CONSTRUCTION SPECIFICATION FOR
CEMENT TREATED GRANULAR BASE AND SUBBASE

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This specification covers the requirements for the construction of one or more courses of a mixture of granular material, Portland cement and water on a prepared subgrade, the application and maintenance of a bituminous curing membrane and where required, the application of a sand cover to the bituminous surface. Where the term cement treated granular base is used, it means cement treated granular base or cement treated granular subbase.

This specification refers to the following standards, specifications or publications:

**Ontario Provincial Standard Specifications, Construction:**

- OPSS 206 Grading
- OPSS 301 Restoring Unpaved Roadway Surfaces
- OPSS 304 Single and Double Surface Treatment
- OPSS 314 Untreated Granular Subbase, Base, Surface, Shoulder and Stockpiling
- OPSS 350 Concrete Pavement, Concrete Base and Lean Concrete Base
- OPSS 501 Compacting
- OPSS 502 Weighing of Materials
Ontario Provincial Standard Specifications, Material:

OPSS 1003 Aggregates - Asphaltic Concrete, Hot Mixed and Hot Laid
OPSS 1010 Aggregates, Granular A, B, M and Select Subgrade Material
OPSS 1102 Liquid Asphalt
OPSS 1301 Hydraulic Cementing Materials
OPSS 1302 Water

315.04 SUBMISSION AND DESIGN REQUIREMENTS

315.04.01 Samples

Samples of the granular base course material to be used shall be submitted to the Authority for analysis and mix design purposes at least six weeks before placing cement treated granular base.

315.04.02 Protection

The Contractor's method of protection of the work from cold weather shall be submitted in writing to the Authority at least one week before the protection is required.

315.05 MATERIALS

315.05.01 Cement

Cement shall be normal Portland cement and shall conform to OPSS 1301.

315.05.02 Water

Water shall conform to OPSS 1302.

315.05.03 Granular Material

Granular material shall be Granular A or B and shall conform to OPSS 1010.

315.05.04 Curing Membrane

The bituminous material required for the curing membrane shall be R.C 250 and shall conform to OPSS 1102.

315.05.05 Cover Material

Cover material shall be HL 4 or HL 8 fine aggregate conforming to section 1003.05 of OPSS 1003.

315.05.06 Mix Proportions

The Engineer shall determine the mix proportions.

The proportioning of cement and water to granular material shall be within the following limits.

Cement - ± 5 % of the specified mass of cement.
Water - ± 8 % of the specified mass of water.
For bidding purposes it may be assumed that cement content will be approximately 5 percent of the dry mass of granular materials and the water content will be approximately 7 percent of the dry mass of granular materials.

315.06 EQUIPMENT

315.06.01 Mixing Equipment

A central mixing plant of the batch or continuous type, capable of mixing granular material, cement and water shall be used. The plant shall be capable of maintaining an output of not less than 180 t/h. The following conditions shall apply.

a. If a batch mixer of the pugmill type is used, the dry materials shall be proportioned by mass.

b. If a continuous type of mixer is used, the dry materials shall be proportioned by volume.

c. A cement diversion chute shall be provided so that the flow of cement may be diverted from the main belt to a sampling weighing scale. The cement diversion chute shall be so constructed as to provide control over the cement test time.

Cement weighed at batch mixing plants shall be weighed on scales separate and distinct from the aggregate batching scales except that if separate compartment for the cement is contained within the aggregate hopper and the cement for each batch is weighed prior to the weighing of the aggregate, the cement may be weighed on the aggregate scale.

d. Cement shall be added to the granular material in such a manner that it will be uniformly distributed throughout the aggregate during the mixing operation.

e. If a continuous type mixer is used, the correct proportion of granular material, cement and water shall be introduced into the mixer through approved feeders or metering devices. The metering devices and feeders shall be interlocked and so synchronized as to maintain a constant ratio of cement to aggregate. A positive signal system shall be provided to indicate when the level of any material in its storage bin reaches the strike off capacity of the feeder or the minimum level of metering. The plant shall be equipped with facilities satisfactory to the engineer for calibrating gate openings by weighing check samples.

f. The mass of charge in a batch mixer or the rate of feed in a continuous mixer shall not exceed that which will permit complete mixing of all the material. Dead areas in the mixer, in which the material does not move or is not sufficiently agitated shall be corrected either by reduction in the volume of material or by other adjustments.

g. Water may be proportioned by mass or volume. The quantity, the rate and the time of addition of the water to the mixture of granular material and cement shall be as directed by the Engineer. All water additions shall be made under conditions which permit an accurate determination of the quantity added.

h. Mixing of the material shall continue until the cement and water are evenly distributed throughout the mass. In no case shall the period of mixing be less than 30 s from the time all materials are in the mixer.

315.06.02 Transport Equipment

Trucks used to transport the mixed materials from the central plant to the spreading equipment, shall be equipped with protective covers which shall be used as directed by the Engineer.
315.06.03 **Grader**

Graders shall be self-propelled, equipped for scarifying, and have sufficient gross mass, blade length, wheel base and power to shape in one pass a full 3.75 m lane width of cement treated base. Finishing graders shall be equipped with automatic grade and slope controls.

315.06.04 **Pressure Distributor - Water Curing**

Pressure distributors shall be truck mounted and capable of applying a fog or fine mist of water to the road surface without direct impingement.

315.06.05 **Pressure Distributor - Bituminous Curing Membrane**

Asphalt distributors used for this work shall conform to OPSS 304.

