

1.0 GENERAL

1.1 Scope

- 1.1.1 Concrete sidewalk, sidewalk crossings (i.e. pedestrian ramps), curb and gutter, rolled curb and gutter, monolithic walk, curb and gutter, concrete apron and structural sidewalk, concrete median, boulevard and island paving shall be constructed in accordance with the following specifications and the standard drawings. The type of construction to be used will be shown on the construction plans or as directed by the Engineer and shall be in accordance with the provisions of this section.
- 1.1.2 The Contractor will be given the option of constructing hand formed sidewalk, curb and gutter at the unit rate bid in the schedule, provided that tie bars are used to tie the walk to the curb and gutter when poured separately. Extruded concrete shall meet the requirements of these specifications.

1.2 Related Sections

- 1.2.1 Section 2110 – Excavation
- 1.2.2 Section 2120 – Embankment
- 1.2.3 Section 2130 – Subgrade Preparation
- 1.2.4 Section 2230 – Granular Base Course
- 1.2.5 Section 2500 – Supply of Portland Cement Concrete

2.0 PRODUCTS

2.1 Concrete

- 2.1.1 Concrete shall conform to Section 2500 – Supply of Portland Cement Concrete

2.2 Granular Material

- 2.2.1 Type 33 Base Course in accordance with Section 2230 – Granular Base Course.

2.3 Reinforcing Bars

- 2.3.1 All reinforcing steel shall be supplied according to the type and dimensions as shown on the Drawings.
- 2.3.2 All reinforcing steel shall be shall conform to the requirements of CSA G30.12-M, Billet-Steel Bars for Concrete Reinforcement. If, in the opinion of the Engineer, any reinforcing steel provided for the concrete works exhibits flaws in manufacture or fabrication, such material shall be immediately removed from the site and replaced with acceptable reinforcing steel.
- 2.3.3 The reinforcing steel shall be supplied in accordance with the following requirements:
 - .1 Tie Bars shall be Grade 40 deformed bars.

- .2 Dowel Bars shall be Grade 40 plain bars.
- .3 Bar Accessories shall be of a type approved by the Engineer.
- 2.3.4 All reinforcing steel shall be straight and free from paint, oil, mill scale and injurious defects. Rust, surface seams or surface irregularities will not be cause for rejection provided that the minimum dimensions, cross-sectional area and tensile properties of a hand wire-brushed specimen are not less than the requirements of CSA G30.12M.
- 2.4 Curing Compound
 - 2.4.1 The Compound shall equal or exceed the ASTM "Specification for Liquid Membrane-Forming Compounds for Curing Concrete," Designation C-309. The water retention efficiency tests shall be carried out in accordance with ASTM C156.
 - 2.4.2 The Compound shall adhere to damp concrete having a horizontal or vertical surface and form a continuous film when applied according to the manufacturer's instructions. When dried, the Compound shall not be tacky and must adhere to the concrete surface even under normal pedestrian traffic conditions. The film shall not render the concrete surface slippery. The Compound shall be clear or translucent, resinous base, non-bituminous. It shall contain a fugitive dye, readily distinguishable upon the concrete for at least four hours after application. The colour shall become inconspicuous within seven (7) days of application.
- 2.5 Polyethylene Film
 - 2.5.1 Polyethylene film shall be clear or white opaque and conform to the requirements of ASTM C171.
- 2.6 Form Coating
 - 2.6.1 Form coating shall be of a type approved by the Engineer.
- 2.7 Joint Sealer
 - 2.7.1 The joint sealer shall be a hot-poured elastic type and shall conform to the requirements of ASTM D6690, Specification for Joint Sealants, Hot-poured, for Concrete and Asphalt Pavements.
- 2.8 Fibre Joint Filler
 - 2.8.1 Fibre joint filler shall be rot-proof and of the preformed, non-extruding, resilient type made with a bituminous fibre and shall conform to the requirements of ASTM D1751 or D1752, Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction.

3. EXECUTION

3.1 Excavation and Base

- 3.1.1 The subgrade shall be excavated in accordance with Section 2110 for Excavation, Section 2120 for Embankment and Section 2130 for Subgrade Preparation.
- 3.1.2 Disturbed subgrade material shall be compacted in accordance with the above specifications. Frequency of density tests shall be as indicated in the above specifications.
- 3.1.3 A **minimum** 150 mm layer of granular **material** shall be used under concrete sidewalks, curb and gutters, concrete median, boulevard & island paving. If necessary, **compacted** subbase, granular base course or native earth material (in accordance with their respective specifications) shall be used to raise the subgrade to allow for the 150 mm layer of **granular material**. **Acceptable granular materials includes subbase and base course and recycled materials. If recycled material is used it must meet the specifications for subbase or base and must be approved by the Engineer.**
- 3.1.4 The **granular material** on which the concrete will rest shall be compacted to a minimum **95%** standard proctor density. Frequency of density tests shall be as indicated in the specifications.
- 3.1.5 During hot weather or if the **granular material** on which the concrete will rest is dry, dampen the subgrade prior to placing concrete without creating mud or the ponding of water.
- 3.1.6 The placing of concrete on **granular material** which is too wet or too dry, or which is frozen, will not be permitted. The prepared grade shall be sufficiently moist to prevent absorption of water from the freshly placed concrete, but must be free from mire or water pondage.

