

1.0 GENERAL

- .1 The complete work under this trade shall be governed by the dictates of good practice in all details of materials and methods even if not minutely specified. The work shall be properly coordinated with the requirements of other units of work specified in other sections.
- .2 All concrete work shall be constructed in accordance with the Standard Drawings.
- .3 The Contractor shall notify the City of Prince Albert prior to the removal of any existing street and traffic signs. The Contractor will notify the City of Prince Albert upon construction completion to ensure that signs are replaced.

1.2 Existing Structures

- .1 Temporary support, adequate protection and maintenance of all underground and surface structures and utilities and other obstructions encountered in the progress of the work shall be furnished by the Contractor at his own expense and under the direction of the Engineer. The structures and utilities which may have been disturbed or damaged shall be restored to their original or new condition at such a time as deemed necessary or upon completion of the work.

1.3 Sidewalks, Curb and Gutter

- .1 In locations noted on the plans, new sidewalk, monolithic sidewalk curb and gutter, or curb and gutter shall be constructed. The dimensions shall be as specified on the drawings and in the Bid Form.

1.4 Measurement for Payment

- .1 Payment for new and replacement curbs, gutters and sidewalks shall be full compensation for excavation, preparing the subgrade and compaction to 98% Standard Proctor density, supply and placing granular bedding where required, forming, supplying and placing concrete, jointing, jointing materials, finishing, curing, stripping forms, backfilling to within 50 mm at back of walk and curb valve adjustments. Measurement for new and replacement concrete curbs, gutter and sidewalks shall be as follows:
 - .1 The subgrade area for the new sidewalks, curbs and gutters has been excavated in conjunction with the roadways excavation and has been filled with compacted granular base course material and geotextile filter fabric as indicated on the plans. Common excavation, subgrade preparation and geotextile filter fabric quantities and payments are included in the roadways pay items.
 - .2 Sidewalks not poured monolithically with curbs will be measured by the square metre.

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- .3 Sidewalks poured monolithically with curbs or curbs and gutters will be measured by the lineal metre measured along the line of the back of the curb.
 - .4 Curbs or curbs and gutters not poured monolithically will be measured by the lineal metre.
 - .5 Concrete sidewalk ramps will be paid at the unit price bid per square metre for the type of ramp constructed and will include saw cuts, gutter, drop curb and tapered curb and transition sections and any reinforcing steel required.
 - .6 Payment for concrete pavement shall be at the unit price bid per square metre and shall include all preparation work required to prepare the site and all reinforcement steel.
 - .7 Payment for sidewalk lane crossings shall be at the unit price bid per square metre and shall include all preparation work required to prepare the site and all reinforcement steel.
 - .8 Payment for curb or curb and gutter, lane, driveway and commercial crossings shall be at the unit price bid per lineal meter of crossing including the 1.5 metre transition wings.
 - .9 Rebar for new trench crossing will be paid for at the unit price bid per lineal metre of rebar installed. Rebar will be installed as detailed and in crossing locations of new underground piping installations.
 - .10 Removal of existing curbs, curbs and gutters, and curb crossings will be paid for at the unit price per linear metre regardless of the size of the curbs. The unit price shall include disposing of the concrete removed at a location designated by the Engineer.
 - .11 Removal and disposal of existing combined concrete curb and walk or separate sidewalk shall be at the unit price bid per square metre regardless of depth.
 - .12 Compacted granular base where required shall be paid for at the unit price bid per cubic metre for compacted granular base course under sidewalk and curb and gutter.
 - .13 Curb stops shall be adjusted to match the adjacent back-of-walk elevation. No separate payment will be made for this item, should be included in the unit prices for concrete construction.
 - .2 Payment for concrete curbs, gutters and sidewalks shall be subject to the penalties outlined in Section 3.13 for deficient concrete.

2.0 PRODUCTS

2.1 Granular Base Course

- .1 Material for the granular base course shall consist of sound, hard, durable crushed rock or crushed gravel and shall not contain organic or soft, thin elongated, or laminated materials, materials that break up when alternately frozen and thawed or wetted and dried, or other deleterious materials. When compacted near the optimum moisture content to not less than 100% of the maximum dry density corrected for the stone content as determined by ASTM D698, the material shall have a minimum CBR value of 65 and a maximum particle size of 18 mm.
- .2 Granular base course shall meet the following gradation when tested to ASTM C136 and ASTM C117, and give a smoother curve without sharp breaks when plotted on a semi-log grading chart:

BASE COURSE		
Sieve Designations (mm)	Percent by Weight Passing	
	Lower Limit	Upper Limit
19.0	100	100
12.5	81	100
5.0	50	80
2.0	32	52
0.900	20	35
0.400	15	25
0.160	8	15
0.071	6	10
Plasticity Index	0	6
% Fractured Face	60 Minimum	
% Light Weight Pieces	5 Maximum	

2.2 Cement

- .1 All cement used shall be Normal Portland Cement and shall conform to CSA standard CAN3-A5 Type 10 or Type 50.

