

4. Curbs, Gutters, and Sidewalks

PART I – DESIGN

4.1 General

4.1.1 Unless otherwise approved, all curb, gutter and sidewalk shall be as outlines in these standards.

4.2 Sidewalks and Walkways

- 4.2.1 Sidewalks and walkways through residential areas, commercial areas, and parks shall form an integrated pedestrian circulation system through the Development.
- 4.2.2 For all roadways, unless otherwise authorized or directed by the Town, sidewalks will be located in accordance with the Engineering Standard Drawings.
- 4.2.3 Sidewalks shall be provided on both sides of the roadway, except for industrial roadways. Consult the Town for the site-specific sidewalk requirements in industrial and commercial zones.
- 4.2.4 For cul-de-sacs, sidewalks are required along the entire perimeter unless otherwise approved by the Town.
- 4.2.5 The Design must consider pedestrian access and allow for walkways through cul-de-sacs and other locations, as appropriate.
- 4.2.6 Sidewalks and walkways shall be a minimum 1.5 m wide with a maximum grade of 6% longitudinally, 2% in the crossfall direction, and in accordance with the Engineering Standard Drawings.
- 4.2.7 Walkways for parks, hereafter referred to as trails, shall be constructed of asphalt concrete in accordance with the Engineering Standard Drawings. Asphalt concrete shall meet the applicable sections of Section 3.0.
- 4.2.8 The horizontal alignment of sidewalks along roads shall be parallel to the centreline of the right-of-way wherever possible.
- 4.2.9 Sidewalk and walkway grading shall be done in accordance with the lot grading plan and shall be done in such a way as to avoid conflicts with the drainage pattern within the right-of-way. Walkway landings shall be provided as required in steeper slope areas.
- 4.2.10 Changes in grade shall be gradual.
- 4.2.11 No sidewalk or walkway shall be used as a drainage swale.
- 4.2.12 Paraplegic ramps shall be provided at all intersections with walkway access in accordance with the Engineering Standard Drawings.
- 4.2.13 Pedestrian protection (i.e. trees, shrubs, bollards, etc.) may be required at the intersection of primary walkways/trails and roadways, as directed by the Town.
- 4.2.14 The Town may require that benches, waste receptacles, and other street furniture be strategically placed along certain sidewalks or walkways. Refer to the Town's landscape standards for further details regarding street furniture.

4.3 Curb and Gutter

- 4.3.1 For all roadways, concrete curb and gutter shall be provided in accordance with the Engineering Standard Drawings.
- 4.3.2 All curb and gutter driveway crossings shall be reinforced with a minimum of two 10m rebar (or equivalent steel reinforcement).
- 4.3.3 Vertical face curb and gutter shall be provided along all roadways fronting parks and public utility lots (except for emergency accesses) unless other means of protecting vehicular access into these lands is provided. Curb access for Town maintenance equipment must be provided, complete with knockdown bollards.
- 4.3.4 Where a transition section is required between differing types or sizes of curbs and gutters, the engineering drawings must include a detail showing how the transition is to be constructed.
- 4.3.5 Curb Returns
 - a.) For local and collector roadway intersection curb returns, the minimum curb radius shall be based upon the vertical turning movement for the anticipated traffic, vehicle capacity, Town analysis, and speed reduction. Typically, this will require a minimum radius 10 m for local roadway intersections where the road will not be a bus or truck route, and 15 m for all other collector and arterial roadway intersections.
 - b.) Curb returns on local residential roadways shall have a minimum radius of 10 m. The curb shall transition into a vertical face cross-section 1.0 m prior to the start of the curb return and a reverse transition 1.0 m after the end of the curb return at the intersecting roadway. This requirement may be slightly modified by the Town to accommodate catch basins which must be located within the curb return.
 - c.) Curb returns on local industrial roadways, collector roadways, and arterial roadways shall be constructed with a minimum radius of 15.0 m to accommodate truck turning movements.
- 4.3.6 All new sidewalks that are to be built abutting existing curb must be pinned. Town must be contacted to inspect project a minimum of 24 hours prior to pouring of concrete.

PART II – MATERIALS

4.4 Portland Cement Concrete

4.4.1 Portland Cement

- a.) Portland cement shall conform to type 50 sulphate resistant.