3.2 Forms

- 3.2.1 Forms shall be in accordance with CSA 7.2.4.7 and be of steel or wood of sufficient strength to resist the pressure of plastic concrete, and the supply shall be sufficient to until the concrete has attained sufficient strength to support its own weight, together with construction loads likely to be imposed. The use of bent, twisted, battered or worn- out forms will not be permitted. Forms may be checked for alignment and elevation by the Engineer before concrete is poured, and shall be cleaned and oiled before each use. Where required, reinforcement shall be secured in the location shown on the drawings and shall be free from scale, grease and rust immediately prior to placing concrete. Forms shall be held securely by approved methods to prevent movement and bulging when the concrete is being placed. Flexible forms will be required for all curves with a radius of less than five metres.

3.3 Depositing of Concrete

- 3.3.1 Concrete shall be deposited in the forms as close as practicable to its final

position, and in no case more than 1 m from the point of final deposit in the horizontal or vertical direction. Concrete shall not be deposited by vibration to prevent segregation, unless approved by the Engineer.

- 3.3.2 Special care shall be taken to place the concrete against the forms, particularly in corners, in order to prevent voids, pockets, rough areas and honeycombing. The concrete shall be tamped in such a manner as to work the coarse aggregate away from the forms and exposed surfaces. For consolidated works, vibrators can be used subject to the approval of the Engineer. Concrete shall be placed continuously until a complete section between expansion joints has been poured.
- 3.3.3 The concrete shall be thoroughly consolidated against and along the faces of the forms. Hand spreading shall be done with shovels and concrete rakes, in order that the concrete will not be segregated. Precautions should be taken to prevent overworking of the concrete.

3.4 Finishing

- 3.4.1 The surface shall be levelled in accordance with CSA A23.1-04. A vibrator mounted levelling beam or other appropriate equipment may be used if approved by the Engineer. Special care shall be taken not to over-vibrate the concrete and in no case shall an excess of water be brought to the surface/or added to the surface. The surface shall then be marked in the specified manner and left until the concrete has set sufficiently to permit the finishing operations without causing bleeding. At this time the surface shall be brought to a true surface with a wood-float and a uniform brush finish shall be applied. Final marking of the blocks shall then be carried out leaving blocks with edges rounded or levelled to a radius of not less than 10 ± 5 mm. The edges of the walk and the lines dividing the walk into sections shall be rigidly straight; joints with ragged edges will not be permitted.
- 3.4.2 The Contractor shall mark each City block or portion of block with a suitable tool showing the name of the Contractor and the year constructed.
- 3.4.3 The Contractor shall supply the marking tool and shall mark the sidewalk with the letters "WCB" at each water curb box location. The mark is to be placed 150 mm from the back of the sidewalk.

3.5 Joints

3.5.1 Expansion Joints

- .1 Expansion joints are required where indicated on the plans and around pole bases, manholes, catch basins and other appurtenances surrounded by concrete. This joint shall be 10 mm wide and truly perpendicular.
- .2 No expansion joints shall be placed within 3 m of a service connection lead, catch basin or fire hydrants.
- .3 A strip of expansion joint material 10 mm thick and to the full depth of the sidewalk shall be placed around the base of all poles and other isolated places

as specified.

3.5.2 Contraction Joints

- .1 Contraction joints shall be placed every 1.5 m or less, by means of a marking tool or other approved method, whose depth shall not be less than 40 mm and width shall not be less than three (3) mm but not more than six (6) mm. The edge of the joint shall be rounded off with an edger having an arc of a circle having 10 mm as a radius. These joints shall be perpendicular to the longitudinal axis of the sidewalk, curb and gutter and shall extend through the full width of the sidewalk, curb and gutter.

3.5.3 Surface Joints

- .1 After trowelling, a joint not less than 10 mm deep shall be marked in the surface of the walk as shown on the drawings. The edge of the joint shall be rounded off with an edger having an arc of a circle of a 10 mm radius.

3.5.4 Sawed Joints

- .1 If required, saw joints shall be made with a special concrete saw capable of producing a true straight joint of constant depth in accordance with Section 2010. Sawed joints shall be completed while the concrete is in a hardened state and has obtained sufficient strength in accordance with CSA A23.1. Max width should be 3 mm.

