextile Fabric and Water

Geotextile fabric shall be pre-soaked by immersion in water for at least 6 hours immediately prior to placing. Two layers of fabric shall be applied to the surface of the concrete and shall cover the entire width and edges of the exposed concrete. Strips shall overlap 100 mm and shall be held down to prevent displacement. The fabric shall be maintained in place and kept saturated for a minimum period of 7 days. The Contractor may constantly water the mats or cover them with opaque polyethylene film, or a combination of both, in order to keep the mats saturated.

Alternatively, this method shall be used for a minimum period of 3 days following which the surface shall be cured with curing compound as specified in TS 1350.05.03.02.

TS 3.50.07.10.03 Curing with Polyethylene Film

White, opaque polyethylene film (100 µm thick) shall be placed such that air flow between it and the concrete surface is prevented. The film shall be held down at the edges and laps, and shall be overlapped a minimum of 150 mm, to prevent displacement. The film shall be kept in place for a minimum period of 7 days.

Alternatively, this method shall be used for a minimum period of 3 days following which the surface shall be cured with curing compound as specified in TS 1350.05.03.02.

TS 3.50.07.10.04 Curing with Membrane Compound

Immediately prior to application, the curing compound shall be agitated by mechanical means to provide a homogeneous mixture. Curing compound shall be spray applied in two coats to the concrete surface, with the second coat applied at right angle to the first coat, such that the membrane formed is uniform in thickness and colour and is free of breaks and pinholes. The surface shall be maintained in this condition for a minimum period of 7 days. The rate of application shall not be less than that specified by the manufacturer of the compound.

TS 3.50.07.11 Concrete Curb and Curb and Gutter Protection

Concrete Curb and Concrete Curb and Gutter Protection shall meet the requirements of TS 1350.

TS 3.50.07.12 Backfill

Granular backfill shall be placed to the required lines and depth as shown on the contract drawings or as specified by the City. The moisture content and compaction of the granular backfill shall be uniform and shall meet the requirements of TS 1010.

TS 3.50.08 QUALITY ASSURANCE

Quality assurance shall meet the requirements of TS 1350.

TS 3.50.09 MEASUREMENT FOR PAYMENT

**TS 3.50.09.01 Concrete Curb
Concrete Curb and Gutter**

Measurement for the above item(s) shall be by the length in linear metres along the front face of the curb. No deduction will be made for utility frames and covers.

TS 3.50.10 BASIS FOR PAYMENT

**TS 3.50.10.01 Concrete Curb - Item
Concrete Curb and Gutter - Item**

Payment at the contract price for the above item(s) shall be full compensation for all labour, equipment, materials and incidentals to do the work. Payment shall include, but not be limited to, the supplying, placing and finishing of the concrete, the supplying and placing of steel reinforcement and the supplying, placing and compacting of backfill material.