
SOIL CEMENT BASE COURSE

PART 1 GENERAL

- 1.01 OTHER CONTRACT DOCUMENTS The General Conditions of the Contract, General Requirements, and Supplemental Conditions attached hereto shall apply to and be part of this Section.
- 1.02 DESCRIPTION OF WORK The Work described herein shall be for the supply and installation of plant-mixed or street-mixed soil-cement base course for road construction.
- 1.03 RELATED WORK Section 02212 Roadway Excavation and Grading
Section 02303 Granular Base Course
Section 02510 Plant Mixed Bituminous Pavement
Section 02514 Concrete Construction
- 1.04 APPROVALS The Contractor shall notify the Engineer of the source of supply and submit samples of all materials to be incorporated into the Work a minimum of ten (10) calendar days prior to the start of construction. Each sample shall contain not less than 60 kilograms of material and the Contractor shall assume all costs incurred in obtaining and shipping the samples. Sampling of materials shall be performed in accordance with applicable ASTM procedures. Preliminary approval of the quality and nature of the material submitted in the samples will not constitute general acceptance of the material or source of supply. Any material of a quality or nature not suitable for use in the Work will not be accepted.

PART 2 PRODUCTS

- 2.01 CEMENT Cement shall be Type 10 - Normal Portland Cement manufactured in accordance with CSA Standard - CAN/CSA A5 'Portland Cement'.
- 2.02 WATER Water shall be potable and free from injurious amounts of oil, acid, alkali, soluble chlorides, organic matter, sediment, and other deleterious substances.
If requested by the Engineer, the Contractor shall provide written verification from an approved testing laboratory confirming the water used in the manufacture of the soil cement meets the requirements this Section.

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2.01 SOIL AGGREGATE

The soil aggregate shall be either insitu material, approved imported soil, or a combination of the above, and exclusive of any stone or gravel retained, it shall conform to the following gradation:

Passing 25 mm sieve	100%
Passing 4.75 mm sieve	55 - 85%
Passing 2.00 mm sieve	25 - 70%
Passing 425 um sieve	15 - 45 %
Passing 75 um sieve	6 - 20%

The maximum content of deleterious materials retained on the 4.75 millimetre sieve shall not exceed 15% by weight of total dry soil sample.

PART 3 EXECUTION

3.01 SUBGRADE

The subgrade or granular base course shall be shaped to the grade and cross-section shown on the Drawings or as stated in Section 01001 Supplemental Conditions. Soil Cement shall not be placed until the subgrade or granular base course has been accepted by the Engineer.

The Contractor shall maintain the subgrade or granular base course to the required section and degree of compaction, free from ruts, waves and undulations by means of blade graders and compaction equipment and, where required, water shall be applied as directed by the Engineer. The subgrade shall be compacted to a minimum of 100% of standard proctor density, as determined by the Engineer and shall be prepared for a minimum distance of one block in advance of the placing of the soil cement.

Soft or yielding sub-grade or granular base course shall be corrected as directed by the Engineer and replaced with Class "C" Base Course compacted to a minimum of 95% of modified proctor density before placing soil cement.

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- 3.02 STREET HARDWARE All street hardware, valve casings and manholes shall be either raised, lowered, removed or covered to accommodate the Work. The Contractor shall cover all openings with a steel plate prior to application of the soil cement. Prior to the completion of the work, all street hardware shall be reinstated and set level with the finished grade. Any voids or openings adjacent to street hardware shall be filled with compacted soil-cement or hot mix asphalt. The initial location of valves and manholes will be done by the City, and subsequent locating will be done by the Contractor.
- 3.03 EXISTING PAVING Where the proposed soil cement abuts to existing paving, the existing paving shall be saw cut in a straight line at right angles to the centre line of the existing paving and with a vertical face free of loose material.
- 3.04 WEATHER Soil cement base course shall not be produced or placed when the soil or sub-grade is frozen, or when the air temperature, taken within 150 millimetres of the sub-grade, is +4°C or less, or during periods of high winds, or when, in the opinion of the Engineer, there is imminent danger of rain or damaging frost within 24 hours. The Contractor shall protect all newly placed soil cement from adverse weather conditions with polyethylene or insulated covers as directed by the Engineer. The soil cement shall be adequately protected from freezing for seven (7) calendar days following placement and the Contractor shall promptly replace any soil cement damaged by adverse weather conditions.
- 3.05 QUANTITY OF CEMENT A minimum quantity of 6% Portland cement by weight of dry soil aggregate shall be incorporated into the soil aggregate with equipment capable of controlling the rate of application within plus or minus five percent (5%) of the designated quantity. When bulk cement is used, equipment suitable for handling, weighing, and mixing the cement shall be provided.

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Notwithstanding the requirement that a minimum quantity of 6% Portland Cement by weight of dry soil aggregate applied, the Contractor shall ensure that sufficient cement be added to the soil to give a durable product with a minimum compressive strength of **3.5 MPa** after seven (7) days.