4.4.2 Aggregate

- a.) Aggregate shall conform to CAN/CSA-A23.1 Clause 5.
- b.) Coarse aggregate is the total aggregate retained on a 5 mm sieve. Fine aggregate is the total aggregate passing through a 5 mm sieve and retained on a 2.5 mm sieve.
- c.) Ironstone content in coarse aggregate shall not exceed 1.0% by mass of the total coarse aggregate sample.
- d.) Ironstone content in fine aggregate shall not exceed 1.5% by mass of the total, dry, unwashed fine aggregate sample.
- e.) Where ironstone content testing results are greater than the maximum specified ironstone content, the concrete represented by the failed test shall be removed and replaced by the Contractor, at the Contractor's sole expense.

4.4.3 Water

- a.) Water shall be clear, free from deleterious material that may inhibit proper mixing and curing of concrete, and in accordance with CAN/CSA-A23.1 Clause 4.

4.4.4 Air-Entraining Admixtures

- a.) Air-entraining admixtures shall conform to ASTM-C260.

4.4.5 Chemical Admixtures

- a.) Chemical admixtures, including water-reducing agents, retarders, and accelerators, shall conform to ASTM-C494.
- b.) The use of chemical admixtures shall only be permitted upon written authorization of the Town.

4.4.6 Fly Ash

- a.) Fly ash shall conform to CAN/CSA-A3000, A23.5, pozzolan Type F or Type Cl.
- b.) Up to 10% of the specified minimum cement content may be replaced with fly ash for concrete production between May 16 and September 30.

4.4.7 Curing Compound

- a.) Curing compound shall conform to ASTM-C309, Type 2, Class B, white pigment, resin- based, liquid membrane-forming compound.

4.4.8 Joint Filler and Sealant

- a.) Preformed joint filler shall conform to ASTM-D1751.
- b.) Joint sealant shall conform to ASTM-D1190, hot-poured elastic type.

4.4.9 Mix Design

- a.) The mix design shall conform to the following:
 - i. Slump: 60 ± 20 mm;
 - ii. Entrained air limits: greater than 5.5% by volume;
 - iii. Maximum aggregate size: 20 mm;
 - iv. Maximum water to cementing materials ratio: 0.45 by mass;
 - v. Minimum cement content:
 - vi. 335 kg/m^3 between April 15 and May 15 or between October 1 and October 15; or
 - vii. 302 kg/m^3 between May 16 and September 30.
 - viii. Maximum fly ash content:
 - ix. None between April 15 and May 15 or between October 1 and October 15; or 33 kg/m^3 between May 16 and September 30.
 - x. Minimum 28-day compressive strength:
 - xi. 30 MPa for air content 5.5 to 5.9%;
 - xii. $[42 - (2 \times \text{air content } \%)]$ MPa for air content 6.0 to 8.0%; or
 - xiii. 26 MPa for air content greater than 8.0%.
- b.) If concrete is to be placed by pumping, the specified slump and air content shall be met at the point of pump discharge.
- c.) Concrete shall not be placed between October 16 and April 1 unless written authorization has been issued by the Town. All concrete authorized to be placed during this period shall attain a minimum compressive strength of 27.0 MPa at 7 days, and shall be provided with cold-weather protection, in accordance with CAN/CSA-A23.1 Clause 23.2.3.4, sufficient to maintain concrete surface temperatures 10°C or greater for 7 consecutive days following placement. Submit a detailed work plan for all such authorized cold-weather concrete work to the Town for review and acceptance at least 5 days in advance of such scheduled concrete work at the site.

- d.) For slip formed concrete, limit slump as follows:
 - i. For curbs and gutters: 20 ± 10 mm; and
 - ii. For walks: 30 ± 10 mm.

4.5 Concrete Formwork

4.5.1 Formwork Materials

- a.) Formwork materials shall be in accordance with CAN/CSA-S269.3; plain, reusable, pre-coated plywood sheets or formed steel panels.
- b.) The use of forms that are dented, rough, out of shape, or otherwise unsuitable shall not be permitted.
- c.) The use of earth forms is prohibited, except where specifically authorized by the Town.

4.5.2 False work Materials

- a.) False work materials shall be in accordance with CAN/CSA-S269.1.

4.5.3 Form Ties

- a.) Form ties shall be removable or snap-off metal ties, fixed or adjustable length, and free of devices which may leave holes larger than 25 mm diameter in the concrete surface.

4.5.4 Form Release Agents

- a.) Form release agents shall be chemically active agents containing compounds that react with free lime in concrete resulting in water insoluble soaps.

