

**DIVISION 300**  
**BASES AND GRANULAR SURFACES**

**SECTION 301**  
**LIME TREATED SUBGRADE**

**301.01 Description.** This item shall consist of treating the existing subgrade with water and lime according to these specifications and in substantial conformity with the lines, grades, compacted thickness, and cross section shown on the plans.

**301.02 Composition.** The mixture shall be composed of the soil in the existing subgrade, lime, and water. The mixture shall contain not more than 8% by weight of lime. At least 30 days before the beginning of lime treatment, adequate quantities of soil and lime shall be supplied to the Materials Division for determination of lime requirements. The Engineer will specify, based on laboratory tests, the exact percentage of lime to be used.

The type of lime used shall be either quicklime or hydrated lime as shown in the Contract.

**301.03 Materials.** The materials shall comply with the following requirements:

(a) **Water.** All water used in mixing shall be clean and free from injurious amounts of oil, salt, or other deleterious substances, and shall be free of vegetable matter or other foreign materials.

(b) **Lime.** The lime shall comply with AASHTO M 216.

(c) **Soil.** The soil shall be the soil in the existing subgrade.

**301.04 Construction Requirements. (a) Preparation of Subgrade.** Before beginning the lime treatment, the subgrade shall be shaped to the required grade and section and compacted to sufficient density to prevent rutting under normal operation of construction equipment. Soft areas shall be corrected to provide uniform stability before lime application. Any material in temporary cross roads, bridge approaches, or other areas that extends above the elevation of the proposed subgrade shall be removed and disposed of, as directed.

(b) **Preparation of Soil.** The proposed roadbed shall be scarified to the depth and width indicated on the plans for the subgrade treatment. The scarified material shall be partially pulverized. The

depth of scarification shall be carefully controlled and operations conducted in a manner to provide that the subgrade material below the depth of the proposed treatment shall remain undisturbed.

**(c) Application of Lime.** The rate of application of lime shall be as determined by laboratory design or as directed. Hydrated lime may be applied to the partially pulverized material either in a slurry or in the dry condition. Quicklime (slurry) shall be applied to the partially pulverized material in a slurry. Quicklime (dry) shall be applied to the partially pulverized material in the dry condition. Spreading shall be accomplished by adding either the slurry or dry lime uniformly to the surface of the material. Spreading equipment, including truck spreaders, shall be of a type and design capable of uniformly distributing the lime without excessive loss.

No equipment, except water trucks and that equipment used for spreading and mixing, shall be permitted to pass over the spread lime until it is mixed with subgrade material.

Any procedure that results in excessive loss or displacement of the lime shall be immediately discontinued.

**(d) Addition of Water.** Water shall be applied to the spread lime immediately after placing to moisten the lime and form a dust palliative. Water shall be added during mixing operations to moisten the mixture but the total water added to the mixture including that added to form a slurry shall not exceed the optimum by more than 5%.

**(e) Mixing.** Mixing may be accomplished by means of rotary tillers, pulvimixers, or other mechanical equipment. The first stage of the mixing process shall continue until the lime and moisture are thoroughly and uniformly dispersed throughout the mixture. After this has been completed, the surface shall be rolled with pneumatic rollers until sealed sufficiently to shed rain.

After the first mixing stage, the mixture shall be allowed to set for a minimum of 3 days or until the mixture becomes friable. During this period, the surface shall be sprinkled as necessary to keep it moist.

After this period, the mixture shall be scarified and thoroughly and uniformly mixed with rotary tillers or pulvimixers until the soil is thoroughly pulverized and mixed with the lime. During the

mixing, water shall be added to keep the moisture within  $\pm 2\%$  of the optimum.

**(f) Compaction.** After the materials have been satisfactorily mixed and pulverized, the full depth of the mixture shall be compacted to a uniform density of not less than 95% of the maximum laboratory density. Percent coarse particles retained on the #4 (4.75 mm) sieve shall be determined according to AASHTO T 27. The maximum laboratory density shall be determined as follows:

<b><u>% Retained</u></b> <b><u>#4 (4.75 mm) Sieve</u></b>	<b><u>Test Method</u></b>
10 Max.	AASHTO T 99, Method A
11 - 30	AASHTO T 99, Method C
31 Min.	AASHTO T 180, Method D

**Note:** In lieu of AASHTO T 224, correction for coarse particles retained on the 3/4" (19.0 mm) sieve shall be determined by replacing with an equal mass of material passing the 3/4" (19.0 mm) sieve and retained on the #4 (4.75 mm) sieve.

The in-place density shall be determined by using AASHTO T 310, Direct Transmission. The moisture content shall be determined by AASHTO T 310 or AHTD Test Method 347 or 348. Sprinkling may be necessary during the compaction to maintain the desired moisture content. Compaction shall be accompanied by sufficient blading to eliminate surface irregularities and to maintain the required section.

**(g) Finishing.** During the final stages of the compaction, the surface of the subgrade shall be shaped to the lines, grades, and cross sections shown on the plans. When required, the surface may be lightly scarified and bladed. Final rolling of the completed surface shall be accomplished with a pneumatic roller.

**301.05 Maintenance.** The Contractor shall, at no cost to the Department, maintain the treated subgrade until the next course is applied. The maintenance shall be considered as part of the processing of the treated subgrade.

**301.06 Seasonal and Temperature Limitations.** Application of lime will not be permitted when the surface temperature is below 50° F (10° C), nor shall it be applied before April 1 or subsequent to a date in October sufficiently early to give reasonable assurance that all mixing, spreading, and rolling will be complete on or before October 31, except by written permission of the Engineer.

**301.07 Quality Control and Acceptance.** Quality control and acceptance testing shall be according to Subsection 210.02 except that the minimum frequency of testing for density and moisture shall be one test per each 12,000 square yards (10,000 sq m) of subgrade area. The minimum depth of testing shall be 8" (200 mm) with the gauge in the direct transmission mode.

**301.08 Method of Measurement.** (a) Processing Lime Treated Subgrade will be measured by the square yard (square meter).

Water will not be paid for separately, but full compensation therefor will be considered included in the contract unit price bid for Processing Lime Treated Subgrade.

(b) Lime will be measured by the ton (metric ton).

**301.09 Basis of Payment.** Work completed and accepted and measured as provided above will be paid for as follows:

(a) Processing Lime Treated Subgrade will be paid for at the contract unit price bid per square yard (square meter) for Processing Lime Treated Subgrade.

(b) Lime will be paid for at the contract unit price bid per ton (metric ton) for Quicklime (slurry) in Treated Subgrade, Quicklime (dry) in Treated Subgrade, or Hydrated Lime in Treated Subgrade, as applicable. Water used in the slurry method will not be measured and paid for directly.

The contract unit prices mentioned above will be full compensation for preparation of the subgrade; for furnishing, hauling, placing, and applying materials; for pulverizing, watering, mixing, compacting, and finishing; for performing quality control and acceptance sampling and testing; and for all labor, equipment, tools, and incidentals necessary to complete and maintain the work.

Payment will be made under:

<b>Pay Item</b>	<b>Pay Unit</b>
Processing Lime Treated Subgrade	Square Yard (Square Meter)
Quicklime (slurry) in Treated Subgrade	Ton (Metric Ton)
Quicklime (dry) in Treated Subgrade	Ton (Metric Ton)
Hydrated Lime in Treated Subgrade	Ton (Metric Ton)

## **SECTION 302 SELECTED MATERIAL**

**302.01 Description.** This item shall consist of a foundation course for base courses. It shall be constructed on the prepared subgrade according to these specifications and in substantial conformity with the lines, grades, compacted thickness, and typical cross section shown on the plans.