**3.06 PLANT BATCHED
SOIL CEMENT**

Unless stated otherwise in Section 01001 Supplemental Conditions the supply of soil cement shall be by the plant-mixed method in a central mixing plant capable of producing a product of consistent quantity and quality to satisfy the requirements of this Section.

Cement and soil aggregate shall be combined as stated in Part 3.05 of this Section and only in the amount that can be mixed, delivered, shaped and compacted within four (4) hours of application. After the soil aggregate and cement have been thoroughly mixed, water shall be uniformly added and continuously mixed until a uniform homogeneous mix of soil aggregate, cement and water has been produced. The percentage of moisture in the completed soil cement mixture and in un-pulverized soil lumps, based on oven-dry weights, shall not be below or greater than two (2%) percent above the specified optimum moisture content, and shall be less than that quantity which will cause the soil-cement mixture to become unstable during compaction and finishing. The specified optimum moisture content and density shall conform to ASTM D 558 or AASHTO T134 and will be determined by the Engineer. The sub-grade and base course shall be damp when the soil-cement mixture is placed.

**3.07 STREET-MIXED
SOIL-CEMENT**

The existing insitu or imported soil aggregates shall be loosened, pulverized or mixed to the gradation stated in Part 2.03 of this Section. The length of the road pulverized in advance shall not exceed the length that can be completed within two (2) Working Days.

The loosened or pulverized material may be formed into one or more windrows of uniform density and

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cross-section. The tops of windrowed soil material shall be flattened or slightly trenched to receive the cement. The size of the windrow or the depth of material pulverized shall not exceed the quantity that can be properly mixed with each pass of the mixer.

In lieu of loosening and pulverization of the soil aggregate in places on the roadbed, the use of a road mixing machine, which cuts a true plane on the compacted soil aggregate at the required depth, will be permitted providing furrows of loosened material are not created below the plane specified for the bottom of the base.

Cement shall be spread uniformly on the area to be paved or on top of the windrowed material using an approved method of distribution. Spread cement that has been displaced shall be replaced before mixing is started.

All soil aggregate, cement and water shall be mixed in place. Only such cement shall be applied as can be completely processed within four (4) hours after the addition of water to the mixture. Cement shall not be applied if the percentage of moisture in the soil aggregate exceeds that quantity that will permit a uniform and homogeneous mixture of soil aggregate and cement, or if the moisture content of the soil aggregate is more than two (2) percentage points above the specified optimum moisture content for the soil-cement mixture.

The soil aggregate and cement shall be mixed by an approved type of road mixing machine. The road mixing machine shall be the type that picks up all loose soil aggregate from a windrow or from a blanket of loose soil aggregate spread over the full width of the proposed road, or it may be the type which cuts a true plane in compacted material at the required depth. The machine shall be so constructed that it will pick up all the soil aggregate at the time of mixing. The mixer may be of the pug-mill or auger type, or a transverse shaft type that mixes the materials by means of revolving blades or paddles that lift all the loose material from the sub-grade and be capable of mixing the soil aggregate and cement uniformly over the road surface on one pass minimizing the amount of cement dust blown onto adjacent property.

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The road mixing machine shall have provision for introducing water, at the time of mixing, through a metering device or by other approved methods. The water shall be applied by means of controls which shall supply the required ratio of water to the soil-cement mixture passing through the mixer and produce a completed mixture with a uniform moisture content, or the water shall be introduced into the mixture by a pressure distributor. Leakage water shall not be permitted and care shall be taken to avoid the addition of water by spilling or any other means. Excess concentrations of water on or near the surface shall be avoided.

After all the mixing water has been applied, mixing shall be continued until a homogeneous mix of soil aggregate, cement and water has been produced. Mixing may be accomplished by one or more passes of the mixer through the material. The device by which the mixer picks up the soil aggregate shall be subject to control and shall be so controlled and operated on each pass of the mixer as to pick up all the soil aggregate to be treated and at the same time, avoid cutting into the sub-grade or picking up unmixed soil aggregate on successive passes.

After each pass of the mixer, the material adjacent to the curb shall be bladed out from the curb to the full depth of the soil cement to facilitate the proper mixing of material adjacent to the curb. To ensure smooth joints, where soil-cement abuts existing paving, the pavement shall be kept clean of soil-cement at all times. Soil-cement material pulled on to the pavement during mixing shall be pushed back and away from the joint to permit proper mixing of material adjacent to the joint.

Mixing shall continue until the mixture is uniform in colour and at the required moisture content through the full depth and width of the roadway.

Any soil and cement mixture that has not been compacted and finished shall not remain undisturbed for a period longer than thirty (30) minutes without being remixed.

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3.08 COMPACTION

Not more than sixty (60) minutes shall elapse between the addition of water to the soil cement mixture and the start of compaction. At the start of compaction, the percentage of moisture in the mixture shall not be below or more than two (2%) percent above the specified optimum moisture content, and shall be less than the quantity which will cause the soil-cement mixture to become unstable during the compaction and finishing operations.