4.5.5 Void Forms

- a.) Void forms, where required, shall be inert closed cell expanded polystyrene.
- b.) "Frost Cushion" by Beaver Plastics, or accepted alternate.

4.5.6 Form Stripping Agent

- a.) The form stripping agent shall be colourless mineral oil, free of kerosene, with viscosity between 15 and 24 mm²/s at 40 °C, flashpoint minimum 150 °C, open cup method.

4.5.7 Slipform Equipment

- a.) Slipform equipment shall be of a design suitable to the Work, suitable for use with vibratory equipment, and capable of uniformly extruding, spreading, shaping, and consolidating freshly poured concrete into a dense, homogeneous formation.
- b.) The equipment should produce a concrete surface requiring minimal hand finishing.
- c.) The equipment shall be self-propelled and capable of automatically controlling alignment and grade.

4.5.8 Reinforcement

Reinforcing for concrete structures, where required, shall conform to the following:

4.5.9 Reinforcing Steel

- a.) Reinforcing steel shall be grade 400, billet steel, deformed bars in accordance with CAN/CSA-G30.18, unless otherwise specified or directed by the Town.
- b.) Weldable, low alloy steel deformed bars, where specified, shall duly conform to CAN/CSA-G30.18.

4.5.10 Tie Bars

- a.) Tie bars shall be grade 300, billet steel, uncoated, deformed bars in accordance with CAN/CSA-G30.18, unless otherwise specified or directed by the Town.
- b.) Epoxy-coated tie bars, where specified, shall conform to ASTM-D3963.

4.5.11 Steel Dowels

- a.) Steel dowels shall be clean, straight, free of flattened or burred ends, uncoated and in accordance with CAN/CSA-G30.18.
- b.) Epoxy-coated tie bars, where specified, shall conform to ASTM-D3963.

4.5.12 Cold-Drawn Steel Wire

- a.) Cold-drawn steel wire shall be uncoated and in accordance with CAN/CSA-G30.3M.
- b.) Epoxy-coated cold-drawn steel wire, where specified, shall conform to ASTM-D3963.

4.5.13 Welded Steel Wire Fabric

- a.) Welded steel wire fabric shall be uncoated and in accordance with CAN/CSA-G30.5M.
- b.) Epoxy-coated welded steel wire fabric, where specified, shall conform to ASTM-D3963.

4.5.14 Tie Wire

- a.) Tie wire shall be cold-drawn, annealed steel in accordance with CAN/CSA-G30.3.

4.5.15 Epoxy Coatings

- a.) Epoxy coatings shall be in accordance with ASTM-D3963.

4.5.16 Galvanizing

- a.) Galvanizing shall be in accordance with CAN/CSA-G164.

4.5.17 Plain Round Bars

- a.) Plain round bars shall be in accordance with CAN/CSA-G40.21.

4.5.18 Chairs, Bolsters, Bar Supports, and Spacers

- a.) Chairs, bolsters, bar supports, and spacers shall be suitable for strength and support of reinforcing and live loads during construction.

PART III – CONSTRUCTION

4.6 General

- 4.6.1 The following sections represent the minimum requirements for some typical, key construction procedures for sidewalk, curb, and gutter construction. These minimum requirements must be met or exceeded by the detailed construction specifications and drawings developed by the Consultant.
- 4.6.2 Construction activities must adhere to the provisions of the Erosion and Sediment Control Plan prepared for the Development in accordance with Section 1.10.1.7

4.7 Quality Assurance

- 4.7.1 The Consultant must maintain detailed records of all inspections and testing as evidence of compliance of the work with these Standards. These records shall be provided to the Town upon request.
- 4.7.2 The Town may at any time require the Contractor to provide evidence of certification by the testing agency to ensure the materials and performance of the work meet these Standards.
- 4.7.3 The Consultant shall provide a written endorsement of the Contractor's compliance with these Standards with the application for the Construction Completion Certificate.

4.8 Quality Control Testing

4.8.1 The Developer shall retain the services of independent testing laboratories or agencies to conduct all quality control testing. The proposed testing laboratory or agency shall be subject to the acceptance of the Town.

