

## Cement Stabilized Aggregate Base

SCDOT Designation: SC-M-308 (06/08)

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### 1. SCOPE

- 1.1. Cement Stabilized Aggregate Base (CSAB) consists of aggregate, Portland cement, and water. CSAB is proportioned, mixed, placed, compacted, and cured in accordance with these specifications. CSAB will conform to the lines, grades, thickness, and typical cross section shown in the Plans or otherwise established by the RCE. CSAB will ordinarily be covered with one or more lifts of asphalt as shown on the Plans. This Specification addresses requirements for materials, equipment, and construction of CSAB.

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### 2. REFERENCED DOCUMENTS

- 2.1. SCDOT Standard Specifications Divisions 200, 300, 400, and 700
- 2.2. **SC-T-140**, Moisture-Density Relations of Soils or Soil-Aggregate Mixtures Using a 10 lb. Rammer and 18 in. Drop

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### 3. SUBMITTALS

- 3.1. Submit samples of aggregate and Portland cement to the Geotechnical Materials Engineer at the Office of Materials and Research for approval of materials and for determining the correct cement content at least 30 days before beginning the operations.

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### 4. MATERIALS

- 4.1. Use materials that meet the requirements of Divisions 300, 400, and 700 of the Standard Specifications as follows:
  - 4.1.1. *Portland Cement*
    - 4.1.1.1 Use Type I Portland cement meeting the requirements as specified in Subsection 701.2.1, except that the allowable maximum alkali content ( $\text{Na}_2\text{O}+0.658\text{K}_2\text{O}$ ) is increased to 1.0%.
  - 4.1.2. *Water*
    - 4.1.2.1 Use water meeting the requirements as specified in Subsection 701.2.11.
  - 4.1.3. *Aggregate*
    - 4.1.3.1 Use aggregate meeting the requirements of Macadam Base Course or Marine Limestone Base Course as specified in Subsection 305.2.

#### 4.1.4. *Asphalt Material*

- 4.1.4.1 Use RS-2, CRS-2, or EA-P Special for the asphalt curing coat and meet the requirements specified for asphalt materials in Subsection 407.

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### **5. EQUIPMENT**

- 5.1. Ensure that the equipment necessary for the proper construction of the work is on site, in acceptable working condition, and approved by the RCE as to both type and condition before the start of work under this section. Provide sufficient equipment to enable prosecution of the work in accordance with the project schedule and completion of the work in the specified time.
- 5.2. Have sufficient vibratory rollers, smooth wheel tandem rollers, three-wheel rollers, pneumatic tired rollers, or other means of obtaining compaction that is satisfactory to the RCE. Ensure that the rate of operation is sufficient to uniformly compact the specified width and depth of the base course being processed within a period of 2 hours.

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### **6. CONSTRUCTION REQUIREMENTS**

#### 6.1. *Weather Limitations*

- 6.1.1. Apply cement only when the temperature is above 40°F in the shade and rising. Perform no work on frozen or excessively wet subgrade.

#### 6.2. *Preparation of Subgrade*

- 6.2.1. Construct the subgrade for the cement stabilized aggregate base course in accordance with the requirements specified in Section 208. Complete the subgrade at least 500 feet ahead of the placement of base course materials where feasible. When included in the work, construct shoulders in accordance with the requirements of Section 209 and accurately trim to the alignment and grade of the base course to form a trench or channeled section as prescribed on the Plans.

#### 6.3. *Mixing and Placing Materials*

- 6.3.1. Unless otherwise provided in Special Provisions, mix the base course by the stationary plant method. Use the quantity of Portland cement added to the aggregate, which is typically between 2.5% and 5.0% by weight of the surface dry aggregate, at the rate established by the Geotechnical Materials Engineer of the OMR within the tolerance specified herein.
- 6.3.2. Mix the aggregate, Portland cement, and water in a pugmill, either of the batch or continuous-flow type. Use a plant equipped with feeding and metering devices that add aggregate, cement, and water into the mixer in the specified quantities. In all plants, the acceptable variation of the weight or rate of feed of the cement is within 5.0% of the amount designated above. Continue mixing until a uniform homogeneous mixture is obtained. The RCE may require an increase in the mixing time when necessary to secure a proper blend of the materials.

- 6.3.3. Haul the mixture to the roadway in trucks with protective covers. Place the mixture on a moist subgrade in a uniform layer using an approved spreader. Construct layers of such contour and thickness that the completed base course conforms to the required grade and cross-section. Dumping of the mixture in piles or windrows is not permitted.
- 6.3.4. Do not allow more than 30 minutes to elapse between the placements of the base course mixture in adjacent lanes, except at longitudinal construction joints. Do not allow more than 60 minutes to elapse between the start of moist mixing and the start of compaction.

#### 6.4. *Compaction*

- 6.4.1. Before beginning compaction, ensure that the mixture is in a loose condition for its full depth. During compaction, ensure that it is uniformly compacted to not less than 98.0% of the maximum laboratory density obtained according to **SC-T-140**. The in-place density and moisture content is determined with a nuclear moisture-density gauge. If necessary, the gauge is calibrated for moisture content at the beginning of the work and at any time during the work.
- 6.4.2. Perform the compacting with equipment specified above. Finish in such a manner that produces a uniform dense mass, free from cracks, ridges, or loose material. Maintain the moisture content of the surface material within 2% of the specified optimum moisture content during finishing operations.

