



9.0 CURB, GUTTER AND SIDEWALKS

9.1. General

Products, Concrete Materials, Execution and Methods of Concrete Construction shall be in accordance with CSA CAN3-A23.1 or as described in this section.

9.1.1. Work Included

The work described in this section pertains to the construction of concrete curbs, gutters, sidewalks, crossings and paving stones. Refer to Standard Drawings that follow:

- 9.2 - Municipal Cul-De-Sac Curb and Gutter;
- 9.3 - Industrial/Commercial Curb and Gutter Crossing;
- 9.4 - Typical Monolithic Lane and Driveway Crossing;
- 9.5 - Wheelchair/Bike Ramp Locations;
- 9.6 – Cross Walks and Ramps at Urban Intersections;
- 9.7 - Paraplegic Ramp Details at Both Curb Returns;
- 9.8 - Paraplegic Ramp Details at Centre of Curb Return – Rolled Curb;
- 9.9 - 500 mm Curb and Gutter for Arterial Roadways;
- 9.10 - 250 mm Standard Curb and Gutter;
- 9.11 - 250 mm Rolled Curb and Gutter;
- 9.12 - 1.50 m Standard Monolithic Sidewalk;
- 9.13 - 1.50 m Rolled Monolithic Sidewalk;
- 9.14 - 1.20 m or 1.50 m Separate Sidewalk;
- 9.15 - Typical Catch Basin Installation – 150 Curb and 250 Gutter.



9.2. Products

9.2.1. Portland Cement

Portland cement shall meet the requirements of CSA Standard Portland A5-M cement and shall be Type 10 normal, or type 50 sulphate resistant, as required by the County.

9.2.2. Aggregates

The fine and coarse aggregate used in the concrete mix shall conform to the following specifications:

- 1) Fine Aggregate - CSA CAN3-A23.1, Clause 5.3.
- 2) Coarse Aggregate - CSA CAN3-A23.1, Clause 5.4. Table 2 Group 1 (28-5)

Sieve Size (mm)	% Passing by Mass
40.000	100
28.000	95-100
14.000	30-65
5.000	1-10
2.500	0-5

9.2.3. Admixtures

All admixtures used to enhance the concrete shall conform to the following specifications:

- 1) Air Entrainment: ASTM C260
- 2) Chemical: ASTM C494
- 3) Calcium Chloride: ASTM C494

The use of calcium chloride shall only be used when approved by the County, but in no case will the amount added be greater than 2% of the cement weight. It shall not be used when the air temperature is above 4°C.



Fly ash shall not exceed 10% by weight of cement, and it shall conform to the requirements of CAN/CSA-A23.5. Only approved compatible super plasticizing admixtures and air entraining agents shall be used with the fly ash. The County may require characteristic data for fly ash to prove conformance to the standards. After September 1st, no portion of the specified cement content may be replaced with fly ash unless approved in writing by the County.

9.2.4. Reinforcing Steel

Reinforcing bars shall be deformed bars in accordance with CSA Standard Specification G30.12-M1977.

Cold drawn wire or welded wire fabric for concrete reinforcement shall be 150 x 150 and conform to the requirements of CSA Standard Specification G30.3-1972.

9.2.5. Expansion Joint Filler

Joint filler shall conform to CGSB Standard Specification for polyurethane sealing compound #19-GP-15 or ASTM Standard Specification for SIKA FLEX 1A.

9.2.6. Membrane Curing Compound

Resin-base impervious curing compound shall conform to ASTM Standard Specification C309 Type 1D-Type B. The curing compound shall contain white fugitive dye.

9.2.7. Preformed Expansion Joint Filler

Preformed expansion joint filler shall conform to ASTM Standard Specification D-1752.

9.2.8. Concrete

Concrete mixes shall be designed by a qualified professional engineer engaged by the Contractor. The mix design shall be submitted to the County for approval a minimum of 10 days prior to delivery of any concrete to the site. The specified compressive strength at 28 days shall be 30 MPa. The strength level of 30 MPa shall be considered to be achieved if averages of all sets of 3 consecutive strength tests equal or exceed the specified strength, and no individual strength test is less than 20 MPa.