4.8.2 Minimum quality control test frequencies, specified as follows, are the minimum number required. The Developer shall ensure that as many tests as necessary are performed to ensure that the work conforms to the requirements of these Standards, regardless of the minimum number specified.

a.) Moisture Density Curves (ASTM-D698):

- i. One for each type of material from each source to be compacted to a specified density. The maximum density shall be the dry unit mass of a soil sample at optimum moisture content as determined in accordance with ASTM-D698 Method A.

b.) Sieve Analyses (ASTM-C136):

- i. Aggregate – one for each 1,000 tonnes of aggregate.

c.) Field Densities (ASTM-D2169 or ASTM-D2922):

- i. Fill – one for each 2,000 m² of compacted lift.
- ii. Sub-grade – one for each 1,000 m² of compacted lift.

d.) Portland Cement Concrete Testing:

- i. Abrasion test, soundness test, sieve analysis, and crushed face count for each aggregate source.
- ii. Plant inspections, materials sampling, and testing as follows:
 - Weekly concrete plant inspections during production will be conducted to verify plant calibrations, operation, production settings, and handling procedures. Samples of materials and mixtures will be taken and tested.
 - Slump testing, to CAN/CSA-A23.2-1C and CAN/CSA-A23.2-5C, to be taken between the 10% and 90% points of discharge of a concrete load, and conducted with every strength test, or as directed by the Town.
 - Air content testing, to CAN/CSA-A23.2-1C and CAN/CSA-A23.2-4C or CAN/CSA-A23.2-6C, to be taken between the 10% and 90% points of discharge of a concrete load, and conducted with every strength test, or as directed by the Town.
 - Air void examination, to ASTM-C457, modified point count traverse method at 100-times magnification, to be performed on one 100 mm diameter core, drilled from hardened concrete, for every 1,000 m of concrete curb, gutter, or sidewalk poured, or other frequency as directed by the Town. The top of the core shall be ground down to 2 mm ± 0.5 mm below and parallel to the finished concrete surface to produce a surface suitable for microscopic examination.
 - Ironstone content testing shall be conducted with every strength test, or as directed by the Town.
 - Strength testing, to CAN/CSA-A23.1-9C and CAN/CSA-A23.2-2C, to be taken at a minimum frequency of one test for each 60 m³ of concrete, or fraction thereof, in any one day, or as directed by the Town.
 - Cores, as necessary, to verify the finished concrete thickness.
 - A minimum of one (1) sieve analysis, to ASTM-C136, and crushed face count for every 1,000 tonnes of aggregate used in concrete production.
 - Conduct a complete petrographic analysis of the fine and coarse aggregate for the proposed mix design and provide results of abrasion loss, MgSO₄ soundness loss, cement-aggregate reactivity, and ironstone content testing.
- iii. All testing shall be performed by a technician certified by CSA or ACI.

4.9 Site Preparation

4.9.1 Prepare the site in accordance with Section 3.26 of these Standards.

4.10 Clearing

4.10.1 Conduct clearing in accordance with Section 3.27 of these Standards.

4.11 Grubbing

4.11.1 Complete grubbing in accordance with Section 3.28 of these Standards.

4.12 Topsoil Stripping and Stockpiling

4.12.1 Strip and stockpile topsoil in accordance with Section 3.29 of these Standards.

4.13 Excavation

4.13.1 Complete any necessary excavation in accordance with Section 3.33 of these Standards.

4.14 Fill and Grade

4.14.1 Fill and grade the area in accordance with Section 3.34 of these Standards.

4.15 Shallow-Buried Utility Trenches

4.15.1 Backfill and compact shallow-buried utility trenches in accordance with Section 3.35 of these Standards.

4.16 Sub-grade Preparation

4.16.1 Complete sub-grade preparation in accordance with Section 3.36 of these Standards.

4.17 Base Course

4.17.1 Construct any required base course in accordance with Section 3.37.

4.18 Protection of Prepared Base

4.18.1 Protect prepared surfaces in accordance with Section 3.38.

4.19 Formwork

4.19.1 Fabrication and Erection

- a.) Verify lines, levels, centres, and dimensions against the construction drawings prior to proceeding with fabrication and erection of formwork and false work.
- b.) Fabricate and erect false work in accordance with CAN/CSA-S269.1.
- c.) Fabricate and erect formwork in accordance with CAN/CSA-S269.3 in such a manner to produce finished concrete conforming to the shapes, dimensions, locations, levels, and tolerances specified herein and required by CAN/CSA-A23.1.
- d.) Align form joints and make watertight. Lay out forms in such a manner to minimize the number of form joints.
- e.) Do not place shores or mud sills on frozen ground. Provide suitable drainage through the site to prevent washout of soil supporting mud sills and shores.
- f.) Use 25 mm chamfer strips on exterior corners and 25 mm fillets on interior corners of concrete members, unless otherwise specified or directed by the Town.
- g.) Form chases, slots, openings, drips, recesses, and expansion and control joints where required.
- h.) Build in anchors, sleeves, and other inserts as required. Ensure that anchors and inserts are installed such that they will be flush with the finished concrete surface.