315.06.06 **Compaction Equipment**

Compaction equipment shall be self-propelled. Steel wheeled rollers shall weigh no less than 9 t. Pneumatic tired rollers shall conform to section 304.06 of OPSS 304. Not less than one steel wheeled roller and one rubber tired roller or one vibratory roller and one rubber tired roller shall be used.

315.07 **CONSTRUCTION**

315.07.01 **General**

The work required for cement treated granular base and cement treated granular subbase is detailed in subsections 315.07.02 to 315.07.10 inclusive.

315.07.02 **Preparation for Cement Treated Granular Base and Subbase**

315.07.02.01 **Subgrade**

The surface on which the cement treated granular base is to be placed shall be constructed conforming to OPSS 206 except that the compacted surface shall not deviate by more than 15 mm from the specified grade and cross-section and 15 mm at any place on a 3 m template.

315.07.02.02 **Previous Contract**

Where the road surface to receive cement treated granular base has been prepared under a previous contract the surface shall be restored conforming to OPSS 301 except that the surface tolerance shall conform to the clause 315.07.02.01.

315.07.03 **Weather Restrictions**

The construction of the cement treated granular base shall not proceed when a falling air temperature reaches 5°C, nor shall the work be resumed until a rising air temperature reaches 5°C. Cement treated granular base shall not be placed when it is raining or when rain is imminent. Cement treated granular base already placed shall be protected against the effects of rain until it is sufficiently hardened. The cement treated base shall be protected from cold weather conforming to section 350.07 of OPSS 350. The Contractor's proposed method of protection shall be subject to the Engineer's "Permission to Construct".
315.07.04  Time Restrictions

The mixed material shall be placed on the prepared surface within 45 min. of the addition of water in the mixer.

The placing, compacting and finishing of the cement treated base shall be completed within a period of 2 h from the time of the mixing.

Not more than 30 min. shall elapse between the placing of the material in adjacent lanes, unless vertical faces are prepared as specified under subsection 315.07.06.

315.07.05  Compaction

The compacted dry unit mass of the finished cement treated material shall be not less than 100 percent of the maximum dry density conforming to OPSS 501.

Compaction equipment shall be operated in both directions without turning.

315.07.06  Joints

Where material is to be placed against compacted material, which has been in place more than 30 min., a vertical joint shall be prepared by cutting back the compacted material to a sound vertical face, to the full depth. Cutting back to the full depth shall always be done prior to the conclusion of the day's work.

315.07.07  Surface Finish

Finishing to the required grade and cross-section shall be accomplished by means of a blade grader, using automatic controls, or a cutting attachment to a slip form paving machine using automatic controls for the control of longitudinal grade and transverse slope. The automatic controls shall be operated from a string line set to grade adjacent to the mechanical equipment used, or a laser plane.

The finished surface of the cement treated granular base shall be checked with a 3 m straight edge which when placed anywhere on the surface in any direction shall not show a gap greater than 10 mm between straight edge and the cement treated granular base.

315.07.08  Curing

In the period during and immediately following the finishing of the cement treated granular base, curing shall be ensured by applying a fine spray or fog of water at such intervals as may be required to maintain the surface at not less than its optimum moisture content as specified in the mix design. In no case shall a jet of water be allowed to impinge directly on the finished surface.

Before the conclusion of each day's construction the finished cement treated granular base course shall be treated with a bituminous curing membrane conforming to subsection 315.05.04.

The finished cement treated granular base shall be kept continuously moist until the bituminous material is placed. The bituminous material shall be applied to a moist surface at a minimum rate of 0.8 L/m² to provide complete and uniform coverage. The Contractor shall maintain the membrane in a continuous unbroken condition for a period of not less than 7 days.

315.07.09  Traffic Restrictions

The Contractor shall not be permitted to haul materials over the finished cement treated granular base and not open the finished cement treated granular base to construction traffic until the 7 d curing period has expired.
The finished cement treated granular base and subbase may be opened to public traffic at the discretion of the Engineer.

Should public traffic be allowed to use the sealed surface, cover material as specified in subsection 315.05.05, shall first be applied. The rate of application of cover material shall be only that quantity required to prevent pickup of the curing membrane by traffic.

315.07.10 Shouldering

Shouldering operations shall proceed immediately after the final compaction and finishing of the cement treated granular base. Shouldering shall conform to section 314.07 of OPSS 314.

All shoulder construction material shall be placed directly onto the shoulder and any spillage and materials dragged onto the finished surface shall be removed immediately without damage to the cement treated granular base. The area so affected shall be cleaned in a manner approved by the Engineer.

315.09 MEASUREMENT FOR PAYMENT

315.09.01 Cement Treated Granular Base
Cement Treated Granular Subbase

Measurement will be of the mass in tonnes and the method of determining the mass shall conform to OPSS 502.

315.09.02 Restoring Roadway Surfaces

Measurement shall conform to OPSS 301.

315.09.03 Shouldering Material

Measurement of shouldering material will be of the mass in tonnes and the method of determining the mass of material shall conform to OPSS 502.

315.10.01 Cement Treated Granular Base - Item
Cement Treated Subbase - Item

Payment at the contract price for the above tender item(s) shall be full compensation for all labour, equipment and materials to do the work.

315.10.02 Restoring Roadway Surfaces

Where the road surface to receive cement treated granular base has been prepared under a previous contract then payment for restoring the roadway surface shall conform to OPSS 301.

Where the road surface is prepared under this Contract then all costs of meeting the required surface tolerances shall be included under the applicable grading item.

315.10.03 Shouldering Material

Payment for shouldering material will be made at the contract price of the tender item for the type of granular material supplied.