The concrete shall contain not less than 315 kg of Portland cement per cubic metre of concrete produced.

The air content of the concrete shall be maintained between the limits of 6-8%.

The minimum slump permissible will be that which will allow the concrete to be placed efficiently and provide a homogeneous mass. The maximum allowable slump shall be 70 mm +/- 10 mm for all hand-poured concrete and 40 mm +/-10 mm for all machine-extruded concrete.

9.2.9. Retempering with Air

If, due to a low air entrainment percentage, as specified, the County feels it is necessary to add an approved air-entraining agent on site, placement of concrete shall stop to allow the concrete truck's drum to turn at mixing speed for a minimum of 3 minutes. Should the air content of the concrete not conform to specifications after retempering with air, then the concrete shall be rejected.

The County has the right to withdraw permission to add an air-entraining agent to the mix and reject the concrete if this practice is being abused.

9.2.10. Retempering with Water

If, due to a low slump as specified, the County feels it is necessary to add water to the mix, it shall be injected into the drum under such pressure and direction of flow that it conforms to the specifications in ASTM C-94, Appendix XI. Placement of concrete shall stop at that point to allow the concrete truck's drum to turn at mixing speed for a minimum of 3 minutes. Should the slump of the concrete not conform to specifications, after retempering with water, then the concrete shall be rejected.

The County has the right to withdraw permission to add water to the mix and reject the concrete if this practice is being abused.



9.3. Execution

9.3.1. Placing Concrete

Concrete shall not be placed until the subgrade, sub-base and base course materials have been completed, and approved by the County. The base shall be sufficiently moist to prevent absorption of water from the concrete, and free from mud or water ponding.

The concrete shall be placed within 90 minutes of initial mixing at the plant, or before the drum on the concrete truck has turned 300 revolutions. Complete discharge of concrete shall not exceed 2 hours. The concrete shall be transported by methods which will prevent segregation and deposited on the subgrade so that as little handling as possible is required.

Concrete shall be placed continuously until a complete section between expansion joints has been poured.

The concrete shall be thoroughly consolidated against and along the faces of the forms. Hand spreading shall be done with shovels, not with rakes, in order that the concrete will not be segregated. Precautions should be taken to prevent overworking of the concrete.

Concrete shall be handled from the mixer to the place of final deposit as rapidly as practicable by methods which shall prevent the separation or loss of the ingredients. It shall be deposited in the forms as near as practicable to its final position to avoid rehandling.

The sequence of concrete placement shall be arranged so that concrete which has partially hardened shall not be subjected to injurious vibration.

The vertical free fall height of concrete shall not exceed 1.0 m. For falls greater than 1.0 m chutes or tremies shall be used.

During placement, concrete shall be sufficiently tamped or vibrated with suitable equipment to secure a close bond with the reinforcement, eliminate entrapped air voids and ensure a homogeneous structure with adequate consolidation.



The rate of delivery of mixed concrete shall be such that the interval between the placing of successive truck loads shall not exceed 30 minutes. If the time exceeds 30 minutes, then a construction joint shall be formed.

After the initial set of the concrete, neither the forms or the concrete structure shall be jarred and no strain shall be placed on the ends of projecting reinforcement.

Construct all pararamps and crossings monolithically to the dimensions and at locations specified.

9.3.2. Joints

Curb, gutter and sidewalk contraction joints shall be constructed at 3.0 m intervals and as detailed on the standard drawings, and shall not be less than 50 mm deep. Contraction joint widths shall not be greater than 5 mm.

Midway between each contraction joint on the sidewalk, a surface joint, 13 mm deep, shall be constructed. These joints shall not extend into curb and gutter.

A surface joint shall be constructed longitudinally at the location shown on the standard drawings and shall continue through all driveways and lane crossings.

A construction joint shall be formed at the end of every pour. This joint shall be constructed in a "V" shape, as directed by the County, and using 10.0 m rebar 600 mm long, spaced every 500 mm.