4.19.2 Slipforming

- a.) Set and maintain a grade line by establishing a taut string or wire line, set against the survey control datum.
- b.) Provide stable support for the traveling slipform machine.
- c.) Protect adjacent work and property from damage. Repair any damage caused during the performance of the Work to the satisfaction of the Town, at the sole cost of the contractor.
- d.) Coordinate concrete delivery and placement to maintain uniform advancement of the slipforming operation without interruption. If progress is interrupted at any time, immediately suspend vibrating and tamping.
- e.) Maintain adequate slump to prevent slipformed concrete from sagging.
- f.) Slipformed surfaces shall be smooth, dense, and free of pockets and honeycombing.
- g.) Correct minor irregularities in the slipformed finish using hand finishing methods.

4.19.3 Form Removal

- a.) Strip forms within 48 hours of concrete placement to facilitate finishing operations.
- b.) Re-shoring to remove forms shall be done in accordance with CAN/CSA-S269.1.

4.19.4 Hand-Forming

- a.) Hand-form and place concrete at corners, curb crossings, and catch basins concurrent with slipforming operations. Where such concurrent work is impractical, complete hand-form areas within 7 days of slipforming adjacent work.

4.20 Reinforcing

4.20.1 Fabrication, Shipping, and Handling

- a.) Fabricate reinforcing steel in accordance with CAN/CSA-A23.1 and ACI-315 – Details and Detailing of Concrete Reinforcement.
- b.) Protect epoxy- and paint-coated portions of bars with adequate covering during shipping and handling.

4.20.2 Field Bending and Welding

- a.) Field bending and welding shall only be permitted where specifically authorized by the Town.
- b.) Weld reinforcement in accordance with CAN/CSA-W186.
- c.) Field bending shall be performed without the use of heat, by applying slow and steady pressure.
- d.) Remove and replace any bars that develop cracks or splits.

4.20.3 Placing Reinforcement

- a.) Place reinforcement in accordance with applicable shop drawings and CAN/CSA-A23.1.
- b.) Place sufficient chairs, tie wires, and supports to adequately maintain the position of the reinforcement during placement of the concrete, in accordance with the tolerances provided by the referenced CAN/CSA guidelines.
- c.) Use plain round bars as slip dowels in concrete where required. Apply asphalt paint to the end of the dowel intended to move with the hardened concrete. When the paint is dry, apply a coat of mineral lubricating grease.
- d.) The Consultant shall inspect reinforcement placement before concrete placement is permitted.
- e.) Ensure sufficient cover is achieved over reinforcement when placing concrete.
- f.) Reinforcing steel, anchor bolts, or other inserts shall not be inserted during concrete placement.

4.20.4 Field Touch-Up

- a.) Touch-up all damaged and cut ends of epoxy-coated, painted, or galvanized reinforcing with compatible finish to provide a continuous finish.

