

## 1.0 **CONCRETE**

### 1.1 **CONCRETE MIX**

- .1 Concrete mix shall be in accordance with the following:

Minimum 28 Day Strength 25 MPa\*  
Designated Aggregate Size.....maximum 25 mm (1 inch)  
Slump.....25-75 mm (1-3 inches)  
Air Entrainment.....5 - 7 %  
Cement.....Type 10 Normal Portland Cement  
Calcium Chloride .....ASTM D98, 2% maximum, with  
Project Managers approval

### .2 **STRENGTH REQUIREMENTS**

- .1 The average of all tests shall exceed 25 MPa.  
.2 The average of five (5) consecutive samples must be at or above 25 MPa.  
.3 No three (3) consecutive test samples shall fall below 25 MPa.  
.4 No individual strength test shall be below 21.5 MPa.

## 2.0 **AGGREGATES FOR CONCRETE**

- .1 Prior to purchasing aggregates, the contractor shall have samples and ASTM Tests taken of the aggregate at the source of supply by a testing firm acceptable to the Owner. The source of supply will be approved if the samples submitted meet the requirements of these specifications. The supply of aggregate that has been tested must also be in a stockpile of sufficient quantity to supply the complete sidewalk, curb and gutter program. Samples will be taken periodically after initial approval and as the work proceeds with a minimum number one (1) aggregate test per 275 cubic metres of placed concrete. Aggregates not meeting the requirements of these specifications will be rejected. Supply plants not properly equipped to grade coarse and fine aggregates within the limits herein specified or required, will not be approved. The cost of all aggregate tests shall be borne by the successful bidder.

### **3.0 TESTING AND INSPECTION**

- .1 The Contractor shall employ a testing agency approved by the Project Manager, to carry out mix designs and aggregate tests for materials approved.
- .2 The City shall engage a testing firm, and the costs of testing, including the cost of the moulds shall be borne by the City.
- .3 The Contractor shall allow access and provide material for all tests by the City's Testing Agency.
- .4 Minimum number of field tests shall be as follows:
  - .1 Curb and Gutter - one test for each section 0-200 lineal metres of curb and gutter.
  - .2 Monolithic Sidewalk - one test for each section 0-150 lineal metres of sidewalk.
  - .3 Air Content tests - in accordance with CSA Specification A23.2-4c, minimum testing frequency same as field cast cylinders.
  - .4 Slump tests - in accordance with CSA Specification A23.2-5c, minimum testing frequency same as field cast cylinders.
  - .5 Test Cylinders - at least three test cylinders will be taken daily for each class of concrete placed.

### **.5 TESTING AND SAMPLING METHODS**

- .1 Compression Test Specimens - Standard method of Making and Curing Concrete Compression and Flexure Test Specimens (CSA A23.2-3C).
- .2 Compression Tests - Standard method of Compressive Strength of Cylindrical Concrete Specimens (CSA A23.2-9C)
- .3 Air Content - Standard method of Air Content of Plastic Concrete by the Pressure Method (CSA A23.2-4C).

.4 Slump - Standard method of Slump of Concrete (CSA A23.2-5C).

.5 Sampling Plastic Concrete - Standard method of Sampling Plastic Concrete (CSA A23.2-1C).

.6 **FACILITIES INSPECTION**

.1 Proper facilities shall be provided for the Project Manager to inspect the ingredients and processes used in the manufacture and delivery of the concrete. The manufacturer shall afford the Project Manager all reasonable facilities without charge, for securing samples to determine whether the concrete is being furnished in accordance with this specification.

.2 Notify the Project Manager twenty-four (24) hours in advance of any concrete placement.

**4.0 ENFORCEMENT**

.1 In the event that the concrete tested in accordance with Section 2 of these specifications fails to meet the strength requirements, the Project Manager shall have the right to require any one or all of the following at no additional expense to the City of Medicine Hat.

.1 Changes in the concrete mix proportions for the remainder of the work.

.2 Coring and testing of the concrete represented by the tests which failed to meet the required strength; sampling and testing shall be according to ASTM Designation C42.

.3 Removal and replacement of the concrete failing to meet the minimum strength requirements.

.4 Extension of the warranty period beyond the specified two (2) year time limit.

- .2 In the event of non-compliance with the specifications in Section 3.5, additional testing will be done at the contractor's expense regardless of the results of the retesting. The cost of the testing will be invoiced by the City to the contractor, and subsequently will be deducted from the progress payments.
- .3 If the measured slump or air content falls outside the limits specified, a check test shall be made immediately on another portion of the same sample. In the event of a second failure, the Project Manager may refuse to permit the use of the load of concrete presented.