3.09 DENSITY

Prior to any compaction, the mixture shall be in loose condition for its full depth. Compaction shall start as soon as possible after spreading and the loose mixture shall be uniformly compacted across the full width of the road to the specified density within two (2) hours of being placed. Rolling shall commence with the roller completely covering the outer edge of the material and shall proceed uninterrupted across the area to be compacted until the required degree of compaction is attained. Successive passes of the roller shall be spaced so not more than seventy-five percent (75%) of the width of the rear roller wheel is on uncompacted material at any time. The intensity of rolling will be such that the maximum density is obtained to a uniform degree throughout the depth of the soil cement base within the specified time limit. Final surface compaction shall be completed using pneumatic-tired or steel-wheeled rollers. Compaction equipment shall be capable of producing the required degree of compaction within the time limits as specified or as indicated by the Engineer. The use of any equipment which abrades and loosens the compacted surface shall not be permitted.

The surface of the uncompacted, partially compacted or completely compacted soil-cement base shall be kept moist at all times until a bituminous curing material has been applied. An adequate water supply shall be maintained at the point of spreading and compacting and the equipment shall be available so that water can be applied without driving over the uncompacted mixture.

The soil cement shall be compacted to a minimum of ninety-eight (98%) percent of ASTM or AASHTO Standard Proctor density at optimum moisture content through for the full depth of the soil cement base.

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If the resulting density, after compaction, is less than that specified, three (3) additional density tests will be carried out and the results averaged. Should the average of the three tests fail to meet the minimum requirements, the section shall be reconstructed at the contractor's expense, in accordance with the following schedule;

For a portion reprocessed the same day as originally constructed, add 50% of the original cement content.

For a section reprocessed the day following the original construction, add 75% of the original cement content.

For a section reprocessed more than one day since the original construction, add 100% of the original cement content.

3.10 FINAL GRADING

The soil-cement shall be graded with a smooth level surface and shall conform to the lines, grades, and thickness shown on the Drawings or as outlined in Section 01001 Supplemental Conditions. The surface shall be lightly scarified to loosen any imprints left by the compaction or grading equipment followed by further compaction with a steel-wheel, vibratory, or pneumatic type rollers, producing a smooth, dense surface free of compaction planes, cracks, ridges or loose material. Where they occur, the area shall be again be scarified and compacted to the required density.

The moisture content of the surface shall be maintained at the optimum moisture specifications by means of a water distributor during the finishing operation. Care must be exercised and the water controlled so as to prevent segregation of the cement and soil aggregate. The surface of the cement stabilized base shall be such that, when tested with a three (3) metre straight edge placed on the surface of the roadway, the maximum deviation of the surface of the straight edge shall not exceed thirty (30) millimetres.

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High spots on the soil-cement base will be removed, before setting of the cement, using cutting blades or other equipment which will not disturb the compacted material. The excess material will be removed to the shoulder or adjacent sub-grade. Low areas will be dug out and replaced with new material for the full depth of soil cement. Finished portions of soil cement that are travelled on by equipment used in construction of adjacent sections of soil cement, shall be protected to prevent the equipment from marring or damaging the completed Work.

**3.11 CONSTRUCTION &
CONTROL JOINTS**

Soil-cement for large areas shall be built in a series of parallel lanes of length and width that meet the approval of the Engineer. At the end of each construction day, or at any time where delays will put the completion of the Work beyond the limit set for completion, straight longitudinal joints shall be made at the edge(s) of each day's construction by cutting back the end or side of the compacted material at right angles to form a true vertical face with the road bed, which shall be free from all shattered and loose material.

Unless directed otherwise by the Engineer, control joints shall be saw-cut to a depth of $\frac{1}{4}$ to $\frac{1}{2}$ the thickness of the finished soil-cement within twenty-four (24) hours of final compaction. The spacing of the saw-cuts shall be such that the resulting slabs shall be equal in length and width.

3.12 CURING

The Contractor shall maintain the surface of completed soil-cement in a moist condition by applying a fine spray of water in an amount sufficient to fill the surface voids. The Contractor shall then promptly apply a bituminous curing seal of liquid asphalt or emulsified asphalt prime coat. The type of prime coat used may vary from a rapid curing asphalt (RC 70,250), medium curing asphalt (MC 30,40,250, EP-90), or an emulsified asphalt (SS-1, 1h, CSS-1, 1h) to suit the condition of the base as directed by the Engineer. The rate of application shall be approximately 0.90 litres per square metre, to be applied evenly by means of a pressure distributor.

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The curing seal shall completely cover the soil cement base course surface.

The Contractor shall maintain the curing seal membrane for a seven (7) calendar days period and he shall ensure the soil-cement remains completely covered with bituminous seal coat during this period.

The completed soil cement roadway shall be kept closed to traffic the full seven (7) calendar days before the asphalt wearing course can be applied. The Contractor shall barricade and secure the completed roadway to prevent vehicle traffic from marring the surface. The roadway may be open to traffic after the seven (7) day curing period, provided the soil-cement has hardened sufficiently to prevent marring or distortion of the surface by equipment or traffic, and provided the bituminous curing seal is not impaired.

END OF SECTION