4.21 Pouring

4.21.1 Concrete Delivery

- a.) Concrete delivery shall be in accordance with CAN/CSA-A23.1 Clause 18.4.
- b.) Rotating drum trucks, capable of adequately agitating and mixing the concrete during transport, shall be used for concrete delivery.
- c.) Rotate the drum at mixing speed for at least 3 minutes immediately before discharge.
- d.) Re-tempering
 - i. Re-temper the concrete mixture with water at the site when slump at the point of initial discharge is less than that specified, and only upon authorization of the Consultant.
 - ii. Re-temper the concrete mixture with air-entraining admixtures at the site when entrained air in the concrete at the point of initial discharge is less than that specified, and only upon authorization of the Consultant. Only Town-accepted air-entraining admixtures shall be used. A qualified technician shall coordinate the re-tempering process at the site. Only one opportunity shall be granted to re-temper any one load to meet the required air content. If re-tempering fails to meet the specifications, the load shall be rejected. A load of concrete that has been rejected following a failed attempt at re-tempering with air-entraining admixtures shall not be re-tempered at the concrete plant and subsequently returned to the site for use in the Work.
 - iii. If the need for re-tempering with water or air-entraining admixtures becomes consistent, the Consultant or Town may refuse to accept concrete loads that have been re-tempered, and may require the Contractor to revise the mix design accordingly before concrete production can continue.
- e.) On-site mix adjustments with cementitious materials, sand aggregate, or any chemical admixtures, other than air-entraining admixtures and superplasticizers, is strictly prohibited, unless authorized by the Town in writing.
- f.) The use of air de-entraining admixtures, or any other chemical admixtures, including water-reducing agents, retarders, and accelerators, is strictly prohibited, unless authorized by the Town in writing.
- g.) Where the ambient temperature is greater than 23 °C, the maximum concrete mix temperature shall not exceed 30 °C at the time of placement. If the concrete mix temperature exceeds 30 °C at the time of placement, all such concrete represented by that load shall be rejected.
- h.) Where the ambient temperature is less than 5 °C, the concrete mix temperature shall be between 15 °C and 30 °C at the time of placement. If the concrete mix temperature is outside of these specified limits at the time of placement, all such concrete represented by that load shall be rejected.
- i.) Completely discharge the concrete load within 90 minutes of initial mixing of water, cement, and aggregate at the plant. The discharge time may be extended to up to 120 minutes with the use of hydration control admixtures, where accepted by the Town. The supplier must submit sufficient evidence that the plastic concrete properties (slump, air content, and temperature) can be maintained through the extended discharge time period. Such evidence must be submitted for Town review and acceptance at least ten (10) days in advance of scheduled concrete work at the site.
- j.) Provide the Consultant with a delivery ticket for each concrete load, clearly indicating the following information:
 - Concrete supplier Concrete plant location Ticket number
 - Truck number
 - Mechanical date and time stamp of initial plant mixing
 - Mix design identification
 - Cement type
 - Aggregate size
 - Type and amount of admixtures
 - Volume of water added
 - Volume of concrete
 - Site arrival time
 - Start and end of discharge times
 - Any other information that may reasonably be requested by the Town

4.21.2 Concrete Placement

- a.) Place concrete in accordance with CAN/CSA-A23.1.
- b.) Thoroughly clean all reinforcement and formwork before placing concrete.
- c.) Moisten the sub-grade or sub-base surface, reinforcement, and formwork with water prior to placing concrete to minimize absorption of water from the concrete following placement.
- d.) Do not place concrete during a rain event, when a rain event is imminent, nor when the weather is unsuitable for concrete placement.
- e.) Pour concrete continuously and rapidly between predetermined construction joints.
- f.) Use pencil vibrators for curb and gutter, and vibrating screeds for walks.
- g.) Continuously place concrete for the duration of the scheduled pour. Arrange concrete delivery such that the discharge interval between loads is less than 30 minutes. Install a construction joint where the discharge interval exceeds 30 minutes.
- h.) Curblines, curbs, curbs, and curb crossings shall be poured monolithically. The use of dowels and joint sealant at the back of the curb is strictly prohibited.
- i.) Curb and gutter shall be constructed in accordance with the Engineering Standard Drawings.
- j.) Sidewalk shall be constructed in accordance with the Engineering Standard Drawings.
- k.) Sidewalk rehabilitation shall be constructed in accordance with the Engineering Standard Drawings.

4.22 Finishing

4.22.1 Finishing

- a.) Perform initial and final concrete surface finishing in accordance with CAN/CSA-A23.1.
- b.) The finished concrete surface shall be glare-free and slip resistant.
- c.) The use of water to facilitate finishing operations is strictly prohibited. To aid in concrete finishing, the surface may be fogged with an evaporation reducer acceptable to the Town.
- d.) Protect the work area from rain to avoid excessive moisture on the unfinished surface.
- e.) Finishing shall be performed by, or under the direction of, qualified concrete finishers.

4.22.2 Tool all edges to a width of 50 mm and round all edges to a 6 mm radius, unless otherwise specified or directed by the Town.

4.22.3 Apply a brush final finish longitudinally along curb and gutter. Apply a brush final finish transversely along walks. Broom finish as follows:

- a.) Use a brush with nylon bristles that can form surface grooves no deeper than 3 mm.
- b.) Remove excess water from the brush bristles prior to brushing.
- c.) Brush in a uniform pattern over the entire surface in the specified direction.