10 m bars at 500 mm on centre shall be dowelled and epoxied into the back of the existing curb prior to placing concrete.

9.3.3. Finishing

Sidewalk surfaces, either separate or monolithic with curb and gutter, shall be struck off and screeded to the slope, cross-section and elevation shown on the drawings or as directed by the County. The surface shall be consolidated and smoothed using a wood float. Light-steel trowelling shall be used followed by a uniform brush finish. Sidewalk shall be edged at all joints to prevent chipping of the concrete.



The exposed surfaces of concrete curbs and gutters, either separate or monolithic with sidewalks, shall be finished by means of a wood float then light-steel trowelling followed by uniform brushing, and all edges shall be rounded to the required radius. No patching will be allowed.

Pararamps, and crossings to lanes and private property shall be struck off and screeded to the required slope and cross-section. The finished surface shall be brushed as specified above.

All edges, including contraction or surface joints, shall be tooled for a width of 50 mm and rounded to a radius of 6 mm. The brush grooves shall be transverse on the sidewalk and longitudinal on the curb and gutter. The finished surface shall have no exposed aggregate or honeycomb.

If there is evidence of excess water on the concrete surface, finishing shall be delayed until the excess water has evaporated.

Surface grooves made by the broom shall not be more than 3 mm deep. Before brushing, all surplus water shall be removed from the brush.

9.3.4. Curing

Immediately after finishing, the concrete surface shall be protected by applying a membrane curing compound. After finishing and removal of forms if necessary, all exposed surfaces shall be wetted with water and then thoroughly sprayed with membrane curing compound. The membrane curing compound shall be applied in accordance with the manufacturer's instructions with an approved pressurized spray.

The curing compound shall be applied in such a manner as to cover the entire surface thoroughly and completely with a uniform film at a rate which shall depend on the roughness of the surface of the concrete, but in no case at less than 0.25 L/m² of concrete surface.



9.3.5. Backfilling

Unless otherwise directed by the County, the Contractor shall backfill along the back of the curb edges, to the top of the concrete, within 3 to 7 days of the placing of the concrete. The backfill shall be mechanically tamped in maximum lifts of 150 mm, to a minimum of 95% Standard Proctor Density and to a distance of 300 mm from the back of the walk or curb.

Where landscaping is to be carried out immediately after completion of the walks or curbs and gutters, the backfilling shall be left 100 mm low to allow for the topsoil.

9.3.6. Forming

Forms shall be steel or wood of sufficient strength to resist the pressure of wet concrete, and the supply shall be sufficient to permit their remaining in place until hydration has occurred, or longer if the County considers it necessary. The Contractor shall remove all face forms to allow for a smooth brush finish. The use of bent, twisted, battered or worn-out forms will not be permitted. Forms will be checked for alignment and elevation by the County 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 standard drawings and shall be free from mill scale, grease and rust prior to placing concrete. Forms shall be held securely by approved methods to prevent movement and bulging when the concrete is placed. Forms must be approved by the County before concrete is poured.

Curbs having a radius of less than 40 m shall be constructed with flexible forms. A sufficient length of form (not less than 50 m) shall be placed and checked before concrete is poured to ensure true line and grade. The forms shall be well staked, braced or otherwise held rigidly true to the established line and grade. The County may, at any time, reject the use of any forms considered unsatisfactory.



9.4. Mechanical Extruding Machines

Slip-form paving machines or concrete extruding machines may be used for placing concrete provided they have received the approval of the County prior to commencement of the work and meet the following requirements:

- 1) The vibrators on the equipment shall be capable of producing a dense mass with a smooth surface, free of honeycombing.
- 2) The equipment shall include automatic grade and line controls which shall be used at all times.

Commence placement of concrete only after the subgrade has been prepared and approved by the County.

Any special grading or preparation of the base required by the Contractor to accommodate equipment shall be the responsibility of the Contractor, and shall restore the roadway and boulevards to their original condition within 3 to 7 days of the initial disturbance.

