



CONSTRUCTION SPECIFICATION FOR CONCRETE SIDEWALK

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351.01 SCOPE

This specification covers the requirements for the construction of concrete sidewalks, including ramps.

351.02 REFERENCES

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

Ontario Provincial Standard Specifications, Construction

OPSS 206	Grading
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 - Base, Subbase, Select Subgrade, and Backfill Material
OPSS 1308	Joint Filler in Concrete
OPSS 1350	Concrete - Materials and Production

Ontario Ministry of Transportation Publications

MTO Laboratory Testing Manual:

LS-450 Method of Test for Determination of Concrete Pavement Thickness Using Drilled Core Specimens

MTO Forms:

PH-CC-433A Concrete Mix Design Submission Form A

ASTM International

A48/48M-22 Gray Iron Castings

C171-20 Sheet Materials for Curing Concrete

C1028-07e1 Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method

CSA Standards

A23.2-14C Obtaining and Testing Drilled Cores for Compressive Strength Testing*
* [Part of A23.1-19/A23.2-19 - Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete]

351.03 DEFINITIONS

For the purpose of this specification, the following definitions apply:

Cold Weather means those conditions when the ambient air temperature is at or below 5 °C. It is also considered to exist when the ambient air temperature is at or is likely to fall below 5 °C within 96 hours after completion of concrete placement. Temperature refers to shade temperature.

Sidewalk Bay means the area between two transverse joints, regardless of the type of joint.

351.04 DESIGN AND SUBMISSION REQUIREMENTS

351.04.01 Design Requirements

351.04.01.01 Concrete Mix Designs

The concrete mix used for the sidewalk shall be designed to provide adequate strength and durability and to meet the requirements specified in the Contract Documents.

351.04.02 Submission Requirements

351.04.02.01 Concrete Mix Designs

Concrete mix design(s) submissions shall be according to OPSS 1350.

351.04.02.02 Tactile Walking Surface Indicator Plates

At least 1 week prior to the installation of the tactile walking surface indicator (TWSI) plates, a copy of the Working Drawings shall be submitted to the Contract Administrator.

In addition, the following shall be submitted with the Working Drawings:

- a) The manufacturer's installation instructions.

- b) When requested by the Contract Administrator, a certificate from the manufacturer for the tactile walking surface indicator plates that confirms the product was manufactured and met the test requirements according to the Contract Documents. The certificate shall include test results from an independent testing laboratory currently accredited by the Standards Council of Canada.

351.05 MATERIALS

351.05.01 Concrete

Concrete and concrete materials shall be according to OPSS 1350 with the following addition:

- a) The minimum specified 28-Day compressive strength shall be 30 MPa, or as specified in the Contract Documents.

351.05.02 Expansion Joint Material

Expansion joint filler material shall be asphalt impregnated fibreboard having a minimum of 12 mm thickness and shall be according to OPSS 1308, Type A.

351.05.03 Granular Base

Granular base shall be according to OPSS 1010.

351.05.04 Subgrade Moisture Vapour Barrier

Subgrade moisture vapour barrier shall be according to ASTM C171.

351.05.05 Tactile Walking Surface Indicator Plates

The TWSI plates shall be:

- a) As specified in the Contract Documents.
- b) Cast iron, Gray in colour.
- c) New.
- d) According to ASTM A48, Class 30 or 35B.
- e) Bare and not coated with paint or other coating substances.
- f) Sound, free from pouring faults, cracks, blowholes, and other defects.

The top of the truncated domes and the field between the truncated domes shall have a wet and dry static coefficient of friction of 0.8 according to ASTM C1028.

The initials or trademark of the manufacturer, year of manufacture, and country of manufacture shall be distinctly cast and legible in raised letters on the top side of each plate.

351.06 EQUIPMENT

351.06.01 Formwork

Formwork shall be according to OPSS 919.