**302.02 Materials.** Selected material shall consist of a satisfactory sandy type soil or mixture of sandy soil and stone or gravel. The maximum size of gravel or stone particles shall be 3" (75 mm).

The material furnished shall be free from sod, stumps, logs, roots, or other perishable or deleterious matter; shall be the class called for in the Contract; and shall comply with the requirements listed below for that particular class:

<b>Class</b>	<b>Maximum Percent Passing #200 (0.075 mm) Sieve</b>	<b>Maximum Plasticity Index</b>
SM-1	25	3
SM-2	35	6
SM-3	35	10
SM-4	50	6

It shall be the responsibility of the Contractor to furnish a material that will remain stable and will not rut under construction operations.

When it becomes necessary to admix materials to attain compaction requirements, such material and admixing shall be at no cost to the Department.

The finished material shall comply with specification requirements.

**302.03 Construction Requirements.** The selected material shall be placed on a completed and approved subgrade substantially conforming to the grades and cross section shown on the plans.

The subgrade shall be prepared as specified in Section 212, and shall be free from an excess or deficiency of moisture at the time of placing the selected material. The selected material shall not be placed on a frozen subgrade and shall be placed in layers not to exceed 10" (250 mm) in depth, loose measure. When vibrating or other approved types of special compacting equipment are used, the depth of a single layer of selected material may be increased to 12" (300 mm), loose measure, upon approval of the Engineer.

The material in each layer of selected material shall be compacted to a uniform density of not less than 98% of the maximum laboratory density. Percent coarse particles retained on the #4 (4.75 mm) sieve shall be determined according to AASHTO T 27. The maximum laboratory density shall be determined as follows:

<u>% Retained - #4 (4.75 mm)</u>	<u>Test Method</u>
<u>Sieve</u>	
10 Max.	AASHTO T 99, Method A
11 - 30	AASHTO T 99, Method C
31 Min.	AASHTO T 180, Method D

**Note:** In lieu of AASHTO T 224, correction for coarse particles retained on the 3/4" (19.0 mm) sieve shall be determined by replacing with an equal mass of material passing the 3/4" (19.0 mm) sieve and retained on the #4 (4.75 mm) sieve.

The in-place density shall be determined by using AASHTO T 310, Direct Transmission. The moisture content shall be determined by AASHTO T 310 or AHTD Test Method 347 or 348. It shall be the responsibility of the Contractor to maintain the moisture content of each layer of material being compacted at substantially optimum either by addition of water or by aeration.

The Contractor shall be responsible for the stability of all selected material placed under the Contract until final acceptance of

the work. The replacement of any portions that become displaced due to carelessness or negligent work on the part of the Contractor shall be at no cost to the Department.

**302.04 Quality Control and Acceptance.** Quality control and acceptance shall be according to the provisions of Section 306.

**302.05 Method of Measurement.** Selected Material will be measured in vehicles either by the cubic yard (cubic meter) or by the ton (metric ton).

**302.06 Basis of Payment.** Work completed and accepted and measured as provided above, will be paid for at the contract unit price bid per cubic yard (cubic meter) or ton (metric ton) for Selected Material, of the particular class specified, which price shall be full compensation for preparing the subgrade and furnishing material; for placing, adding moisture, aerating, manipulating, and compacting; for performing quality control and acceptance sampling and testing; and for all labor, equipment, tools, and incidentals necessary to complete the work.

Payment will be made under:

<b>Pay Item</b>	<b>Pay Unit</b>
Selected Material (Class SM___)	Cubic Yard (Cubic Meter) or Ton (Metric Ton)

**SECTION 303  
AGGREGATE BASE COURSE**

**303.01 Description.** This item shall consist of a foundation course for surface course, for other base courses, or for pavements. It shall be constructed on the prepared subgrade, subbase, or other completed base course according to these specifications and in substantial conformity with the lines, grades, compacted thickness, and typical cross section shown on the plans.

**303.02 Materials.** Aggregate Base Course shall be gravel, crushed stone, and/or steel slag so proportioned as to meet the requirements for a class of aggregate specified in Table 303-1. Steel slag is allowed for Classes 1 and 2 only. Classes 7 and 8 shall be any mechanically crushed natural rock or stone of igneous,

sedimentary, and/or metamorphic origin produced from a solid geological formation by quarrying methods.

The Contractor shall have the option of using any higher numbered class Aggregate Base Course than that specified, provided that payment will be for the class specified.

Material furnished for Aggregate Base Course, Class 3 through Class 8, shall have a percent of wear by the Los Angeles Test not greater than 45 as determined by AASHTO T 96.

When it is necessary to blend two or more materials, each material shall be proportioned separately through mechanical feeders to ensure uniform production. Premixing or blending to avoid separate feeding will not be permitted. Production of material by blending materials on the roadway to obtain a mixture that will comply with the requirements specified herein will not be permitted.

For the purpose of this specification, shale and slate are not considered to be gravel or stone. The material furnished shall not contain more than 5% by weight of shale, slate, and other objectionable, deleterious, or injurious matter.

For Classes 1 and 2 materials, the fraction passing the #200 (0.075 mm) sieve shall not be greater than three-fourths of the fraction passing the #40 (0.425 mm) sieve. For Classes 3 through 8, the fraction passing the #200 (0.075 mm) sieve shall not be greater than two-thirds of the fraction passing the #40 (0.425 mm) sieve. For Classes 3 through 8 the fraction passing the #40 (0.425 mm) sieve shall have a liquid limit not greater than 25.

To ensure that gravel is uniformly graded, the difference between the percent passing the various sieves shall be as follows for Classes 3, 4, and 5:

	<b>Sieve</b>	<b>Percent</b>
3/4" - 3/8"	(19.0 mm - 9.5 mm)	5 min.
3/8" - #4	(9.5 mm - 4.75 mm)	5 min.
#4 - #10	(4.75 mm - 2.00 mm)	5 min.
#10 - #40	(2.00 mm - 0.425 mm)	4 min.

When the material contains aggregate larger than that specified above for the class called for in the Contract, the oversize aggregate shall be removed by screening or by screening and crushing. The



removal of large size aggregate by hand methods will not be permitted.

**303.03 Construction Requirements.** The base course material shall be placed on a completed and approved subgrade or existing base that has been bladed to substantially conform to the grade and cross section shown on the plans.

The subgrade shall be prepared as specified in Section 212 and shall be free from an excess or deficiency of moisture at the time of placing base course material. The subgrade shall also comply, where applicable, with the requirements of other items that may be contained in the Contract that provide for the construction, reconstruction, or shaping of the subgrade or the reconstruction of the existing base course.

Base course material shall not be placed on a frozen subgrade or subbase.

The aggregate shall be placed on the subgrade or other base course material and spread uniformly to such depth and lines that when compacted it will have the thickness, width, and cross section shown on the plans.

If the required compacted depth of the base course exceeds 6" (150 mm), the base shall be constructed in two or more layers of approximate equal thickness. The maximum compacted thickness of any one layer shall not exceed 6" (150 mm) except when vibrating or other approved types of special compacting equipment are used, the compacted depth of a single layer of base course may be increased to 8" (200 mm) upon approval of the Engineer. Each layer shall be stable before advancing to the next layer sequence.