2.3 Aggregates

- .1 Samples: Before any aggregates are used in the work, the Contractor shall obtain and ship to a testing laboratory designated by the Engineer for preliminary approval, representative samples containing not less than 25 kg of aggregate. Sampling shall be done in accordance with CSA Test Method A23.2 – 1A. The Contractor shall pay for all costs of obtaining and shipping samples and for all Laboratory Tests.

.2 Materials: Fine and coarse aggregate shall conform to the requirements of CSA CAN3-A23.1-M77 with the following gradation limits:

.1 Coarse Aggregate: Shall conform to the following gradation limits:

<u>Sieve Opening</u>	<u>Percent Passing</u>
28 mm	100%
19 mm	90 - 100
9.5 mm	25 - 60
5 mm	0 - 10
2.5 mm	0 - 5
80 um	0 - 1

Coarse aggregate shall consist of crushed stone or gravel or combination thereof, having hard, strong, durable particles, free from elongated particles, dust, shale, earth, vegetable matter or other injurious substances.

.2 Fine Aggregates: Shall conform to the following gradation limits:

<u>Sieve Opening</u>	<u>Percent Passing</u>
10 mm	100%
5 mm	95 - 100
2.5 mm	80 - 100
1.25 mm	50 - 90
630 um	25 - 65
315 um	10 - 35
160 um	2 - 10
80 um	0 - 3

Fine aggregate shall consist of sand, stone screenings or there inert materials with similar characteristics or a combination thereof having clean, hard, strong, durable uncoated grains and free from an injurious amount of dust, lumps, shale, alkali, organic matter, loam or other deleterious substances.

.3 Approval: Preliminary approval of the aggregate as represented in the samples and test results shall not constitute general acceptance of all material in the deposit or source of supply, and acceptance shall be subject to field tests taken at the discretion of the Engineer. Materials may be considered unsuitable, even though particle sizes are as required, if particle shapes are thin or elongated or if the material fails to provide a suitable concrete. Rejected material will not be paid for. The acceptability of the final material will be determined by the Engineer.

.4 Storage: The aggregates shall be stockpiled in such a manner as to minimize segregation. Stockpiles should be built up in layers of uniform thickness.

2.4 Concrete Strength

- .1 All concrete shall be proportioned and mixed to produce a concrete having a minimum compressive strength of 32 MPa at 28 days.

2.5 Water

- .1 The water used in mixing or curing concrete shall be clean and free from salt, oil, acids, alkalis, and organic or other deleterious substances.

2.6 Air Entraining Admixture

- .1 An air entrainment admixture conforming to the requirements of CSA Standard A266.1 shall be used to produce an air entrained concrete containing not less than 5% and not more than 8% entrained air, as determined by the standard test described in CSA Standard CAN3-A23.2-4C.

2.7 Reinforcing Steel

- .1 Reinforcing steel shall conform to the following requirements:
 - .1 Welded steel wire fabric shall conform to CSA standard G30.5.
 - .2 Billet steel bars shall conform to CSA standard G30.12-M.

2.8 Expansion Joint Filler

- .1 Expansion joint filler shall be a 19 mm thick non-extruding bituminous type and shall conform to ASTM D1751 for preformed expansion joint filler.

2.9 Expansion Joint Sealer

- .1 Joint sealer shall conform to CGSB standard specification for polyurethane sealing compound 19-GP-15 or ASTM standard specification for hot poured joint sealer D-1190.

2.10 Membrane Curing Compound

- .1 Curing compound shall be impervious resin base, conforming to ASTM standard specification C309 Type, 1D-Type B. The membrane curing compound shall be applied in accordance with the manufacturer's instructions.