351.06.02 Hand Finishing Equipment and Joint Tools

Floats and joint tools shall be made of magnesium or wood. Magnesium bull floats shall be commercially made.

351.06.03 Slip Forming

The equipment used for slip forming shall have automatic horizontal and vertical alignment controls, and shall be used in conjunction with a minimum of one stringline.

351.06.04 Straight Edges

Straight edges shall be according to OPSS 904.

351.07 CONSTRUCTION

351.07.01 General

Concrete sidewalk shall be constructed at the locations and to the dimensions specified in the Contract Documents.

351.07.02 Excavation and Embankment Construction

Excavation and embankment construction shall be according to OPSS 206.

351.07.03 Subgrade

When the subgrade is prepared for granular base, the finished subgrade surface shall be within a 15 mm deviation measured at any point on a 3 m long straight edge.

When the subgrade is prepared for sidewalk, the finished subgrade surface shall be within a 12 mm deviation from the specified grade and cross-section, with the surface being within a 10 mm deviation measured at any point on a 3 m long straight edge.

351.07.04 Granular Base

Placement of granular base material shall be according to OPSS 314.

When a granular base is prepared for sidewalk, the finished granular surface shall be within a 12 mm deviation from the specified grade and cross-section, with the surface being within a 10 mm deviation measured at any point on a 3 m long straight edge.

351.07.05 Compaction

Compaction of subgrade and granular base shall be according to OPSS 501.

351.07.06 Preparation Work

Prior to placing concrete on:

- a) subgrade, the subgrade shall be wetted down, except where clays occur.
- b) granular base, the granular immediately ahead of the concrete placing operation shall be wetted down thoroughly.

The wetting down shall be carried out without leaving standing water.

Alternatively, a subgrade moisture vapour barrier may be placed to completely cover the subgrade under the sidewalk. Adjacent strips shall be lapped 100 mm minimum and ends shall be lapped 300 mm minimum.

351.07.07 Form Setting

Throughout their entire length, forms shall be set true to the lines, grades, and thickness specified in the Contract Documents and in direct contact with the subgrade or granular base.

351.07.08 Utility Isolation in Sidewalk

The required Utility isolations shall be constructed in the concrete sidewalk to the details and locations specified in the Contract Documents.

351.07.09 Placing of Concrete

Placing of concrete shall be according to the Placing of Concrete, General clause and Concrete Placing Restrictions clause of OPSS 904.

Any excess concrete beyond the sidewalk edge shall be removed.

Concrete shall be placed at a steady rate, such that a monolithic concrete is obtained without the formation of cold joints. When there is an interruption in placing concrete greater than 20 minutes, the surface of the concrete shall be covered with wet burlap. The Contract Administrator shall be notified immediately of any interruption resulting in a cold joint. A proposal for remedial action shall be submitted to the Contract Administrator for approval.

351.07.10 Tactile Walking Surface Indicator Plate Installation

A set of two TWSI plates shall be set into plastic concrete at each concrete sidewalk ramp as specified in the Contract Documents and according to the plate manufacturer's installation instructions.

Plates shall be cleaned after installation.

351.07.11 Consolidation

Consolidation of concrete shall be according to OPSS 904.

351.07.12 Concrete Finishing

Concrete finishing shall be according to OPSS 904.

The concrete sidewalk shall be given a broomed texture after finishing with a float.

The concrete adjacent to all formwork and joints shall be finished with a tool that produces a 5 mm rounded edge and a smooth, horizontal surface with a maximum width of 50 mm. All tooling shall be uniform and straight and shall be depressed to a maximum of 1 mm below the adjacent surface. Any ridges along the tooled marks shall be removed.

351.07.13 Joints

351.07.13.01 General

Longitudinal and transverse joints shall be constructed of the type and at the locations specified in the Contract Documents.

351.07.13.02 Dummy Joints

Dummy joints shall be hand formed using a 5 mm radius dummy joint tool.