4.22.4 For sidewalks, stamp the Contractor's name and year of construction in the plastic concrete at the limits of construction for each stage of the Development. Sidewalks must be also imprinted with "CC" and "CO" stamps, indicating the location of the curb valve for the water service and the location of any sewer clean outs for each lot. In the case where there is no walkway in front of a lot, the stamps shall be placed on the top of the curb.

4.23 Crack-Control Joints

4.23.1 Crack-control joints are intended to control the location of shrinkage cracks in hardening concrete. Construct joints in accordance with the following:

- a.) Formed Joints
 - i. Form the groove by inserting a metal or fibre strip, or polyethylene film into the plastic concrete.
 - ii. Finish the edges to a 6 mm radius.
 - iii. Remove the insert immediately following the initial set of the concrete.
 - iv. Seal the joint with Sika 2C or approved equivalent product to be preapproved by the Town.

b.) Tooled Joints

- i. Form the groove by hand using a jointing tool with a thin metal blade to impress a plane of weakness into the plastic concrete.
- ii. Finish the edges to a 6 mm radius.
- iii. Seal the joint with Sika 2C or approved equivalent product to be preapproved by the Town.

4.23.2 Joints shall be 3 to 5 mm wide at the following depths:

- a.) Minimum 50 mm deep to a maximum of 25% of the gutter depth for curb and gutter; and
- b.) Minimum 25 mm deep to a maximum of 25% of the walk thickness for walks.

4.23.3 Joint spacing shall be a maximum of 3 m.

4.23.4 Surface Dummy Joints

- a.) 5 mm wide by 10 mm deep and centered between contraction joints across walks.
- b.) For monolithic construction, place surface joints across the walk portion and contraction joints on the curb and gutter, both joints being on the same side.
- c.) Place a longitudinal joint on walks continuing through crossings where required.

4.24 Isolation Joints

4.24.1 Isolation joints are required next to immovable structures, where indicated on the construction drawings, and where directed by the Consultant or the Town.

4.24.2 Construct the joint by sawing or forming to create a clean break through full cross-section of the concrete member.

4.24.3 Make the joint wide enough to allow a snug fit for the pre-formed joint filler.

4.24.4 Alternatively, place pre-formed joint filler against the structure and pour the concrete against the filler.

4.25 Construction Joints

4.25.1 Construction joints are required between concrete pours or for joining new concrete to existing concrete, and at the beginning and end of driveway sections.

4.25.2 Review and confirm the location of all construction joints prior to commencing construction.

4.25.3 Construct the joint with a keyway, dowels, or tie bars as required.

4.25.4 Vertically trim existing concrete by saw cutting at least 50 mm deep and breaking.

4.25.5 Transverse Construction Joints

- a.) Use 10M deformed tie bars at 300 mm spacing, extending minimum 300 mm into both sides of the joint.
- b.) At the end of a joint pour, vary joint spacing as follows:
 - i. Where a joint pour ends within 300 mm of a required joint location, equally space the last two joints; and
 - ii. Where a joint pour ends within 800 mm of a required joint location, equally space the last three joints.

4.25.6 Longitudinal Construction Joints

- a.) Use 10M deformed tie bars at 1,000 mm spacing, extending minimum 300 mm into both sides of the joint.

- 4.25.7 Leave the joint in place until the concrete has set, then carefully remove the joint form to avoid damaging the fresh concrete.
- 4.25.8 Finish the edges to a 6 mm radius.
- 4.25.9 Roughen all formed construction joints to expose the aggregate of the hardened concrete. The Contractor may elect to apply a suitable retardant to the forms of the construction joint, and remove retarded surface mortar using low-pressure water jets or stiff brushes.

4.26 Sidewalk Joints Abutting an Existing Curb

- 4.26.1 Form a 10 mm wide by 30 mm deep slot between the back of the curb and the walk.
- 4.26.2 Fill the slot with Sika 2C or approved equivalent product to be preapproved by the Town.

4.27 Protection

- 4.27.1 Protect freshly placed concrete from freezing, premature drying, adverse weather conditions, tampering, and physical disturbance in accordance with CAN/CSA-A23.1 Clause 21.
- 4.27.2 Concrete shall be protected from freezing for a minimum of 4 days following placement, or for the time necessary to achieve 75% of the specified 28-day compressive strength, whichever is greater.