3.5.5 Cold Joints

- .1 Cold joints are required at the end of each day's placement of concrete at a contraction joint location. This joint shall be perpendicular to the surface and curb line. Dowels are to be inserted, as shown on the standard drawings, in order to provide a tie to the next pour of concrete.

3.6 Reinforcing

- 3.6.1 The radii shall have five, 10 M reinforcing bars for monolithic walk curb and gutter in accordance with the pattern shown in Standard Roadway Drawing R-9A. In residential areas, reinforcing in the curb radius may be omitted if approved by the Engineer. Use reinforcing bar, to bond new to older work at cold joints, in accordance with the pattern shown in Standard Roadway Drawing R-7B – Dowel Detail for Expansion Joints. At least 150 mm of the dowels shall extend beyond the cold joint, into existing concrete.
- 3.6.2 All separate curb and gutter constructed adjacent to Commercial or Industrial Zoned Areas shall be reinforced with two 10 M reinforcing bars.
- 3.6.3 All curb and gutter and sidewalk bridging a catch basin, manhole or similar underground support shall be reinforced in accordance with the pattern shown in Standard Roadway Drawings R-11 (A, B, C, D). At least 150 mm of the dowels shall extend beyond the cold joint, into existing concrete.
- 3.6.4 All walk poured as a separate operation behind the curb and gutter shall be held in place by 600 mm 10 M bars inserted into the curb and gutter, at 1.5 m on

centre (centre line of walk panels). At least 150 mm of the bar shall extend beyond the cold joint, into existing concrete.

- 3.6.5 All Commercial and Industrial crossings shall be reinforced in accordance with the pattern shown in Standard Roadway Drawing R-10. At least 150 mm of the dowels shall extend beyond the cold joint, into existing concrete.

3.7 Curing and Protection

- 3.7.1 After the concrete has been finished to cross-section and as soon as the concrete has set sufficiently, the entire surface shall be sprayed with a concrete curing compound in a manner and in such quantity as will be directed by the Engineer. All concrete surfaces that are left exposed to the air after removal of forms shall be cured in the same manner as described in the immediately above after removal of forms.

- 3.7.2 No vehicular traffic shall be allowed to cross the crossings for a period of seven (7) days after construction or when 20 MPa has been reached (field cure cylinders or concrete cores) and substantial barricades shall be erected and maintained for this purpose. All freshly laid concrete shall be barricaded with suitable barricades for a period of one (1) day and any damage to the finish of the walks or crossings shall be corrected.

- 3.7.3 No heavy construction equipment shall be allowed to operate adjacent to the freshly laid concrete for a period of seven (7) days for normal strength concrete and three (3) days for high early strength concrete or when 20 MPa has been reached (field cure cylinders or concrete cores) or as approved by the Engineer.

- 3.7.4 If these corrections are not carried out before the concrete is hardened, repairs shall be made by the Contractor by replacing all damaged walk or curb and gutter. Patching will not be permitted. The forms shall be removed with care, as not to damage the walk or curb. In the event of any defect in construction or finish, the entire sections must be removed on the order of the Engineer.

- 3.7.5 The Contractor shall maintain on the job sufficient canvas or other suitable covering to protect all freshly laid concrete from the action of the elements.

- 3.7.6 The Contractor shall be responsible for supervision and monitoring of freshly-poured concrete until the concrete sets and hardened to prevent vandalism.

3.8 Cold Weather Requirements

- 3.8.1 When the atmosphere has a temperature lower than 5°C, all reinforcing materials, forms, and ground with which the concrete is to come in contact shall be defrosted and in no case shall concrete be deposited on or against any surface which is at a temperature of less than 2°C.

- 3.8.2 No concrete shall be placed on frozen subgrade (native or granular). If the subgrade is frozen it shall be thawed prior to concrete placement.

- 3.8.3 Concrete placement and protection shall be limited by the following table.

Concrete temperature shall not drop below 10°C during the curing period. Rapid cooling of the concrete at the end of the heating period is to be avoided.

Outside Minimum Ambient Air Temperature	PROTECTIVE MEASURES
5°C to 25°C	Normal curing - no temperature protection required.
Below 5°C	Adequate insulation for 7 days to achieve strength specified in CAN/CSA-A23.04 with suitable enclosure or supplementary heat.