351.07.13.03 Contraction Joints

Contraction joints shall be placed at every third dummy joint and shall be sawcut or formed to a depth that is one quarter the thickness of the sidewalk.

When sawcutting is used, sawcutting shall be carried out as soon as the joint can be sawcut without ravelling the joint or damaging the concrete surface, and prior to any cracks developing.

Sawcut joints shall be cleaned. Cleaning of joints shall remove all sawcut slurry, grinding and grooving effluent, if applicable, and any other debris from the joint. Cleaning of joints shall consist of flushing the joints with water in one direction to remove slurry, effluent, and debris. Additional methods of cleaning the joints may be required and shall be approved by the Contract Administrator.

When the sidewalk width is 2.5 m or greater, a longitudinal contraction joint shall be sawn or formed at a maximum spacing interval of 1.5 m. Longitudinal contraction joints shall be constructed with equal spacing between joints and from joints to the sidewalk edges.

351.07.13.04 Expansion Joints

Expansion joints shall be constructed to the full depth of the slab.

Expansion joints shall be filled with expansion joint material and shall be clean and dry at the time of construction.

Expansion joints shall be constructed where the sidewalk abuts a rigid object or changes direction.

351.07.14 Identification Stamp

The concrete sidewalk shall be clearly and legibly marked with an approved stamp at each end of the work, every 20 m and all other places as directed by the Contract Administrator. The stamp shall be centered on the sidewalk bay next to and parallel to transverse joint. The stamp shall identify the Contractor's name and the year of construction.

351.07.15 Curing

Concrete curing shall be according to OPSS 904.

351.07.16 Concrete Subject to Cold Weather

For concrete subject to cold weather during the curing period, the protection of concrete shall be according to OPSS 904

351.07.17 Protection of Sidewalk

Vehicular traffic shall be restricted from crossing the sidewalk after the concrete has been placed for a minimum period of 3 Days or until the concrete has reached 75% of the specified 28-Day compressive strength.

351.07.18 Surface Tolerance

Formed and unformed surfaces shall be such that when tested with a 3 m long straight edge placed anywhere in any direction on the surface, there shall be no gap greater than 6 mm between the bottom of the straight edge and the surface of the concrete. When the straight edge is placed across a construction joint, the gap between the straight edge and the surface of the concrete shall not be greater than 3 mm.

351.07.19 Tactile Walking Surface Indicator Plate Tolerances

Tolerances for the tactile walking surface indicator plates shall be as specified in the Contract Documents. If the TWSI plates are not within the specified tolerances, the plates shall be rejected.

Rejected plates shall be removed and replaced as directed by the Contract Administrator.

351.07.20 Material Sampling for Thickness

Core samples shall be obtained for acceptance testing of sidewalk thickness. Cores shall be taken when the concrete is a minimum of 7 Days of age. The Contract Administrator shall randomly select one core from each lot. Coring shall be carried out according to CSA A23.2-14C. The cores shall be 100 mm in diameter and shall be drilled through the full depth of the sidewalk, perpendicular to the concrete surface.

Each core shall be marked legibly with durable ink immediately after removal with the following:

- a) Contract number.
- b) Lot number.
- c) Exact location of each individual core.
- d) Date of concrete placement (ie. yyyy-mm-dd).
- e) Date of extraction.

The cores, a transmittal form, and MTO form PH-CC-433A, Concrete Mix Design Submission Form A shall be submitted to the Contract Administrator. Filling of Core Holes shall be according to OPSS 1350.

One core shall be removed per lot for testing of thickness by the Owner. The core shall be taken at a random location specified by the Contract Administrator. Coring shall be carried out according to CSA A23.2-14C. The core shall be 100 mm in diameter and shall be drilled through the complete depth of concrete sidewalk. The Contract number, lot number and exact location of the core shall be marked legibly on the core with durable ink. The core shall be given to the Contract Administrator along with Form A of the concrete mix design.

