

**DIVISION 300**  
**BASES AND SUBBASES**

**SECTION 301**  
**CEMENT MODIFIED SUBBASE**

**301.01 Description.** This work shall consist of modifying the existing subgrade by pulverizing the in-place soil, adding portland cement, mixing, wetting, compacting and shaping the mixed material to the required density, in accordance with these specifications and conforming to the lines, grades, thickness and typical cross-sections shown on the plans or established by the Engineer.

**MATERIALS**

**301.02 Portland Cement.** Portland cement shall conform to the requirements of Subsection **701.02** of these specifications except that the allowable maximum alkali content ( $\text{Na}_2\text{O}+0.658\text{K}_2\text{O}$ ) is increased to 1.0%.

**301.03 Water.** Water shall conform to the requirements of Subsection **701.12**.

**301.04 Soil.** Soil shall consist of the material in the existing subgrade prepared in accordance with Section **208** of these specifications.

**301.05 Bituminous Material.** The material for the bituminous curing coat shall be MC-30, RC-30, RS-2, CRS-2, or EA-P Special and shall meet the requirements set forth for bituminous materials in Section **406**.

**CONSTRUCTION REQUIREMENTS**

**301.06 General.** It is the primary requirement of this speci-

cation to obtain a completed subbase of modified material containing a uniform mixture of portland cement and sub-grade material, free from loose or segregated areas, of uniform density and moisture content, well bound for its full depth and with a smooth surface suitable for placing subsequent courses. It shall be the responsibility of the Contractor to regulate the sequence of his work, to process a sufficient quantity of material to provide full depth as shown on the plans, to use the proper amount of portland cement, maintain the work and rework the courses as necessary to meet the requirements of this specification.

**301.07 Equipment.** Equipment necessary for the proper construction of the work shall be on the project, in acceptable working condition, and be approved by the Engineer, as to both type and condition, before the start of construction operations. The Contractor shall provide sufficient equipment to enable continuous prosecution of the work and its completion in the specified time. Mixing may be accomplished by (1) a multiple-pass traveling mixing plant or (2) a single-pass traveling mixing plant. The cement modified subbase may be constructed with any machine or combination of machines and auxiliary equipment that will produce results as outlined in this specification, and shall be operated by experienced and capable workers.

**301.08 Preparation of Roadbed.** Before other construction operations are begun, the roadbed shall be graded and shaped as required to construct the portland cement modified subbase using material in place in conformance with the lines, grades, thickness and typical cross-sections shown on the plans. Unsuitable soil or material shall be removed and replaced with acceptable soil.

**301.09 Pulverization.** The soil shall be so pulverized that, at the completion of moist-mixing, 100% by weight passes a 2-inch sieve, and a minimum of 65% passes a No. 4 sieve, exclusive of gravel or stone. Old bituminous wearing surface shall be pulverized so that 100% will pass a 2-inch sieve.

The depth of scarification shall be carefully controlled and blading operations conducted in a manner to insure that the surface of the roadbed below the scarified and pulverized material shall remain undisturbed and shall conform to the required cross-section.

**301.10 Application of Cement (Road Mix).** Portland cement shall be spread uniformly on the pulverized soil at a rate (in pounds per square yard) established by the Research and Materials Laboratory. This rate will be established in the laboratory using samples representative of the soils to be modified. The cement shall be spread with equipment that can be calibrated and adjusted so that the established rate will be attained uniformly throughout the length and width of the roadway. The spreading equipment shall have adjustable openings or gate headers and will not be solely dependent on vehicle speed to obtain the required spread rate. A tolerance of  $\pm 5\%$  will be allowed in the spread rate for individual sections of roadway; however, adjustments should be made in order to keep the actual spread rate as close as possible to that established by the Research and Materials Laboratory. Cement shall be applied only to such an area that all the operations can be continuous and completed in daylight, unless adequate artificial light is provided, and within six (6) hours of such application.

The percentage of moisture in the soil, at the time of cement application, shall not exceed the quantity that will permit uniform and intimate mixture of soil and cement during dry mixing operations and it shall not exceed the specified optimum moisture content for the soil-cement mixture. No equipment, except that used in spreading and mixing will be allowed to pass over the freshly spread cement until it is mixed with the soil.

No cement shall be applied unless the temperature is above 40°F in the shade and rising. The work shall not be performed on a frozen or excessively wet subgrade.

**301.11 Mixing and Processing.** Unless otherwise provided in the special provisions or shown on the plans, Method (A) or (B) below may be used at the option of the Contractor.