The extruded concrete shall be checked for alignment and elevation by the County while the concrete is being placed. All incorrectly placed or misaligned work shall be immediately removed while the concrete is still wet, and the work redone to the proper specifications using whatever means are required.

Whenever possible, the forming and placing of concrete by conventional hand pouring methods (as may be required at corners, crossings and catch basins) shall be carried out in conjunction with the extruding machine operation. Where this procedure is not practical, the "tie-ins" shall be completed within 3 days of construction of the adjacent extruded section, using 10.0 m rebar at all joints. All "tie-ins" shall be completed in one continuous pour.



9.4.1. Consolidation

The concrete shall be consolidated by means of an approved vibrating screed or, in the case of curb and gutter only, by means of a poker or pencil vibrator not exceeding 50 mm in diameter.

Particular care shall be given to placing and tamping along the faces of the forms to ensure a dense, smooth surface.

Vibrations shall be of sufficient duration to thoroughly compact the concrete but not long enough to cause segregation. Vibrators shall not be used for moving concrete.

9.5. Inspection

All exposed concrete surfaces shall be checked by the Contractor with a 3.0 m straight-edge, and any water pockets or deviations in line or grade exceeding a total of 6.0 mm shall be corrected immediately.

Differences in elevation at any given point from that given by the design shall not exceed 13.0 mm, and the maximum variation shall not be greater than 13.0 mm.

Deviations in horizontal alignment at any given point from that given by the design shall not exceed 25.0 mm, and the fluctuations in the horizontal alignment shall not be greater than 25.0 mm.

Concrete not meeting the above criteria shall be replaced.

9.6. Field Tests

Testing shall be performed by a qualified CSA testing laboratory in accordance with the following:

- 1) Samples of concrete shall be obtained in accordance with CSA Test Method A23.2-1C for sampling plastic concrete.
- 2) Test cylinders shall be made and stored in accordance with CSA Test Method A23.2-3C. No less than 1 strength test shall be made from samples from each 150 cubic metres of concrete placed, and in no case shall there be less than 1



test from each day's pour. Each strength test shall consist of 3 test cylinders, 1 tested at 7 days and 2 at 28 days.

- 3) Air content determinations shall be made in accordance with CSA Test Method A23.2-7C, air content of plastic concrete by the volumetric method.

During construction start-up, every load or batch of concrete shall be tested until such time as satisfactory control of the air content has been established. Air content tests taken with the test cylinders will be sufficient once satisfactory control has been established. Whenever a test falls outside the specified limits, the testing frequency shall revert to one test per load or batch until satisfactory control is re-established. Any concrete that falls outside specified air control levels shall be rejected from use.

Slump tests made in accordance with CSA Test Method A23.2-5C, Slump of Concrete, shall be made in conjunction with each strength test.

9.7. Clean-Up

As the work progresses, the Contractor shall clean up the site and all areas in which work has been done shall be left in a neat and presentable condition. All gutters and street drainage ditches that have been blocked as a result of the Contractor's operation shall be restored or repaired.

The Contractor shall dispose of all surplus excavated material, organic soil, rock, boulders and pieces of concrete and masonry at an approved location.

9.8. Protection

The Contractor shall be responsible for keeping all animals and pedestrians off the newly constructed sidewalks or curb until completely set. The Contractor shall also be responsible for keeping all vehicles off the work for a period of 3 days after the concrete has been finished.



9.9. Deficiency Penalty

Where there are variations from specified design strength, the following Deficiency penalty shall be assessed based on the 28-day, laboratory-cured cylinders.

- 1) When the concrete strength of any set exceeds 95% of design strength, no deficiency penalty will be administered.
- 2) When the concrete strength of any set is greater than 80% but less than 95% of design strength, the deficiency penalty will be administered as follows:

$$\frac{Q [P \times 2 (A - B)]}{A}$$

Where: P = unit price

A = specified strength

B = average 28 day cylinder strength

Q = quantity of deficient concrete

- 3) If the concrete strength of any set is less than 80% of design strength, the work represented by that set of cylinders will be rejected and replaced by the Contractor.

END OF SECTION