The material shall be spread the same day that it is hauled. Spreading shall be performed in such manner that no segregation of coarse and fine particles nor nests or hard areas caused by dumping the aggregate on the subgrade will exist. Care shall be taken to prevent mixing of subgrade or unspecified material with the base course material during the blading and spreading operation.

Aggregate shall not be dumped or mixed on an existing or newly constructed ACHM course or PCC Pavement that will not be overlaid under the same Contract nor on any open graded base course. Mechanical spreading equipment shall be used, if necessary, to place the base course on the subgrade.

If sufficient working space is not available to allow proper aeration or addition of water to the base, the base material shall be mixed by any satisfactory method before placement.

Each course shall be thoroughly mixed for the full depth of the course and shall be compacted by any satisfactory method that will produce the density hereinafter specified. The aggregate shall be maintained substantially at optimum moisture during the mixing, spreading, and compacting operations, water being added or the material aerated as may be necessary. The specified grade and cross section shall be maintained by blading throughout the compaction operation. The material in each course shall be compacted to a density, as determined by AASHTO T 310, Direct Transmission, of not less than 98% of the maximum laboratory density determined in the laboratory by AASHTO T 180, Method D. Aggregate base course placed in areas outside of the normal traveled way, such as driveways, islands, gore areas, other incidental construction, and restricted width areas outside of the normal traveled way which cannot accommodate a full width roller shall be compacted to a density, as determined by AASHTO T 310, Direct Transmission, of not less than 95% of the maximum laboratory density. Shoulders are considered to be within the normal traveled way. The aggregate shall be compacted across the full width of application.

The compacted base course shall be tested for depth and any deficiencies corrected by scarifying, placing additional material, mixing, reshaping, and recompacting to the specified density, as directed.

Where neither prime coat nor surfacing is provided in the same Contract with the base course, the material in the base course shall be uniformly compacted, stable, and free of segregated areas.

The Contractor shall maintain the base course in a satisfactory condition until accepted.

**303.04 Quality Control and Acceptance.** Quality control and acceptance shall be according to the provisions of Section 306.

**303.05 Method of Measurement.** Aggregate Base Course will be measured in vehicles either by the cubic yard (cubic meter) or by the ton (metric ton).

**303.06 Basis of Payment.** Work completed and accepted and measured as provided above will be paid for at the contract unit

price bid per cubic yard (cubic meter) or ton (metric ton) for Aggregate Base Course of the particular class specified, which price shall be full compensation for preparing the subgrade; for furnishing material; for spreading, finishing, watering, manipulating, and compacting; for performing quality control and acceptance sampling and testing; and for all labor, equipment, tools, and incidentals necessary to complete the work.

In cases where the combined specific gravity of the material used for Aggregate Base Course exceeds 2.80 and the method of measurement is by the ton (metric ton), the quantity of material will be adjusted for payment by multiplying the quantity of the material used by a specific gravity of 2.80 and dividing by the higher specific gravity.

Payment will be made under:

<b>Pay Item</b>	<b>Pay Unit</b>
Aggregate Base Course (Class__)	Cubic Yard (Cubic Meter) or Ton (Metric Ton)

**SECTION 304 VACANT**

**TABLE 303-1**  
**AGGREGATE BASE COURSE GRADING (AASHTO T 11 AND T 27)**  
**AND CRUSHING REQUIREMENTS (AHTD TEST METHOD 304)**

SIEVE (mm)	CLASS 1	CLASS 2	CLASS 3	CLASS 4	CLASS 5	CLASS 6	CLASS 7	CLASS 8
<b>PERCENT PASSING</b>								
3" (75)	100	100	100					
2" (50)	95-100	95-100	95-100					
1½" (37.5)			85-100	100	100	100	100	
1" (25.0)						60-100	60-100	100
¾" (19.0)	60-100	60-100	60-100	60-100	60-100	50-90	50-90	65-100
⅜" (9.5)	40-80	40-80	40-80	40-80	40-80			
#4 (4.75)	30-60	30-60	30-60	30-60	30-60	25-55	25-55	25-55
#10 (2.00)	20-50	20-50	20-45	20-45	20-45			
#40 (0.425)	10-35	10-35	10-35	10-35	10-35	10-30	10-30	10-30
#200 (0.075)	3-15	3-15	3-12	3-12	3-12	3-10	3-10	3-10
MAX. PLASTICITY INDEX (MINUS #40 MATL.)								
(0.425 mm)	13	10	6	6	6	6	6	6
MINIMUM PERCENT CRUSHED (RETAINED ON #4 [4.75 mm] SIEVE)								
					15			
MINIMUM PERCENT CRUSHER-RUN MATERIAL								
						90	90	90

## SECTION 305 RECONSTRUCTED BASE COURSE

**305.01 Description.** This item shall consist of reshaping an existing base course essentially true to grade and typical section, preparatory to the placement of a surface course of pavement and shall be constructed according to these specifications and essentially in conformity with the lines, grades, and typical sections shown on the plans.

**305.02 Materials.** When required, the Contractor shall furnish additional aggregate base course of the class specified, meeting the requirements of Section 303.

**305.03 Construction Methods.** The existing base course shall be scarified for its entire width as shown on the typical section to a uniform depth sufficient to eliminate all depressions and irregularities. The depth of scarification shall be carefully controlled to prevent contamination of the base material with subgrade. If the base material becomes contaminated due to the Contractor's work, the contaminated base shall be removed and replaced by the Contractor at no cost to the Department.

After the scarifying operation is completed, the roadbed shall be shaped to the specified grade and cross section and compacted by any satisfactory method that will obtain the density herein specified. The base course material shall be maintained at optimum moisture during the shaping and compacting operations by adding water or by aerating the material as necessary. The specified grade and section shall be maintained by blading throughout the compaction operation. The density of the compacted material in the reconstructed base course, as determined by AASHTO T 310, Direct Transmission, shall be not less than 95% of the maximum laboratory density determined in the laboratory by AASHTO T 180, Method D. The reconstructed base course shall be compacted across its full width.

The Contractor shall reshape all or any part of the base as many times as may be necessary to secure the desired results.

**305.04 Quality Control and Acceptance.** Quality control and acceptance shall be according to the provisions of Section 306.

**305.05 Method of Measurement.** Reconstructed Base Course will be measured by the station (metric station) measured along the centerline of the roadway. Roadways in each direction of a divided highway will be measured separately, and additional areas outside the normal roadway will be converted to the normal measurement on an equivalent area basis.

**305.06 Basis of Payment.** Reconstructed Base Course completed and accepted and measured as provided above will be paid for at the contract unit price bid per station (metric station) for Reconstructed Base Course, which price shall be full compensation for all scarifying, spreading, and shaping; for all watering, manipulating, finishing, and compacting; for performing quality control and acceptance sampling and testing; and for all labor, equipment, tools, and incidentals necessary to complete the work.

Payment will be made under:

<b>Pay Item</b>	<b>Pay Unit</b>
Reconstructed Base Course	Station (Metric Station)

## **SECTION 306**

### **QUALITY CONTROL AND ACCEPTANCE**

**306.01 Description.** To assure that the material used meets the requirements of the specifications, certain tests for quality control and acceptance will be performed as specified herein. The properties for which quality control and acceptance testing will be performed are gradation, density, moisture content, plasticity index, and thickness as specified in each Section.