**Method A. Multiple-Pass Traveling Mixing Plant.** After the cement has been applied, it shall be dry-mixed with the soil. Mixing shall continue until the cement has been sufficiently blended with the soil to prevent the formation of cement balls when water is applied. Any mixture of soil and cement that has not been compacted and finished shall not remain undisturbed for more than thirty (30) minutes. Immediately after the dry mixing of soil and cement is complete, water as necessary shall be uniformly applied and incorporated into the mixture. The equipment and supply of water provided shall be adequate to insure continuous application of the required amount of water to sections being processed within three (3) hours of application of the cement. Proper care shall be exercised to insure proper moisture distribution at all times. After the last increment of water has been added, mixing shall continue until a thorough and uniform mix has been obtained.

**B. Single-Pass Traveling Mixing Plant.** After cement is spread, mixing operations shall proceed as follows:

The mixer shall, in one continuous operation, mix the air-dry soil and cement full depth; add the required moisture uniformly; thoroughly moist-mix the soil, cement, and water; spread the completed soil and cement mixture evenly over the machine processed width of the subgrade and leave it in a loose condition ready for immediate compaction. The mixing plant shall provide for a sufficient period of dry mixing to prevent the formation of cement balls when water is applied. Unpulverized dry soil lumps in the soil-cement mixture immediately behind the mixer will not be allowed. Should this condition prevail, the Contractor shall "pre-wet" the raw soil as necessary to correct this condition. The mixer shall

be provided with means for visibly and accurately gauging the water application. The water shall be applied uniformly through a pressure spray bar. The soil-cement mixture shall not remain undisturbed, after mixing and before compacting for more than thirty (30) minutes.

**301.12 Compacting and Finishing.** At the start of compaction, the percentage of moisture in the mixture shall not be below or more than two percentage points above the specified optimum moisture content and shall be less than that quantity that will cause the soil and cement mixture to become unstable during compaction and finishing. Before the beginning of the compaction, the mixture shall be in a loose condition for its full depth and then shall be uniformly compacted. Compaction shall continue until the entire depth of the mixture is uniformly compacted to not less than 95% of the maximum density. The maximum density of the composite mix shall be determined by AASHTO T 134, SC-T-25, or SC-T-29. Should tests show that the 95% requirement is not being met, the Contractor shall adjust his construction operations to obtain the required density. Compaction work shall be completed within a period of two (2) hours from the initial rolling. After the mixture is compacted, the surface of the course shall be reshaped as necessary to conform to the required lines, grades, and cross-section. Light scarifying may be required to obtain a uniform surface and prevent scaling. The surface shall be thoroughly compacted and finished by rolling with an approved smooth wheel tandem roller, pneumatic-tired roller or other means satisfactory to the Engineer. Rolling shall be supplemented by broom dragging when required. The compacting and finishing shall be done in such a manner as to produce a smooth, closely knit surface, free from equipment imprints, cracks, ridges or loose material. The moisture content of the surface material shall be maintained within two percentage points of the specified optimum moisture content during finishing operations.

**301.13 Reconstruction.** If the construction is proceeding

with the approval of the Engineer and the uncompacted soil and cement mixture is wetted by rain so that the moisture content exceeds the allowable, the Contractor will be paid for additional cement used in reconstructing the section, but no compensation will be made for the reconstruction work. If the reconstruction of any section is made necessary by the negligence or omission of the Contractor or unsatisfactory performances of his equipment, or if any section does not comply with the allowable variation in thickness, the Contractor will be required to reconstruct the section without additional compensation.

**301.14 Curing.** After the cement modified subbase has been finished as specified herein, the surface shall be protected against rapid drying by applying a bituminous membrane to the modified subbase. This membrane shall be applied immediately after finishing operations are complete and shall remain in place until the surface of subsequent courses are placed. The bituminous membrane material shall consist of MC-30, RC-30, RS-2, CRS-2, or EA-P Special applied at a minimum rate of 0.15 gallons per square yard of residual asphalt and shall completely cover and seal the total surface of the modified subbase and fill all voids. It shall be the Contractor's responsibility to protect the bituminous membrane from being picked up by traffic by either sanding or dusting the surface. The cement modified subbase should be allowed to cure for a period of not less than three (3) days before subsequent base courses are applied.

**301.15 Construction Joints.** At the end of each day's construction, a straight transverse construction joint shall be formed by cutting back into the total width of completed work to form a true vertical face free of loose and shattered material. Cement modification for large, wide areas shall be built to a series of parallel lanes of convenient length and width meeting the approval of the Engineer.