#### 6.5. *Construction Joints*

- 6.5.1. At the end of each day's construction, form a straight transverse construction joint by cutting back into the completed work to form a true vertical face, free of loose or shattered materials. Construct the base course for large, wide areas in a series of parallel lanes of convenient length and width meeting the approval of the RCE. Form straight longitudinal joints at the edge of each day's construction by cutting back into the completed work to form a true vertical face, free of loose or shattered materials.

#### 6.6. *Construction Limitations*

- 6.6.1. Limit the area over which the cement aggregate mixture is spread in order that all operations specified can be continuous and all work completed within daylight hours, unless adequate artificial light is provided. Complete all work within 3 hours after the application of water to the aggregate and cement mixture, unless the RCE approves a longer period.
- 6.6.2. If operations are interrupted for a continuous period of greater than 2 hours after the cement has been mixed with the aggregate, reconstruct the entire affected section in accordance with these specifications. When the uncompacted mixture of aggregate and cement is wetted so that the moisture content exceeds that specified, manipulate and aerate the mixture to reduce the moisture to the specified content if the base course is completed within the time limits of these specifications.

6.7. *Reconstruction*

6.7.1. If the construction of the base course is proceeding with the approval of the RCE and the uncompacted aggregate and cement mixture is wetted by rain so that the moisture content exceeds the allowable, the Department will pay for additional cement used in reconstructing the section but will not pay for the reconstruction work. If the reconstruction of any section is necessary because of negligence or omission by the Contractor, unsatisfactory equipment performance, or the section does not comply with the allowable variation in thickness, reconstruct the section without additional compensation.

6.8. *Surface Smoothness*

6.8.1. Ensure that the finished surface of the base varies neither more than  $\frac{3}{8}$  inch from a straight edge 10 feet long when applied parallel to the centerline of the road, nor more than  $\frac{1}{2}$  inch from the typical cross-section shown on the Plans.

6.8.2. Do not disturb the finished surface of the base course after the final finishing and compaction. Do not remove random knots after the base course has hardened. Where low areas or depressions in the finished surface of the base occur, level and true the surface using the same material that the base course is to receive as the next component of the pavement structure, but in a separate operation. If the material specified as the next component in the pavement structure is considered unsatisfactory by the RCE, the RCE will specify what material to use. Provide necessary materials and perform such corrective work without any additional compensation.

6.9. *Tolerance in Base Course Thickness.*

6.9.1. The thickness of the completed modified base is measured at staggered intervals not to exceed 250 feet in length for two-lane roads. The depth measurement is made by test holes through the base course. Where the base course is less than the specified thickness by more than  $\frac{1}{2}$  inch, correct such areas by scarifying, adding base material, and re-compacting as directed by the RCE.

6.9.2. Where the measured thickness is more than  $\frac{1}{2}$  inch greater than the specified thickness, it is considered as the specified thickness plus  $\frac{1}{2}$  inch. The average job thickness is the average of the depth measurements determined as specified above. If this average job thickness is less than the specified thickness by more than  $\frac{1}{4}$  inch, an adjusted unit price is used for calculating payment. This adjusted contract unit price bears the same ratio to the contract unit price bid as the average job thickness bears to the specified thickness.

6.9.3. When the Contract includes more than one road, each road is considered separately.

6.9.4. No additional payment over the contract unit price is made for any base course where the average job thickness, determined as provided, exceeds the specified thickness.

#### 6.10. *Curing Coat*

- 6.10.1. After the base course has hardened, but not later than 12 hours after the completion of finishing operations, apply an asphalt curing coat of 0.20 to 0.25 gallons per square yard of asphalt as specified in Section 406. Keep the finished base course continuously moist until the curing coat is applied. At the time the asphalt material is applied, ensure that the base course surface is dense, free of all loose and extraneous material, and contains sufficient moisture to prevent penetration of the asphalt material.
- 6.10.2. Depending upon temperature and weather conditions, the RCE may allow deferral of the application of the curing coat on base course that is placed and completed during the latter portion of a day until the early part of the following day.

#### 6.11. *Opening to Traffic*

- 6.11.1. When staging of construction allows for extended closure to traffic, furnish such personnel and barricades along with other devices necessary to prevent construction equipment or other traffic, regardless of the type vehicle or its reason for being on the project, from using the finished base course. Use the subgrade shoulders or completed pavement for transporting materials, workers and equipment throughout the length of the project. Cross the finished base course at locations designated by the RCE only after a 7-day curing period has elapsed. Cover such designated crossings with at least 8 inches of earth as protection for the completed base course. When the paving operation is commenced, the completed section of the base course may be opened to light construction equipment for a distance not to exceed 1000 feet in advance of the paving work after the 7-day curing period has elapsed. If staging of construction requires prompt opening to traffic, the RCE may permit use of the base course for such purposes. In these instances, place at least one lift of asphalt on the base course within 3 days. Repair any damage to the base caused by early traffic before overlay. If the asphalt material for the curing coat is not sufficiently dry to prevent pickup when the base course is opened to traffic as outlined above, apply a granular cover before opening.

#### 6.12. *Maintenance*

- 6.12.1. Within the limits of the Contract, maintain the cement stabilized aggregate base course in good condition until all work is complete and accepted. Maintenance includes the immediate repairs of any defects and damage that develops. If repair or patching is necessary, extend it to the full depth of the base course and construct in a manner that ensures the restoration to a uniform and durable base course.