2.11 Concrete

- .1 Design Mix

The Contractor shall submit to the Engineer three copies of a proposed design mix showing the proportions of the material to be used. From concrete mixed according to this design, the Contractor shall have three

cylinders taken and tested according to CSA Standard CAN3.A23.2-9C and shall forward three copies of the test results to the Engineer. The costs of the design mix and concrete samples and test shall be borne by the Contractor. No concrete shall be used in the work before a mix design from a recognized testing laboratory has been submitted to the Engineer.

The concrete mix shall be designed as follows:

- .1 Minimum 28 day compressive strength 32 Mpa
 - .2 Slump not exceeding 75 mm
 - .3 Maximum aggregate size 20 mm
 - .4 Air entrainment 5.0 % to 8.0 %
- .2 Concrete Mixing
- .1 On Site: Concrete shall only be made on the site with the approval of the Engineer.
 - .2 Ready-Mixed: Ready-mixed concrete shall be mixed and transported in accordance with CSA Standard CAN3-A23.1-M77.

2.12 Levelling Course

- .1 Levelling course for fills of less than 50 mm shall be medium to coarse graded sand meeting the following gradation when tested to ASTM C136 and ASTM C117, and give a smooth curve without sharp breaks when plotted on semi-log grading chart:

<u>Sieve Size (mm)</u>	<u>Percent Passing (by weight)</u>
25.0	100
5.0	95 – 100
1.25	53 – 85
0.200	10 – 30
0.063	0 - 10

- .2 The liquid limit shall not exceed 25 and the plasticity index shall not exceed 6 for the portion of material passing 0.400 mm sieve.
- .3 The leveling course for fills of more than 50 mm shall consist of base aggregate meeting the requirements of this Specification.
- .4 The leveling course shall be compacted to not less than 98% of the Standard Proctor Density for the material.

3.0 EXECUTION

3.1 Grade Preparation

- .1 The prepared bed for the new sidewalks, curbs and gutters has been excavated in conjunction with the roadways excavation and has been filled with compacted granular base course material and geotextile filter fabric to the lines, grades and cross sections as indicated on the plans. The Contractor shall coordinate and schedule with the roadways contractor required. The Owner shall not be responsible for delays caused by the preparation of the bed of the new sidewalks, curbs and gutters.
- .2 A layer of compacted clean leveling base course shall be used where required as a foundation material under concrete sidewalks, curbs and driveway crossings. The base on which the concrete will rest shall be thoroughly wetted immediately prior to placing the concrete and must not be frozen, muddy or have areas of water pondage.
- .3 The subgrade elevation shall be finished to tolerances requiring 50 mm of leveling course materials on the subgrade when not extruded. The material shall be compacted to 98% Standard Proctor Density.

3.2 Forms

- .1 Forms shall be of 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 not less than 12 hours after concrete has been placed, or longer if the Engineer considers it necessary. The use of bent, twisted, battered or worn-out forms will not be permitted. Forms shall be held securely by approved methods to prevent movement and bulging when the concrete is placed. Forms will be checked for alignment and elevation by the Engineer before concrete is poured, and shall be cleaned and oiled before each use.

3.3 Reinforcement

- .1 Where required, reinforcement shall be secured in the location shown on the drawings or as directed by the Engineer and shall be free from mill scale, grease and rust immediately prior to placing concrete. Reinforcement shall be drilled and dowelled into existing concrete at all joints.

3.4 Placement

- .1 The concrete shall be placed as soon as possible after mixing, but not later than one hour after mixing has begun. Retempered concrete shall not be used. 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 thickness shall be those shown on Standard Drawings. No payment will be made for concrete placed at thickness less than specified.

- .2 Concrete shall be placed continuously until a complete section between expansion joints has been poured.
- .3 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.
- .4 Mechanical Extruding Machines.
 - .1 If an extruding machine is used in constructing curbs, curb and gutter, sidewalk or combined curb and sidewalk, the material excavated to accommodate the machine shall be either stockpiled at a specified location or windrowed to the centre of the street with a minimal disruption to the traffic. After the installation of the concrete works the excavated material shall be replaced to the original street grade or the elevations designated by the Engineer and compacted to not less than 98% Standard Proctor Density. Backfill material required behind curbs or sidewalks shall be hauled in from surplus stockpiles or a location designated by the Engineer. Granular material which may have existed shall be replaced.