**306.02 Quality Control.** The Department will furnish the Contractor with the maximum laboratory density and optimum moisture content for the material being used. The maximum laboratory density shall be determined as follows:

<b><u>% Retained - #4 (4.75 mm) Sieve</u></b>	<b><u>Test Method</u></b>
10 Max.	AASHTO T 99, Method A
11 - 30	AASHTO T 99, Method C
31 Min.	AASHTO T 180, Method D

**Note:** In lieu of AASHTO T 224, correction for coarse particles retained on the 3/4" (19.0 mm) sieve shall be determined by replacing with an equal mass of material passing the 3/4" (19.0 mm) sieve and retained on the #4 (4.75 mm) sieve.

The in-place density shall be determined by using AASHTO T 310, Direct Transmission. The moisture content shall be determined by AASHTO T 310 or AHTD Test Method 347 or 348. A new maximum laboratory density and optimum moisture will be determined whenever the Engineer deems necessary or upon evidence provided by the Contractor.

The Contractor shall furnish all personnel, equipment, and facilities necessary to perform the required sampling and testing. The Contractor's facilities shall be separate from any Field Laboratory and/or Field Office furnished under the Contract. The Contractor shall provide the Engineer with the opportunity to observe all quality control sampling and testing. Quality control sampling and testing by the Contractor shall be performed in a qualified laboratory by a certified technician. Requirements for technician certification and laboratory qualification are contained in the Department's *Manual of Field Sampling and Testing Procedures*. Test reports shall be signed and copies made available to the Engineer if requested.

If the result of any test shows that the required minimum density has not been obtained, corrective action shall be taken, followed by a re-test at the same location. The original and re-test reports shall be cross referenced. All corrective actions shall be performed by the Contractor at no cost to the Department.

Tests for gradation, liquid limit, and plasticity index shall be performed by AASHTO T 11, T 27, T 89, and T 90.

Although no minimum frequency of quality control testing is specified, the Contractor will be required to perform acceptance tests as specified in Subsection 306.03.

**306.03 Acceptance Testing.** Acceptance testing for thickness (when specified on the plans), gradation, plasticity index, density, and moisture content by the Contractor will be based on lots. The size of standard lots will be 1000 tons (1000 metric tons). Partial lots, of any size, may be established by the Engineer at any time.

Test methods for acceptance shall be the same as specified for quality control testing. Acceptance sampling and testing by the Contractor shall be performed in a qualified laboratory by a certified technician. Requirements for technician certification and laboratory qualification are contained in the Department's *Manual of Field Sampling and Testing Procedures*. The item of work being tested shall not be considered complete or accepted until passing test reports are submitted to the Engineer.

The Contractor shall take one test for all properties in each lot or partial lot at a location randomly selected by the Engineer under AHTD Test Method 465.

If the material being furnished is crushed stone and the results of the first five tests for plasticity index (PI) show that the material is non-plastic, further tests for PI may be waived by the Engineer. If a change in material occurs, testing for PI will be resumed. If the new material is crushed stone and the results of the first five tests for PI show that the material is non-plastic, further tests for PI may again be waived by the Engineer.

In addition to the required acceptance tests, the Engineer may require the Contractor to test any location that, by visual observation, appears to be defective.

The Contractor's acceptance sampling and testing procedures, equipment, and results will be subject to independent assurance sampling and testing conducted by the Department. Independent assurance sampling and testing will be conducted at the frequencies indicated in the Department's *Manual of Field Sampling and Testing Procedures*. The Contractor shall be required to make changes to the equipment and/or procedures used if the results of the independent assurance tests do not correlate with the Contractor's test results.

All acceptance testing performed by the Contractor shall be subject to observation by Department personnel. All test reports shall be signed and submitted to the Engineer by the next business day after the tests are performed.

The Department will obtain and test a minimum of one sample, taken at the frequency established in the Department's *Manual of Field Sampling and Testing Procedures*, for verification testing in accordance with Subsection 106.11.



**306.04 Acceptance.** Each lot will be accepted as described herein.

**(a) Gradation and Plasticity Index. (1) Roadway Sampled Material.** If a lot or a partial lot fails gradation requirements, the Contractor shall remove and replace that lot or partial lot with acceptable material at no cost to the Department. Tests will be performed on the replacement material as required for the original material. Acceptance of the replacement material will be the same as for the original material, based on the results of tests on the replacement material. Payment for the quantity in the original lot will be withheld or recovered, and released after the removal and replacement has been acceptably performed.

In lieu of removal and replacement of work rejected for gradation, the Contractor may request permission to attempt corrective actions and/or evaluation under Section 105.04. The Engineer will consider the request and will make a determination whether the requested corrective action and/or evaluation is in the best interest of the Department. This determination by the Engineer shall be final. In making this determination, the Engineer will consider the type of work involved; the corrective action proposed, the magnitude of the deviation; and any other factors deemed applicable to the work involved.

If a lot or partial lot is rejected for PI, the Contractor may request permission to attempt corrective action. The Engineer will consider the request and make a determination whether the proposed corrective action may be attempted; evaluate the material under Section 105; or require removal and replacement of the material. Corrective action or removal and replacement shall be performed by the Contractor at no cost to the Department.

When the material is non-plastic and tests for PI have been waived as specified in Subsection 306.03, the material will be accepted for PI without additional testing.

**(2) Stockpile Sampled Material.** Material used in mixes shall be sampled from the stockpile, tested, and accepted before being incorporated into the work. Stockpiled material found not to be in compliance with the specifications shall be replaced with acceptable material.

**(b) Density.** When a density requirement is specified, the results of all tests shall be at or above the minimum required density and the moisture content should be at or near the optimum. If the result of any test does not meet these requirements, corrective action shall be taken and a re-test will be taken at the same location. All corrective action shall be taken by the Contractor at no cost to the Department.

**306.05 Measurement and Payment.** All work required under this subsection will not be paid for separately, but full compensation therefor will be considered included in the contract unit prices bid for the item in which the material is being used.

## **SECTION 307 CEMENT TREATED BASE COURSE**

**307.01 Description.** This item shall consist of a treated base course, composed of a compacted mixture of existing subgrade or soil aggregate, Portland cement, and water, and shall be constructed according to these specifications and in substantial conformity with the lines, grades, compacted thickness, and typical cross section shown on the plans.

Unless otherwise provided, the Contractor may use either the travel plant or central plant method as described below.

**307.02 Composition.** The mixture shall be composed of existing subgrade, base course and surface course materials, and/or an imported soil aggregate, with Portland cement and water added.

The mixture shall contain not less than 4% cement by volume of compacted mixture, 94 pounds (1420 kg) of cement being considered as 1 cubic foot (1 cu m ). At least 30 days before the beginning of stabilizing operations, adequate quantities of soil and cement shall be supplied to the Materials Division for determination of cement requirements. The Engineer will specify, based on laboratory tests, the exact percentage of cement to be used.

Specimens of soil aggregate, cement, and water shall develop a compressive strength of a least 400 psi (2.7 MPa) in 7 days.

**307.03 Materials.** The materials used shall comply with the following requirements:

**(a) Water.** Water used in mixing or curing shall be clean and free from injurious amounts of oil, salt, or other deleterious substances. Where the source of water is relatively shallow, it shall be maintained at such a depth and the intake so enclosed as to exclude grass, vegetable matter, or other foreign materials.