- 3.8.4 Concrete shall be adequately protected from freezing for a minimum of seven (7) days after completion of placing operations, or longer as required to ensure that the pavement opening requirements of this Specification are met. Protection shall be provided such that the surface of the concrete is maintained a minimum temperature of 10°C for the period specified.
- 3.8.5 The Contractor may request the use of high early strength concrete at his own expense.
- 3.8.6 All concrete showing evidence of freezing shall be removed from the job and replaced at the Contractor's expense.
- 3.9 Hot Weather Requirements
 - 3.9.1 Hot weather is defined for the purpose of this specification as a combination of low relative humidity, windy conditions and high temperatures. The Contractor is advised that the placing of concrete when the evaporation rate exceeds 0.5 kg/m²/hr (determined from Standard Drawing R-18) results in a substandard product that shall not be accepted. The removal and replacement of such if required would be at the Contractor's expense.
 - 3.9.2 The Contractor shall limit the amount of concrete poured during hot weather to enable the work to be finished to the satisfaction of the Engineer. Surface wetting to facilitate finishing is not permitted. Protective measures to prevent fast setting of the concrete are to be implemented.
- 3.10 Inspection
 - 3.10.1 The finished surfaces of all concrete work shall be true to the required cross-section with a tolerance of ± 10 mm from the required elevation and dimensions. Surfaces of curbs, gutters or sidewalks shall not show any depressions or bumps exceeding 5 mm under a straight edge 3 m long, placed parallel to the curb or sidewalk. Concrete not meeting the requirements specified shall be removed to the nearest joint and replaced at the Contractor's expense.
- 3.11 Walk Transition

3.11.1 At those corners where the sidewalk width is reduced, the reduction should be tapered uniformly throughout the entire curve.

3.12 Driveway Crossings

3.12.1 The depth of the walk shall be increased from 130 mm to 180 mm for any crossings in or adjacent to commercial and/or industrial zone properties. Reinforcing for Commercial and Industrial crossings shall be in accordance with Roadway Standard Drawing R-7A. The payment for the extra 50 mm of concrete required for such crossings shall be included in the tender price for concrete crossing. Reinforcing bar may be required in certain crossings as designated in this Section, on the plans, City of Regina Standard Drawings or by the Engineer.

Road Type	Depth
Residential	130 mm
Alley	180 mm (see R-7A for reinforcing)
Commercial	180 mm (see R-7A for reinforcing)
Industrial	180 mm (see R-7A for reinforcing)

3.13 Pedestrian Ramps

3.13.1 Pedestrian ramps shall be installed in all radii according to details set out in City of Regina Standard Drawings or as approved by the Engineer. Tactile Markings shall be produced by a tool similar in detail to that set out in City of Regina Standard Drawings.

3.14 Completion Inspection Criteria

3.14.1 The acceptance criteria for Concrete shall conform to sections 2500 and 2550 of the specifications.

3.14.2 The finished Concrete shall be free of but not limited to cracking (horizontal, longitudinal, shrinkage, craze, and settlement), scaling, chipping, pop-outs (caused by deleterious material, lightweight shale, chert and ironstone), blisters, honeycombing, rain spots, marring from plastic covering, staining, drainage defects, and Alkali Silicate Reactions. Either a pay reduction or a remove and replace will be applied based on the criteria in the table on the following page.

3.14.3 When a deficiency is removed and repaired, the size of section is to be determined by the Engineer. The new material will be subject to testing and inspection of the product for conformance to this specification.

3.14.4 The action required in the following table will be determined by the Engineer. If applicable the Engineer may allow the Contractor options as presented in the following table.

<u>Deficiency Item</u>	<u>Action Required</u>	<u>Corresponding Pay Reduction</u>
Cracking	Length and width of cracking	50% pay reduction for affected

	<p>measured</p> <ul style="list-style-type: none"> • Penalty applied, or • Remove and replace panels affected 	area based on severity.
Scaling	Remove and replace panels affected	Repair required
Chipping	Remove and replace panels affected	Repair required
Pop-outs	<p>Area measured. Number of pop-outs counted for the area.</p> <ul style="list-style-type: none"> • Penalty applied, or • Remove & replace panels affected if three or more pop-outs per panels 	50% pay reduction for affected area.
Blisters	Remove and replace panels affected.	Repair required
Honeycombing	Repair as directed by Engineer, or Remove and replace	Repair required
Rain spots	<p>Area measured.</p> <ul style="list-style-type: none"> • Penalty applied, or • Remove and replace panels affected 	50% pay reduction for affected area based on severity.
Marring from plastic	<p>Area measured.</p> <ul style="list-style-type: none"> • Penalty applied, or • Remove and replace panels affected 	50% pay reduction for affected area based on severity.
Staining	<p>Area measured.</p> <ul style="list-style-type: none"> • Penalty applied, or • Remove and replace panels affected 	50% pay reduction for affected area based on severity.
Footprints, tire tracks, graffiti, etc.	<p>Area measured.</p> <ul style="list-style-type: none"> • Remove and replace • panels affected based on severity 	Repair required
Drainage defects	Remove and replace panels affected.	Repair required
Alkali Silicate Reaction defects	Remove and replace panels affected	Repair required