**301.16 Surface Smoothness.** The finished surface of the modified subbase shall not vary more than 3/8 inch from a

straight edge 10 feet long when applied parallel to the centerline of the road, nor more than 1/2 inch from the typical cross-section shown on the plans. The finished surface of the modified subbase shall not be disturbed after the final finishing and compaction. The removal of random knots will not be permitted after the modified subbase has hardened. Where low areas or depressions result in the finished surface of the subbase, the same material that the modified subbase is to receive as the next component of the pavement structure shall be used to true up the finished surface. In cases where the material selected as the next component in the pavement structure is considered unsatisfactory, the Engineer may specify the material to be used. Such corrective work and material shall be performed by the Contractor without any additional compensation.

**301.17 Tolerance in Thickness of Modified Subbase.** The thickness of the completed modified subbase shall be measured at staggered intervals not to exceed 500 feet in length for two-lane roads. The depth measurement shall be made by test holes through the subbase course. Where the subbase course is deficient by more than one inch, the Contractor shall correct such areas. Where the measured thickness is more than one inch thicker than shown on the plans, it shall be considered as the specified thickness, plus one inch. The average job thickness shall be the average of the depth measurements determined as specified above. Should this average thickness be more than 1/2 inch below the specified thickness, an adjusted unit price shall be used in calculating payment. This adjusted contract unit price shall bear the same ratio to the contract unit price as the average thickness bears to the specified thickness. When the contract includes more than one road, each road shall be considered separately.

**301.18 Traffic.** Local traffic may be permitted to use completed portions of the cement-modified subbase provided the subbase has hardened sufficiently to prevent marring or damaging of the surface by such usage. After the curing pe-

riod, the subbase may be opened to such traffic that no damage to the subbase or curing coat results. The subgrade shoulders or completed pavement shall be used when available in transporting materials, workers, and equipment throughout the project. Construction equipment will not be permitted on the subbase without the approval of the Engineer, unless it is being used in the subsequent construction operation.

**301.19 Maintenance.** The Contractor shall be required within the limits of his contract, to maintain the cement modified subbase in good condition until all work has been completed and accepted. Maintenance shall include immediate repairs of any defects that may occur. This work shall be done by the Contractor without any additional compensation and repeated as often as may be necessary to keep the area continuously intact. Faulty work shall be replaced for the full depth of subbase. The Contractor shall construct the plan depth of cement modification in one homogenous mass. The addition of thin stabilized layers will not be permitted in order to provide the minimum specified depth.

**301.20 Method of Measurement.** Cement modification of in-place materials will be measured by the square yard of surface area of completed and accepted cement modified subbase. Portland cement at the percentage established by the Research and Materials Laboratory for incorporation in the cement modification will be measured by the ton. Materials placed outside the designated area will not be measured for payment. Portland cement used in excess of 5% of the amount established by the Research and Materials Laboratory will not be measured for payment. The Contractor shall furnish the Engineer with invoices of all cement received.

**301.21 Basis of Payment.** The work performed and material furnished as prescribed by this item and measured in accordance with the applicable provisions of Subsection **301.20** above will be paid for at the contract unit price for Cement Modified Subbase and Portland Cement for Cement Modified

Subbase, which price and payment shall each be full compensation for preparing the roadbed; furnishing all material; all freight involved; furnishing scales and labor involved in weighing the material; pulverizing and applying cement, water; all processing, mixing, spreading, sprinkling, compacting, finishing, and curing the cement modified subbase; and all manipulations, tools, equipment, fuels, labor, and incidentals necessary to complete the work.

Base that is deficient in thickness will be paid for at the reduced unit price as provided in Subsection **301.17**.

Payment for each item includes all direct and indirect costs or expenses required to complete the work.

Payment will be made under

Item No.	Pay Item	Pay Unit
3011XXX	Cement Modified Subbase ( <i>thickness</i> " Uniform)	Square Yard
3013000	Portland Cement for Cement Modified Subbase	Ton

## SECTION 302

### SOIL-AGGREGATE SUBBASE COURSE

**302.01 Description.** This work shall consist of increasing the strength of the subgrade by the addition of crushed stone, gravel or slag and shall be constructed on a prepared subgrade or other surface in compliance with these specifications and conforming to the lines, grades, dimensions and typical cross-sections shown on the plans, or as directed by the Engineer.