## **5.0 MIXING AND DELIVERY**

### **.1 MIXING**

Ready mixed concrete shall be mixed and delivered in accordance with ASTM Specifications C-94-62. In case of doubt as to the quality of concrete provided by the proposed supplier on the basis of substandard materials, or methods of manufacture or transportation, the Project Manager may, at his option, order the Contractor not to use concrete on the job from such proposed supplier and the Contractor shall arrange for an acceptable source of supply.

### **.2 DELIVERY TIME**

When a truck mixer or agitator is used for transporting concrete, the concrete shall be delivered to the site of the work and discharge shall be completed within one and one-half hours after the introduction of the mixing water to the cement and aggregates.

## **6.0 MATERIALS**

### **.1 PORTLAND CEMENT**

Portland Cement shall be type 1 and shall conform to CSA Specification 4A., unless otherwise specified.

### **.2 CONCRETE AGGREGATES**

- .1 Concrete Aggregates shall conform to the "Standard Specifications for Concrete Aggregates" - ASTM Designation C33-61T.

.3 ADMIXTURES

- .1 Air Entrainment: An air entraining agent conforming to ASTM C23.3 shall be used in sufficient amounts to produce air entrainment between the limits of 5-7%.
- .2 Calcium Chloride: Calcium Chloride conforming to ASTM D98 will be used as directed by the Project Manager. To provide cold weather protection, the maximum amount permitted will be 2% by weight of cement.
- .3 Initial Set Retarder: An initial set retarding (water reducing) admixture, Daratard HC or equal, shall be used in strict accordance with the manufacturer's recommendations.

.4 WATER

Water used in mixing concrete shall be clean and free from injurious amounts of oils, acids, alkalis, organic materials, or other deleterious substances.

.5 CURING COMPOUND

- .1 Curing compound shall conform to ASTM Specifications C309 Type 1-D or 2, and be approved by the Project Manager.
- .2 The compound shall be sufficiently free from permanent colour to result in no pronounced change in colour from that of natural concrete.
- .3 The compound shall, however, contain a dye of colour strength sufficient to render the film distinctly visible on the concrete for a period of at least four (4) hours after application.

.6 SEALING SOLUTION

The sealing solution shall be a mixture of 50% boiled linseed oil and 50% kerosene or varsol.

## **7.0 EXECUTION**

### **.1 REMOVAL OF EXISTING CONCRETE**

- .1 Remove existing curbs, gutters, and sidewalks and other structures shown on the drawings as being removed.
- .2 Cut existing concrete neatly, and load and haul debris to designated disposal areas. The cost of excavating, loading and hauling to place of disposal is to be included in the unit price for concrete removal.
- .3 Avoid damage to adjacent concrete surfaces not scheduled for removal. Damages will be the responsibility of the Contractor.
- .4 If necessary, in the opinion of the Project Manager, jack hammers shall be used to facilitate sidewalk, curb and gutter removal.

### **.2 EXCAVATION**

- .1 Excavate materials to the required grade, elevations, and cross-sections as shown on the drawings.
- .2 Remove all deleterious or unstable material encountered at the sub-grade level to an approved depth and dispose of in accordance with the contract. Replace with approved fill material compacted to 100% of Standard Proctor Density to provide a uniform bearing over the area of the structure.
- .3 If the sub-grade is excavated in error, below the specified grade, replace with approved fill material compacted to 100% of Standard Proctor Density, at no extra cost to the Owner.
- .4 Excavated material that is unsuitable for use as fill, or surplus excavated material will be disposed of by the contractor at approved locations by the Contractor and approved by the Project Manager. If the Contractor is disposing of surplus material on privately owned land, he will make proper arrangements with the owner and he will be held responsible for any damage occurring as a result of his work.

.3 BERMS

- .1 Berm material shall consist of approved material , either gravel from street excavation, pit run gravel, sand, or common excavation.

- .2 Earth fills will be made up of 150 mm (6 inches) layers and consolidated with approved compaction equipment which will produce a minimum of 100% Standard Proctor density.
- .3 In excavated areas, scarify to 150 mm (6 inches) and recompact to 100% of Standard Proctor density.
- .4 Bid price to include cost of excavation / fill up to 300 mm (12 inches) within the base of the concrete.

.4 FORMING

- .1 Forms, either of steel or wood shall conform to the shape, lines and dimensions of the concrete as called for on the plans.
- .2 Forms shall be substantial and sufficiently tight to prevent leakage of mortar; they shall be properly braced or tied together so as to maintain position and shape.
- .3 Forms shall be set to line and grade and so constructed and fastened as to produce true lines. Special care shall be used to prevent bulging.
- .4 The inside of the forms shall be smooth, cleaned, and coated with non-sustaining mineral oil or other approved material or thoroughly wetted (except in freezing weather).
- .5 Forms shall not be disturbed until the concrete has adequately hardened.