3.5 Appurtenances

- .1 Appurtenances shall be located, examined for deficiencies and staked by the Contractor prior to work beginning on a particular section and any deficiencies noted must be reported to the Engineer immediately. Upon completion of a block of work, the Contractor shall relocate these structures and inspect them with the Engineer. Any damage, which may have occurred during, the concreting operations and deficiencies not previously reported to the Engineer, shall be repaired at the Contractor's expense. The Contractor shall schedule his work in such a manner as to not have more than seven days or 1500 m, whichever is greater, of work in progress at one time. This includes the entire process of preparing the subgrade for the concrete, to the final backfilling and cleaning up. All costs involved in using an extruding machine shall be included in the contract unit prices tendered for curb, curb and gutter, sidewalk and combined curb and sidewalk.

3.6 Finishing

- .1 Surfaces shall be struck off and screeded to the slope, cross-section and elevation shown on the drawings and staked by the Engineer. The surface shall be consolidated and smoothed using a wood float. Light steel trowelling shall be used followed by a uniform brush finish. After brushing and before the concrete has taken its initial set, surfaces shall be edged at

all joints to prevent chipping of the concrete and where required edges rounded to the required radius. No patching will be allowed.

- .2 Access crossing to lanes and private property shall be struck off and screeded to the required slope and cross-section.

3.7 Expansion and Contraction Joints

- .1 The sidewalk shall be divided into 1.5 m sections by the use of tooled joints as detailed on the Standard Drawing. All curbing shall have a 25 mm deep tooled joint at 1.5 m intervals to coincide with joints placed in monolithic or combined sidewalks. Refer to the Standard Drawing. At the beginning and end of curb radii, an expansion joint shall be constructed.

3.8 Curing

- .1 All concrete shall receive two applications of membrane curing compound. The first application is to be applied after the disappearance of the water sheen and the final finishing of the concrete. During hot, dry, windy days, the first application shall be applied immediately after final finishing and before all free water on the surface has evaporated. The second applications shall be made immediately at right angles to the first so that complete coverage on the surface is attained. Immediately after removal of the forms all exposed surfaces shall be thoroughly wetted with water and then sprayed with membrane curing compound. The membrane curing compound shall be applied in accordance with the manufacturer's instructions.

3.9 Cold Weather Requirements

- .1 When the temperature of the surrounding atmosphere is at, or below 4°C, the aggregate and the mixing water shall be heated. The aggregate and mixing water shall have a temperature of not less than 4°C and be entirely free of frozen materials. The aggregate shall not be heated to more than 60°C, and the concrete when deposited in the forms shall have a temperature of not less than 10°C and not more than 38°C. The concrete shall be maintained at a minimum temperature of 10°C for not less than four days after placing.

3.10 Tolerances

- .1 The finished surfaces of all concrete work shall be true to the required cross-section with a tolerance of plus or minus 3 mm from the required elevation and dimensions. Surface of curbs, gutters or sidewalks shall not show any depressions or bumps exceeding 3 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 Field Tests

- .1 Tests shall be made of the concrete to ensure that it meets these specifications. Testing shall be done to conform to the following standard specifications:

Test	Current Issue of ASTM
Sampling of Fresh Concrete	C172
Test for Slump of Concrete	C143
Compression and Flexure Test	C31
Compressive Strength of Molded Concrete Cylinders	C39
Measurement of Air Content	C173 or C231

- .2 Concrete: The services of an independent, qualified, materials testing laboratory shall be retained to perform the field and laboratory concrete tests. The Contractor shall be responsible for arranging for and paying the full cost of all control testing including sampling, transporting the samples for compression tests of the cylinders taken to the designated testing labs. The cost required for sampling and shipping of samples to the laboratory shall be included in the unit prices tendered for concrete work.

The cost of compression testing of concrete specimens in the laboratory will be paid for by the Owner.

The Owner shall appoint the laboratory to be used for concrete testing.

Copies of all test results shall be promptly forwarded to the Contractor, the Concrete Supplier and the Engineer.

- .3 Sub-Grade Density: The Owner shall pay the cost of the sub-grade density control testing required to ensure performance of the Contract. Only tests that indicate that the density is at or above that specified will be paid for. The costs of any test which indicate the density does not meet or exceed the minimum specified will be deducted from the Contractor's Progress Certificate.

The Owner will appoint the laboratory to be used for quality control testing.

- .4 Three concrete cylinders shall constitute one test and shall be made from the same batch or load. They shall be stored undisturbed on site for 24 hours, covered with a plastic sheet to prevent loss of moisture. They shall then be delivered to an approved testing laboratory for curing with one cylinder tested at seven days and the other two at twenty-eight days. A set of three cylinders shall be taken for every 100 m³ of concrete poured or for each side of each block or portion thereof placed in one day, or as directed by the Engineer.