351.07.21 Management of Excess Material

Management of excess material shall be as specified in the Contract Documents.

351.08 QUALITY ASSURANCE

351.08.01 Acceptance

The concrete sidewalk shall be acceptable if all requirements of this specification are met, including requirements for:

- a) 28-Day compressive strength.
- b) Air void system parameters.
- c) Thickness.
- d) Surface tolerance.
- e) There are no defects detected by field inspection according to the Field Inspection subsection.

Acceptance for 28-Day compressive strength and air void system parameters shall be according to OPSS 1350.

Unacceptable lots shall be deemed rejectable. Concrete from unacceptable lots shall be removed and replaced at the Contractor's expense.

The replacement concrete sidewalk for lots that have been removed and replaced shall be evaluated for acceptance on the same basis as the original lots.

351.08.02 Field Inspection

The Contract Administrator shall inspect the work and shall reject all or a portion of the work based on the presence of one or more of the following defects:

- a) Cracks.
- b) Voids, or
- c) Honeycombing.
- d) Surface tolerance not meeting the requirements of this specification.

351.08.03 Acceptance of Thickness

351.08.03.01 Acceptance Testing

The lot size for testing of thickness shall be 500 lineal metres of sidewalk. The sidewalk thickness for each lot shall be determined based on the length of the core removed from each lot for thickness testing. Testing of thickness shall be according to LS-450.

Concrete thickness for a lot shall be considered acceptable when the thickness of the core is not more than 8 mm shorter than the specified thickness.

Unacceptable lots shall be removed and replaced.

The Contractor may submit an alternative in writing for the Owner's consideration for unacceptable concrete.

351.08.03.02 Referee Testing

Referee testing for a lot may only be invoked by the Contractor within 5 Business Days of receiving the test results for that lot.

Referee testing of thickness for a lot shall be done on the same core that was used for acceptance testing of thickness. Referee testing of thickness shall be according to LS-450.

If the difference between the referee test result and the acceptance test result is less than or equal to the confirmation value, then the acceptance test result is confirmed, and the acceptance test results shall be used in the determination of acceptance of the concrete. If the difference between the referee test result and the acceptance test result is greater than the confirmation value, the acceptance test result is not confirmed, and the acceptance test result shall be disregarded and not used in the determination of acceptance.

The confirmation value for confirming the acceptance test result shall be 5.0 mm.

When the referee result confirms the acceptance test result, the Contractor shall be charged the cost of referee testing. When the referee result does not confirm the acceptance test result, the Owner shall bear the cost.

351.09 MEASUREMENT FOR PAYMENT

351.09.01 Actual Measurement

351.09.01.01 Concrete Sidewalk

Measurement of concrete sidewalk shall be by area in square metres.

351.09.01.02 Tactile Walking Surface Indicators for Concrete Sidewalk Ramps

For measurement purposes a count shall be made for each set of TWSI plates installed at each concrete sidewalk ramp. A set shall consist of two TWSI plates.

351.09.02 Plan Quantity Measurement

When measurement is by Plan Quantity, such measurement shall be based on the units shown in the clause under Actual Measurement.

351.10 BASIS OF PAYMENT

351.10.01 Concrete Sidewalk - Item

Payment at the Contract price for the above tender item shall be full compensation for all labour, Equipment, and Material to do the work.

Repair or removal and replacement of an unacceptable sidewalk bay shall be completed at no extra cost to the Owner.

351.10.02 Tactile Walking Surface Indicators for Concrete Sidewalk Ramps - Item

Payment at the Contract price for the above tender item shall be full compensation for all labour, Equipment, and Material to do the work.

351.10.03 Excavation

Payment for excavation shall be under the tender item Earth Excavation, Grading or Rock Excavation, Grading according to OPSS 206.

No payment shall be made for appurtenances adjusted by the Utility company.

351.10.05 Granular Material

Granular materials required for the work shall be paid for at the Contract price for the appropriate granular tender item.