4.28 Curing

4.28.1 Membrane Curing

- a.) Membrane curing is required when the maximum daily air temperature is not expected to exceed 5 °C for 72 hours following concrete placement.
- b.) Cure exposed concrete surfaces using an acceptable curing compound applied with a pressurized spray nozzle.
- c.) Apply a continuous and uniform coating of the compound over the surface. Follow compound manufacturer's instructions for the optimal application dose rate.

4.28.2 Moist Curing

- a.) Moist curing shall only be used where directed by the Town.
- b.) After the concrete has set, maintain a moist condition on the concrete surface by using wet burlap or polyethylene film over the surface for a minimum of 7 days.

4.29 Backfilling

- 4.29.1 Use only suitable excavated or borrow material for fill.
- 4.29.2 Backfill behind curb with suitable clay within 7 days of concrete placement. Backfill a minimum 300 mm width behind the curb in two 150 mm lifts. Compact each lift with mechanical tampers to a minimum 95% Standard Proctor Density. Backfill to the top of curb elevation, unless walk construction immediately follows.
- 4.29.3 Backfill along the edge of the walk immediately following removal of formwork. Provide sufficient depth for topsoil placement as specified or directed by the Town. Compact backfill a minimum of 300 mm out from the walk edge with mechanical tampers, to a minimum 98% Standard Proctor Density.

4.30 Tolerances

4.30.1 Concrete

a.) Surface Temperature

- i. Where the concrete surface temperature is found to be less than 0 °C within 96 hours following placement, the Town may elect to reject the work. In special cases, the Town may elect to accept the work with special provisions of compensation and/or warranty, or accept the work as provided. The application of such shall apply to the area or extents represented by, or measured by, field testing.
- ii. Where the surface temperature is found to be less than 0 °C within 48 hours following placement, remove and replace defective areas to the satisfaction of the Town.

b.) Slump

- i. Where the measured slump from any load is determined to be deficient from that specified, a second test shall be performed on another portion of the same load. If the second test fails, the load will be rejected and the Contractor shall remove any portion of that load that may already have been poured.

c.) Air Content

- i. For concrete where the air content is found to be less than specified, the Town may authorize re-tempering of the concrete as defined in Section 4.21.1 d.).
- ii. For air content less than 4.0, no re-tempering shall be permitted and the load will be rejected. The Contractor shall remove any portion of that load that may already have been poured.

d.) Strength

- i. Where the concrete strength is found to be less than the minimum specified requirement, the Town may elect to reject the work. In special cases, the Town may elect to accept the work with special provisions of compensation and/or warranty, or accept the work as provided. The application of such shall apply to the area or extents represented by, or measured by, field testing.
- ii. Where the concrete strength is found to be less than 85% of the minimum specified requirement, remove and replace defective areas to the satisfaction of the Town.
- iii. The Developer may, at its sole expense, elect to provide evidence of strength by coring and testing to CAN/CSA-23.2-14C, by a qualified independent testing agency, within 7 days of a failed 28-day cylinder test or within 3 days of a failed 7-day cylinder test. Three cores shall be drilled from the concrete area represented by the failed test at locations reviewed and accepted by the Town. The average strength of the three cores will be used in the subsequent application of Section 4.30.1d.).

4.30.2 Walk Surface, Gutter Surface, and Curb Top

- a.) Maximum 5 mm variation under a 3 m straightedge.
- b.) Where the specified tolerance is exceeded, correct such work to the satisfaction of the Town.

4.30.3 Gutter Lip and Walk Grade

- a.) Maximum 5 mm variation from the designated elevation at any station as established from the corresponding survey stake.
- b.) Where the specified tolerance is exceeded, correct such work to the satisfaction of the Town.

4.30.4 Gutter Lip Alignment

- a.) Maximum 10 mm variation over any 30 m section.
- b.) Where the specified tolerance is exceeded, correct such work to the satisfaction of the Town.

4.30.5 Concrete Thickness

- a.) Where the concrete thickness is found to be less than the minimum specified requirement, the Town may elect to reject the work. In special cases, the Town may elect to accept the work with special provisions of compensation and/or warranty, or accept the work as provided. The application of such shall apply to the area or extents represented by the core sample(s).

- b.) Where the thickness deficiency is found to be more than 15 mm of the minimum specified requirement, remove and replace defective areas to the satisfaction of the Town.

4.31 Rejected Work

- 4.31.1 Completely remove and replace rejected work to the limits of the nearest crack control or construction joints.
- 4.31.2 All rejected products and work shall be adequately removed from the site and corrected to the satisfaction of the Town.