**(b) Cement.** Unless otherwise specified, portland cement conforming to the requirements of AASHTO M 85, Type I shall be furnished. One of the following blended cements may be used in lieu of Type I:

- Portland-Pozzolan Cement, AASHTO M 240, Type IP (20% maximum)
- Pozzolan-Modified Portland Cement, AASHTO M 240, Type I (PM)
- Slag-Modified Portland Cement, AASHTO M 240, Type I (SM)

Fly ash or ground granulated blast-furnace slag shall not be substituted for blended cements. Cement shall be from sources that are listed on the Department's Qualified Products List and that have executed a certification agreement with the Department. When cement is furnished in sacks, each sack shall contain not less than 94 pounds (42.6 kg) of cement.

Fly ash or ground granulated blast-furnace slag shall comply with Subsection 501.02(f). Fly ash or ground granulated blast furnace slag may be used as a partial replacement for the cement. Replacement amounts, not exceeding 25% by weight, shall be determined through trial batch investigations using the specific materials proposed for the project. Mixtures with fly ash or ground granulated blast furnace slag shall meet the same requirements as mixtures without fly ash/ground granulated blast furnace slag. All trial batches required by this specification shall be accomplished by the Contractor, observed by the Engineer, and approved by the Engineer of Materials. Mixing of Class C and Class F fly ashes will not be permitted. Fly ash will not be allowed as a substitute for high early strength or blended cements.

For in-place stabilization, the fly ash/ground granulated blast furnace slag and cement shall be blended to form a homogeneous mixture before application on the roadway.

The use of cement salvaged from used or discarded sacks will not be allowed. Cement placed in storage shall be suitably protected. Any loss of quality occurring during the storage period will be cause for rejection. If the cement furnished shows erratic behavior under the field conditions incident to the mixing and placing of the mixture, or in the time of the initial or final set, the Contractor will at once, without notice from the Engineer, cease the use of that brand of cement and furnish material of such properties as to ensure quality work conforming to these specifications.

**(c) Soil Aggregate.** Soil aggregate shall meet the requirements of Subsection 302.02 for any class provided therein.

**(d) Asphalt.**

**(1)** Emulsified asphalt shall comply with Subsection 403.03(d) for Grade CSS-1 or CSS-1h.

**(2)** Medium curing cut-back asphalt shall comply with Subsection 403.03(b) for the grade selected by the Engineer.

**(3)** Rapid curing cut-back asphalt shall comply with Subsection 403.03(a) for the grade selected by the Engineer.

The type of asphalt used for protection and cover for the treated base course shall be at the option of the Contractor, subject to the Engineer's approval.

**307.04 Construction Requirements.** Sufficient equipment shall be available so that the work may proceed in proper sequence to completion without unnecessary delay. Equipment, tools, and machinery used shall be maintained in a satisfactory working condition.

The application of cement and mixing of the cement and soil aggregate will be allowed only on an approved subgrade, free of excess moisture. No work will be allowed on a frozen subgrade. The Contractor's operations shall be such as to prevent the drifting of cement or dust off the right-of-way.

**(a) Preparation of the Roadbed.** Prior to other construction operations, the existing roadbed, including the shoulders, shall be brought to line and grade and shaped to the typical cross section of the completed roadbed and compacted to sufficient density to prevent rutting under normal operations of construction equipment. All soft areas shall be corrected to provide uniform stability. When

soil aggregate is utilized, the subgrade shall be prepared according to Section 212.

**(b) Pulverizing.** After shaping and compacting the roadbed, the material to be processed shall be scarified and pulverized before application of cement. Pulverizing shall continue during mixing operations until a minimum of 80% by weight of the material, exclusive of coarse aggregate, will pass a #4 (4.75 mm) sieve. Material retained on a 3" (75 mm) sieve and other unsuitable material shall be removed.

**(c) Application and Mixing of Cement.** The application and mixing of cement with the aggregate material shall be performed according to one of the following methods:

**(1) Travel Plant Method.** The specified quantity of cement shall be applied uniformly on the material to be processed, and shall not exceed that which can be processed the same working day. When bulk cement is used the equipment shall be capable of handling and spreading the cement in the required amount. The moisture content of the material to be processed shall be sufficiently low to permit a uniform and intimate mixture of the aggregate material and cement.

Mixing shall be accomplished by means of a self-propelled or self-powered machine equipped with a mechanical rotor or other approved type of mixer that will thoroughly blend the aggregate with the cement. Mixing equipment shall be so constructed as to assure positive depth control. Care shall be exercised to prevent cement from being mixed below the depth specified. Machines designed to process less than the full width of base at a single pass shall be operated so that the full width of base can be compacted and finished in one operation. Water shall be uniformly added and incorporated in the mixture. The water supply and distribution equipment shall be capable of supplying the total required amount of water to the section being processed within 3 hours. If more than one pass of the mixer is required, at least one pass shall be made before water is added. Mixing shall continue after all water has been applied until a uniform mixture of aggregate, cement, and water has been obtained for the full depth of the course.

The aggregate and cement mixture that has not been compacted and remains undisturbed more than 30 minutes shall

be remixed. In the event of rain adding excessive moisture to the uncompacted material, the entire section shall be reworked. Should the Contractor be unable to finish the section within the same day, the section shall be reconstructed and an amount equal to 50% of the original amount of cement added to the mixture at no cost to the Department.

**(2) Central Plant Method.** When a central plant is used, the soil aggregate, cement, and water shall be mixed in a pugmill either of the batch or continuous flow type. The plant shall be equipped with feeding and metering devices that will add the soil aggregate, cement, and water into the mixer in accurately proportioned amounts as determined by the laboratory design. Aggregate and cement shall be dry-mixed sufficiently to prevent cement balls from forming when water is added. Mixing shall continue until a uniform mixture of aggregate, cement, and water has been obtained.

The mixture shall be hauled to the roadway in trucks equipped with protective covers. Immediately before spreading the mixture, the subgrade or foundation course shall be moistened and kept moist, but not excessively wet, until covered by the mixture. The mixture shall be placed on the roadbed in a uniform layer by an approved spreader or spreaders. No more than 60 minutes shall elapse between adjacent spreader runs and not more than 60 minutes shall elapse between the time of mixing and the beginning of compaction. The layer shall be uniform in depth, and in such quantity that the completed base will conform to the required grade and cross section. Dumping of the mixture in piles or windrows will not be permitted.

**(d) Compaction and Surface Finish.** The mixture shall be compacted to a density, as determined by AASHTO T 310, Direct Transmission, of not less than 95% of the maximum laboratory density obtained by AASHTO T 134. The moisture content of the mixture during compaction shall not vary more than  $\pm 5\%$  from the optimum moisture as determined by AASHTO T 134.

The surface of the treated roadway shall be reshaped to the required lines, grade, and cross section after the mixture has been compacted. It shall then be scarified lightly to loosen any imprints left by the compacting or shaping equipment and rolled thoroughly. The operation of final rolling shall include the use of pneumatic

tired rollers. The rolling shall be done in such manner as to produce a smooth, closely knit surface, free of cracks, ridges, or loose material, and conforming to the crown, grade, and line shown on the plans.

The density, surface compaction, and finishing operation shall not require more than two hours.

Water shall be added, if necessary, during the finishing operation to maintain the mixture at the proper moisture content for securing the desired surface.

Areas inaccessible to rollers or finishing and shaping equipment shall be thoroughly compacted to the required density by other approved compacting methods and shaped and finished as specified.