- .5 When construction begins, the Engineer may take additional cylinders in order to establish a concrete strength pattern in the early stages of the project.

3.12 Sidewalk Ramps

- .1 Sidewalk ramps shall be constructed as shown on the Standard Drawings at locations shown on the drawings or designated by the Engineer.
- .2 The Contractor shall shape the subgrade to maintain specified concrete thickness and shall pour the ramps at the time of the sidewalk and curb construction.

3.13 Failure to Meet Strength Requirements

- .1 The Owner reserves the right to reject any concrete whatsoever which does not meet all the specified requirements for the concrete.
- .2 The Owner may, however, at the discretion of the Engineer, accept concrete which does not meet the specified strength requirements and, in such case, payment shall be made on the basis of a percentage scale for the concrete product represented by each test as follows:

32.0 MPa Concrete:

32.0 MPa and over	100% of the unit bid price
29.2 MPa to 32.0 MPa	90% of the unit bid price
26.5 MPa to 29.1 MPa	70% of the unit bid price

All concrete below 26.5 MPa will be rejected.

- .3 Furthermore, the Owner reserves the right to reject any particular portion of a pour if there exists manifest evidence that this particular portion of the pour has a strength that is below the minimum acceptable strength required under this Section.
- .4 If any concrete tested in accordance with this Specification fails to meet the specified strength, the Contractor may request coring of the concrete in question. When such coring is approved by the Engineer, arrangements shall be made by the Contractor, through the Engineer, to employ an independent, qualified testing service, all at the expense of the Contractor. The cores shall be taken and tested within seven days of the testing of the twenty-eight day cylinders representing the concrete in question. Three cores shall be taken for each strength test previously taken and there shall be no doubt that the cores taken and the cylinders under consideration represent the same batch of concrete. Cores shall be tested in accordance with the requirements of CSA A23.2-14C and the average strength of the cores as reported by the independent testing service shall constitute a test. When more than one core strength test is taken, the average of all the core strength tests shall represent the strength of the concrete in question.

- .5 The foregoing procedure may be altered if the concrete in question was placed during weather conditions not suitable, in the opinion of the Contractor, to permit satisfactory curing. When 7 day test results indicate that the concrete is likely to be sub-standard or rejected, the Contractor will be notified and can either request to arrange coring at that time or can continue to provide curing for the remainder of the 28 day period. In the event that the Contractor chooses to take cores after 7 days, they shall be taken as described in the foregoing paragraph, transported to an approved laboratory, and cured for a period of time such that the total curing time in place in the structure, plus the curing time in the laboratory is equal to 28 days. The cores shall then be tested and reported as described in the foregoing paragraph.
- .6 In cases where the concrete strength, as indicated by the cores, is higher than the strength based on the concrete cylinder results, the core results shall be used as the basis of acceptance and payment of the concrete. If the core strengths are lower than the strength from the concrete cylinder tests, the cylinder tests shall govern.

3.14 Construction Record Imprints

- .1 Each block of sidewalk constructed shall be marked at each end with a suitable tool showing legibly the name of the Contractor and year of construction.
- .2 Curb box locations are to be marked at right angles along the back of sidewalk. Imprint is to be 150 mm from the back of sidewalk and have initials C.C. Imprints shall be legible and supplied by the Contractor at his cost.

3.15 Protection

- .1 Keep 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 5 days after the concrete has been finished.

3.16 Backfilling

- .1 Backfill along the backs of walks or curbs, to 50 mm below top of the concrete, within seven days of the placing of the concrete. The backfill shall be mechanically tamped in maximum lifts of 150 mm to a minimum density of 95% Standard Proctor Density, to a distance 300 mm from the back of the walk or curb. Granular material which may have existed shall be replaced.

3.17 Final Cleanup

- .1 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 which have been blocked as result of the Contractor's trenching operation shall be restored or repaired at the Contractor's expense.

- .2 The Contractor shall, at his own expense, dispose of all surplus excavated material, organic soil, rock boulders and pieces of concrete and masonry, including those less than 0.1 m³ in volume at an approved off-site disposal area.

3.18 Concrete Deterioration

- .1 Concrete that shows surface scaling, deterioration or loss of cement or aggregate during the maintenance period will be rejected and require removal and replacement by the Contractor at no cost to the Owner.

END OF SECTION