.5 INSPECTION

- .1 Ensure that the base material has not been softened by moisture, and ensure that the base is not too dry for placing concrete.
- .2 Delay placing concrete as required to dry the base if the base is too wet or add moisture as necessary to prevent absorption of water from concrete if the base is too dry.
- .3 Obtain approval of the Project Manager prior to placing any concrete.



.6 PLACING

- .1 All concrete construction shall be vibrated by means of a vibrating screed or internally by means of a poker or pencil vibrator which shall not exceed fifty (50) millimetres (2 inches) in diameter.
- .2 All concrete sections be constructed in accordance with attached detailed drawing.
- .3 Provide 3mm (.12 inches) wide contraction joints at least every three (3) metres (.12 inches). Joints should be tooled to a depth of 30mm (1.18 inches) in concrete sections.
- .4 Flexible metal forms shall be used to form all curves with a radius of less than ten (10) metres (32 feet).
- .5 The finish of the walk is to be brush finish and all edges including joints shall be tooled for a width of fifty (50) millimetres (2 inches) and rounded to a radius of 6 mm (.24 inches).
- .6 Concrete shall be conveyed to the place of final deposit by methods which will prevent the separation or loss of materials.
- .7 Water shall be removed from the excavations before concrete is deposited unless otherwise directed by the Project Manager. Any flow of water into the excavation shall be diverted through proper side drains to a sump, or be removed by other approved methods which will avoid washing and freshly deposited concrete.
- .8 Provide 30mm 1.18 inches0 deep contraction joints directly over locations of tree roots. Spacing of adjacent joints shall be averaged over next two joints, but shall not exceed 1.5m (5 feet).
- .9 Provide expansion joints around all structures such as poles, valve boxes, hydrants, buildings using a 13mm (.51 inches) wide approved expansion joint material.

.7 FINISHING

- .1 Top surface shall be smoothed with a wood float and stiff brush or broom to provide an even surface in such a manner and at such a time as to minimize the depth and quantity of brush marks.
- .2 Bleed water must not be worked into the concrete surface. Delay finishing until excess bleed water has evaporated. Dry cement, or dry mixture of cement and sand shall not be used to absorb surface water.
- .3 The contractor is responsible to ensure the surface of the concrete is not vandalized. Any damaged surface must be repaired, or replaced, to the satisfaction of the Project Manager.

.8 CURING

- .1 All concrete shall receive moist curing for a period of at least seventy-two (72) hours. One of the following methods shall be used as soon as the concrete has hardened sufficiently to prevent marking:
  - .1 Surface covered with canvas or other satisfactory material and kept thoroughly wet.
  - .2 Surface sealed with polyethylene sheeting at least 6 mils thick and the concrete kept thoroughly wet.
  - .3 Subject to the approval of the Project Manager, a liquid, membrane forming, curing compound supplied at the rate recommended by the manufacturer may be used. Curing compounds shall not be used on a surface where bond is required for additional concrete. Curing compound to be applied as follows:
    - .1 Apply in two coats with approved spray equipment to form complete and unbroken film on surface of concrete. Mechanically agitate compound before and during use.

- .2 Apply first spray as soon as excess water has evaporated from surface.
- .3 Apply second spray within 24 hrs. of first.
- .4 Apply each spray at application rate recommended by manufacturer.
- .5 Spray slab edges within 1 hr. of removal of forms.
- .6 Respray areas where membrane is damaged during curing period.

.9 COLD WEATHER REQUIREMENTS

- .1 Do not place concrete when air temperature is below 5 deg. C, (41 deg F) unless the following requirements are met:
  - .1 Preheat water and aggregates as well as reinforcement, forms, and the ground.
  - .2 Concrete when deposited, shall have a temperature of not less 4EC nor more than 27EC under warm weather conditions. Concrete shall be covered and maintained at a temperature of at least 10EC for not less than seventy-two (72) hours after placing, or until the concrete has thoroughly hardened.
  - .3 Do not use calcium chloride, except with the written permission of the Project Manager and then only with normal portland cement and in quantities less than 2% by weight. Close control of calcium chloride quantities and careful mixing is required.

.10 NAMEPLATE

- .1 Once in each block place the imprint of the name plate showing the name of the Contractor and the year of construction.

.11 BACKFILL

- .1 Backfilling shall be completed by the Contractor on all the concrete poured.
- .2 Backfilling shall commence within 10 days, but no sooner than 7 days from the day the concrete was finished.
- .3 Material placed behind sidewalks or curb and gutter shall be compacted to a minimum 90% of Standard Proctor Density. Material shall be placed to the full height of concrete unless otherwise specified by the Project Manager.
- .4 Where landscaping by others is required following the work of this contract, leave backfill 100mm (4 inches) below finish grade to allow for topsoil.

.12 CLEANUP

- .1 Remove all debris and excess materials from the site immediately after completion of the work.
- .2 Cleanup operations shall be carried on continuously as the work progresses.

**END OF SECTION**