**(e) Joints.** As soon as final compaction and finishing of a section has been completed, the base shall be cut back perpendicular to the center line to a point where uniform cement content with proper density has been attained and where the vertical face conforms to the typical section shown on the plans. When the road mix method is used, a header shall be placed against the vertical face of the finished section and securely staked in place. This header shall be left in place until all mixing operations on the adjoining section have been completed, after which the header shall be removed and the trench backfilled with processed material. This material shall be compacted so that a well-sealed joint is formed and a smooth riding surface is obtained.

As an alternate to using a header, the subsequent day's operation may be started by cutting back into the previously placed course to the extent necessary to obtain uniform grade and compaction.

**(f) Surface Test.** The finished surface of the treated base course shall conform to the general surface provided for by the plans. It shall not vary more than ¼" (6 mm) from a 10' (3 m) straightedge applied to the surface parallel to the center line of the roadway, nor more than ½" (12 mm) from a template conforming to the cross section shown on the plans. Excess material shall be disposed of as directed.

**(g) Protection and Cover.** Immediately after the rolling and shaping has been completed, the surface of the treated base course shall be covered by a protective coating of asphalt to prevent loss of moisture during the curing period and to serve as a prime coat for

the later application of wearing course. The asphalt shall comply with the requirements listed herein and shall be applied by means of an approved pressure distributor at the rate of 0.1 to 0.3 gallon per square yard (0.4 to 1.1 L/sq m) to provide complete coverage without excessive runoff. The actual rate of application will be determined by the Engineer. When used, emulsified asphalt shall be diluted with an equal amount of water before application. At the time of application, the base shall be in a moist condition. The protective coating of asphalt shall be maintained until the wearing surface is placed. If the condition of the protective coating is satisfactory, no additional prime coat will be required at the time of placement of the wearing surface.

Furnishing and placing asphalt will not be paid for separately, but full compensation therefor will be considered included in the contract unit price bid for Processing Cement Treated Base Course.

Finished portions of the roadway adjacent to construction that is traveled by equipment used in constructing an adjoining section shall be protected by means satisfactory to the Engineer. If earth covering is used on fresh bases, straw, hay, building paper, or similar material shall be placed under the earth so that the covering may be removed without damage to the base.

**307.05 Maintenance.** The Contractor shall, within the limits of the Contract, maintain the treated base material in good condition until all work has been completed and accepted. Maintenance shall include immediate repairs of any defects that occur. This work shall be done at no cost to the Department and repeated as often as may be necessary to keep the area continuously intact. Faulty work shall be replaced for the full depth of treatment. The Contractor shall construct the plan depth of cement treated base in one homogeneous mass. The addition of thin treated layers to provide the minimum specified depth will not be permitted.

**307.06 Seasonal and Temperature Limitations.** Application of cement will not be permitted when the surface temperature is below 40° F (5° C), nor shall it be applied before April 1. Application of cement shall be terminated sufficiently early to give reasonable assurance that all mixing, spreading, rolling, and curing of the cement treated base course and the application of the subsequent asphalt courses can be complete on or before the following dates, except by written permission of the Engineer:



Asphalt Surface Treatment - Roadway	September 30
Asphalt Surface Treatment - Shoulders	October 31
ACHM Binder Course	October 31
ACHM Surface Course	October 31

**307.07 Quality Control and Acceptance.** Quality control and acceptance shall be according to the provisions of Section 306 except the minimum frequency of testing shall be based on a lot size of 12,000 square yards (10,000 sq m).

**307.08 Method of Measurement.** (a) Processing Cement Treated Base Course will be measured by the square yard (square meter) or by the station (metric station) for the depth specified. When measurement by the station (metric station) is specified, roadways in each direction of a divided highway will be measured, and additional areas outside the normal roadway will be converted to the normal measurement on an equivalent area basis.

Water and asphalt will not be measured or paid for separately, but full compensation therefor will be considered included in the contract unit price bid for the item Processing Cement Treated Base Course.

(b) Portland cement and/or fly ash will be measured by the ton (metric ton).

(c) Soil Aggregate will be measured in place by the square yard (square meter) or by the station (metric station) for the width and depth specified, or in the pit by the cubic yard (cubic meter) as determined in Subsection 109.01(a), or in trucks by the ton (metric ton) or cubic yard (cubic meter) according to Section 209.03, Method 2. When measurement by the station (metric station) is specified, roadways in each direction of a divided highway will be measured and additional areas outside the normal roadway will be converted to the normal measurement on an equivalent area basis.

**307.09 Basis of Payment.** Work completed and accepted and measured as provided above will be paid for as follows:

(a) Processing Cement Treated Base Course will be paid for at the contract unit price bid per square yard (square meter) or per station (metric station) for Processing Cement Treated Base Course.

(b) Portland cement and/or fly ash will be paid for at the contract unit price bid per ton (metric ton) for Cement in Treated Base Course.

(c) Soil Aggregate will be paid for at the contract unit price bid per square yard (square meter), station (metric station), cubic yard (cubic meter), or ton (metric ton) for Soil Aggregate in Cement Treated Base Course.

The contract unit prices mentioned above will be full compensation for furnishing, hauling, and placing materials; for pulverizing, watering, mixing, compacting, finishing, and applying asphalt; for performing quality control and acceptance sampling and testing; and for all labor, equipment, tools, and incidentals necessary to complete the work.

Payment will be made under:

<b>Pay Item</b>	<b>Pay Unit</b>
Processing Cement Treated Base Course (___" [___mm] Uniform Thickness)	Square Yard (Square Meter) or Station (Metric Station)
Cement in Treated Base Course	Ton (Metric Ton)
Soil Aggregate in Cement Treated Base Course (___" [___mm] Compacted Depth)	Square Yard (Square Meter), Station (Metric Station), Cubic Yard (Cubic Meter), or Ton (Metric Ton)

**SECTION 308**  
**CEMENT STABILIZED CRUSHED STONE**  
**BASE COURSE**

**308.01 Description.** This item shall consist of a base course constructed on the completed and accepted subgrade according to these specifications and in conformity with the lines, grades,

compacted thickness, and typical section shown on the plans or as directed by the Engineer.

**308.02 Composition. (a) Cement Content.** The quantity of cement, approximately 3 to 8% by weight, to be used with the aggregate and water shall be determined by the Engineer. The moisture in the mix shall be maintained within a range of  $\pm 1\%$  of optimum.

**(b) Laboratory Tests.** Specimens of aggregate, cement, and water must develop a compressive strength of at least 750 psi (5.2 MPa) in 7 days.

At least 30 days before beginning base construction, adequate quantities of materials shall be supplied to the Materials Division for determination of mix proportions. The Department will determine the quantity of cement, the optimum moisture, and the maximum laboratory density and furnish this information to the Contractor.

**308.03 Materials.** Materials used in the mixture shall comply with the following requirements:

**(a) Aggregate.** Crushed stone shall comply with Subsection 303.02 for Class 7.

**(b) Cement.** Unless otherwise specified, portland cement conforming to the requirements of AASHTO M 85, Type I shall be furnished. One of the following blended cements may be used in lieu of Type I:

- Portland-Pozzolan Cement, AASHTO M 240, Type IP (20% maximum)
- Pozzolan-Modified Portland Cement, AASHTO M 240, Type I (PM)
- Slag-Modified Portland Cement, AASHTO M 240, Type I (SM)

Fly ash or ground granulated blast-furnace slag shall not be substituted for blended cements. Cement shall be from sources that are listed on the Department's Qualified Products List and that have executed a certification agreement with the Department. Fly ash or ground granulated blast-furnace slag, if used, shall comply with Subsection 307.03(b).

**(c) Water.** The water for the base course shall be clean, clear, and free from injurious amounts of oil, salts, or other deleterious substances and shall not contain more than 1000 ppm of chlorides.

If the water is of questionable quality, it shall be tested according to AASHTO T 26.

**(d) Asphalt.**

(1) Emulsified asphalt shall comply with Subsection 403.03(c) for Grade SS-1.

(2) Medium curing cut-back asphalt shall comply with Subsection 403.03(b) for the grade selected by the Engineer.

(3) Rapid curing cut-back asphalt shall comply with Subsection 403.03(a) for the grade selected by the Engineer.

The type of asphalt used for protection and cover for the cement stabilized base course shall be at the option of the Contractor, subject to the Engineer's approval.

**308.04 Construction Requirements. (a) Weather Limitations.**

The cement stabilized base shall not be mixed or placed while the atmospheric temperature is below 40° F (5° C) or when the weather is rainy.

**(b) Equipment.** Sufficient equipment shall be available so that the work may proceed in proper sequence to completion without unnecessary delay. Equipment, tools, and machinery used shall be maintained in a satisfactory working condition.

**(c) Forms.** When forms are required, they shall comply with Subsection 501.07.

**(d) Subgrade.** The subgrade shall be prepared according to the typical sections on the plans before placement of base. When the subgrade is constructed under the same Contract as the base, the subgrade shall be prepared according to Section 212. When the subgrade is constructed under a separate contract, preparation of the subgrade shall be according to Section 214.

**(e) Mixing.** Mixing shall be accomplished at a central mixing plant by either batch or continuous mixing. The aggregates and cement may be proportioned either by weight or by volume.

The plant shall be equipped with feeding and metering devices that will add the aggregate, cement, and water into the mixer in the specified quantities. Aggregate and cement shall be dry-mixed sufficiently to prevent cement balls from forming when water is added. Mixing shall continue until a uniform mixture of aggregate, cement, and water has been obtained.

In all plants, cement shall be added in such a manner that it is uniformly distributed throughout the aggregates during the mixing operation.

The charge in a batch mixer, or the rate of feed into a continuous mixer, shall not exceed that which will permit complete mixing of all the material.

To compute the mixing time in a continuous mixer, the weight of its contents at operating level is divided by the weight of the mixture delivered per second by the mixer:

$$\text{Mixing time, Seconds} = \frac{\text{Pugmill dead capacity in lbs. (kg)}}{\text{Output in lbs.(kg) per second}}$$

The pugmill for the continuous mixer shall be equipped with a surge hopper containing sufficient baffles and gates to prevent segregation of material discharged into the truck and to allow for closing of the hopper between trucks without requiring shut down of the plant.

**(f) Placing and Compacting.** The subgrade surface, if dry, shall be moistened but not to the extent of producing a muddy condition at the time the base mixture is placed. Placing of the base course shall begin along the high point of the pavement on a crowned section or on the high side of a pavement sloping in one direction.

Proportioned and mixed materials shall be transported to the point of delivery in approved non-agitating equipment. Covers shall be provided for protection during transport.

The material shall be spread on the prepared underlying course to such depth that, when thoroughly compacted, it will conform to the grade and dimensions shown on the plans.

The materials shall be spread by a self-propelled spreading machine or similar method approved by the Engineer. Sufficient equipment shall be provided to obtain full width spreading of the base material. If, in the judgement of the Engineer, full width placement is not desirable, the base shall be constructed in partial widths. If the time elapsing between the placing of adjacent partial widths exceeds 30 minutes, a construction joint satisfactory to the Engineer shall be provided. Such joints shall be offset a minimum of 12" (300 mm) from a planned concrete pavement joint.

The equipment and methods employed in spreading the base material shall ensure accuracy and uniformity of depth and width. If conditions arise where such uniformity in the spreading cannot be obtained, the Engineer may require additional equipment or modification in the spreading procedure to obtain satisfactory results.

Immediately upon completion of the spreading operations, the base material shall be thoroughly compacted. Self-propelled rollers, in sufficient number, size, and type shall be provided to obtain the specified results. Care shall be exercised in routing construction equipment to avoid the formation of unnecessary ridges due to wheel tracks or tractor treads. If necessary, the base material after compaction shall be trimmed by means of a self-propelled motor grader to the grade and section shown on the plans. All material loosened in this operation shall be swept from the surface before any further rolling. Finishing operations shall continue until the surface is true to the specified cross section and until the surface shows no variations of more than  $\frac{1}{4}$ " (6 mm) from a 10' (3 m) straightedge laid in any location parallel with, or at right angles to, the longitudinal axis of the pavement.

No equipment or traffic shall be permitted on the finished base course during the first 72 hours of the curing period, except for minor maneuvering to enable the Contractor to begin the next day's work, not to exceed 25' (8 m).

After the base course is 7 days old, one lane in each direction may be used as a haul road, at the Contractor's own risk. Any damaged areas resulting from this operation shall be removed and replaced at no cost to the Department. Loaded trucks will be permitted to back onto the base to unload.

**(g) Construction Joints.** At the end of each day's run a transverse construction joint shall be formed by a header or by cutting back into the compacted material to form a true transverse vertical face. These faces shall be protected by banking damp earth against them or by other approved suitable methods.

The protection provided for construction joints shall permit the placing, spreading, and compacting of base material without injury to the work previously placed.

When a longitudinal construction joint is required in partial width construction, side forms shall be used or the joint shall be formed by cutting back into the compacted material to form a vertical edge. Suitable curing shall be provided for any exposed longitudinal edge. Joints shall be offset from a planned longitudinal pavement joint a minimum of 12" (300 mm).

Care shall be exercised to ensure thorough compaction of the base material immediately adjacent to all construction joints.

**(h) Protection and Curing.** After the base course has been finished as specified herein, it shall be protected against drying for 7 days by the application of asphalt material. The curing methods shall begin as soon as possible, but no later than 24 hours after the completion of finishing operations. The finished base course shall be kept reasonably clean and continuously moist until the curing material is placed.

The asphalt material specified shall be uniformly applied to the moist surface of the completed base course at the rate of approximately 0.2 gallon per square yard (0.75 L/sq m) using approved heating and distributing equipment. The exact rate and temperature of application to give complete coverage without excessive runoff will be specified by the Engineer.

Should it be necessary for construction equipment or other traffic to use the asphalt covered surface before the asphalt material has dried sufficiently to prevent pickup, sufficient granular cover shall be applied before such use.

The curing material shall be maintained and applied as needed by the Contractor during the 7 day protection period so that all of the base course is covered effectively during this period.

Finished portions of base course that are used by equipment in constructing an adjoining section shall be protected in such a manner as to prevent equipment from marring or damaging the completed work.

When the air temperature may be expected to drop to the freezing point, sufficient protection from freezing shall be given the base course for 7 days after its construction and until it has hardened.

**(i) Cold Weather Protection.** During cold weather, when the air temperature may be expected to drop below 35° F (2° C), a

sufficient supply of hay, straw, or other material suitable for cover shall be provided at the site. Any base that has been damaged by freezing shall be removed and replaced at no cost to the Department.

**(j) Tolerance in Base Thickness.** The base course shall be constructed according to the typical sections on the plans  $\pm 1/2$ " (12 mm) in thickness. Sections over  $1/2$ " (12 mm) deficient in thickness shall be removed and replaced at no cost to the Department. No payment will be made for materials placed in excess of planned thickness.

**308.05 Quality Control, Acceptance, and Adjustments in Payment.** **(a) General.** The Contractor shall furnish all personnel, equipment, and facilities necessary to perform the required sampling and testing. The Contractor's facilities shall be separate from any Field Laboratory and/or Field Office furnished under the Contract. The Contractor shall provide the Engineer with the opportunity to observe all quality control and acceptance sampling and testing. Quality control sampling and testing by the Contractor shall be performed in a qualified laboratory by a certified technician. Requirements for technician certification and laboratory qualification are contained in the Department's *Manual of Field Sampling and Testing Procedures*. Test reports shall be signed and copies made available to the Engineer.

**(b) Quality Control.** Quality control of the Cement Stabilized Crushed Stone Base Course in regards to gradation, density, and plasticity index shall be according to the Quality Control and Acceptance provisions contained in Section 306. The density, as determined by AASHTO T 310, Direct Transmission, shall not be less than 95% of the maximum laboratory density determined in the laboratory by AASHTO T 180, Method D. The Contractor shall conduct soundings to insure that the minimum specified depth is maintained.

**(c) Acceptance Testing.** Acceptance testing by the Contractor for thickness, gradation, and compressive strength will be based upon lots. The standard lot size for acceptance will be 4000 cubic yards (3000 cubic meters) of mix, with each standard lot divided into four sublots of 1000 cubic yards (750 cubic meters). The Engineer may establish partial lots at any time. The Engineer will determine the size of any partial lots established and the number and size(s) of the sublots, if any.



The minimum frequency of sampling and testing for thickness, gradation, and compressive strength shall be one test for each subplot. The Department will determine the location for each sample in the subplot by AHTD Test Method 465. For compressive strengths, the Contractor shall obtain one core from each subplot according to AASHTO T 24 and all core holes must be repaired by the Contractor using acceptable material approved by the Engineer. The Contractor shall perform compressive strength testing on the cores according to AASHTO T 22. The Contractor shall certify to the Engineer that the calibration of the concrete cylinder compression testing machine has been verified. This verification shall be performed in accordance with AASHTO T 22 and T 67 under any of the following conditions and documented in accordance with AASHTO T 67:

1. After an elapsed interval of 18 months (maximum) since the previous calibration.
2. After original installation of the machine or following relocation of the machine.
3. Immediately after repairs or adjustments.
4. Whenever there is a reason to doubt the accuracy of the results, without regard to the time interval since the last verification.

Thickness determination shall be made from cores sampled for compressive strength tests. Acceptance of the aggregate gradation shall be according to the Quality Control and Acceptance provisions contained in Section 306.

In addition to the required acceptance tests, the Engineer may require the Contractor to test any location that, by visual observation, appears to be defective. The Department may perform any sampling or testing to verify the Contractor's testing equipment or procedures. The Contractor shall be required to make changes to the equipment and/or procedures if the Department is unable to verify the Contractor's test results.

The Contractor's acceptance sampling and testing procedures, equipment, and results will be subject to independent assurance sampling and testing conducted by the Department. Independent assurance sampling and testing will be conducted at the frequencies indicated in the Department's *Manual of Field Sampling and*

*Testing Procedures.* The Contractor shall be required to make changes to the equipment and/or procedures used if the results of the independent assurance tests do not correlate with the Contractor's test results.

The Department will obtain and test a minimum of one sample taken at random from each lot, including partial lots, to be used both for verification and for acceptance. The location of the lot sample will be determined by the Department using AHTD Test Method 465. Verification testing will be conducted in accordance with Subsection 106.11 and the *Manual of Field Sampling and Testing Procedures*.

Acceptance sampling and testing by the Contractor shall be performed in a qualified laboratory by a certified technician. Requirements for technician certification and laboratory qualification are contained in the Department's *Manual of Field Sampling and Testing Procedures*. Acceptance sampling and testing shall be accomplished in a timely manner. The Contractor shall maintain records of all samples taken and the results of all tests performed. Signed copies of these records shall be furnished to the Engineer on the next business day after the tests are performed. The item of work being tested shall not be considered complete or accepted until all test reports are submitted to the Engineer.

**(d) Acceptance and Adjustments in Payments.** Acceptance and adjustment will be by lot.

Acceptance of a standard lot shall be based on complying test results for thickness and gradation and the average compressive strength testing results meeting a minimum of 750 psi (5.2 MPa) in 7 days. The average result will include the subplot results of tests performed by the Contractor and the results of the lot test performed by the Department.

For a lot or subplot to be considered for acceptance and adjustments, each core shall achieve not less than 70% of the minimum compressive strength specified at 7 days. In the subplot containing the Department's lot test, if the result of either the Contractor's subplot test or the Department's lot test is below the minimum compressive strength specified, the two results will be averaged and the average of the two test results used to determine acceptance or rejection.

If the average compressive strength of the cores is less than the minimum compressive strength specified, adjustments will be made by reducing the contract price for the items of Aggregate in Cement Stabilized Crushed Stone Base Course, Cement in Cement Stabilized Crushed Stone Base Course, and Processing Cement Stabilized Crushed Stone Base Course on a lot basis according to Table 308-1. Continuous production of material not qualifying for full payment will not be allowed.

**TABLE 308-1**  
**Acceptance and Adjustments in Payments**

<b>Average 7 Day Compressive Strength</b>	<b>Pay</b>
750 psi (5.2 MPa )	100 %
750 to 675 psi (5.2 to 4.7 MPa)	90 %
675 to 600 psi (4.7 to 4.2 MPa)	80 %
600 to 525 psi (4.2 to 3.7 MPa)	70 %
less than 525 psi (3.7 MPa)	Remove and Replace

**(e) Unacceptable Base Course.** Any lot or subplot that is not accepted shall be removed and replaced by the Contractor at no cost to the Department. Payment for lots where removal and replacement is required will be withheld or recovered, and released after replacement has been acceptably completed. The quantity and measurement of the quantity used in replacement operations will not be considered.

**308.06 Method of Measurement.** (a) Processing Cement Stabilized Crushed Stone Base will be measured by the square yard (square meter) of the thickness specified. The quantities shown on the plans will be considered as the final quantities and no further measurement will be made unless, in the opinion of the Engineer or upon evidence furnished by the Contractor, substantial variations exist between quantities shown on the plans and actual quantities due to changes in alignment or dimensions or to apparent errors.

(b) The mix proportions in pounds per square yard (kilograms per square meter) of aggregate and cement, as established by the laboratory design, will be used in conjunction with the square yard (square meter) measurement to determine the quantities of crushed stone and cement.

Quality Control and Acceptance sampling and testing of Cement Stabilized Crushed Stone Base Course will not be paid for separately, but full compensation therefor will be considered included in the contract unit prices bid for other items in this Section.

Water and asphalt will not be paid for separately, but full compensation therefor will be considered included in the contract unit price bid for Processing Cement Stabilized Base Course.

**308.07 Basis of Payment.** Work completed and accepted and measured as provided above will be paid for as follows:

(a) Processing Cement Stabilized Crushed Stone Base Course will be paid for at the contract unit price bid per square yard (square meter) for Processing Cement Stabilized Crushed Stone Base Course.

(b) Portland Cement and/or fly ash will be paid for at the contract unit price bid per ton (metric ton) for Cement in Cement Stabilized Crushed Stone Base Course.

(c) Aggregate will be paid for at the contract unit price bid per ton (metric ton) for Aggregate in Cement Stabilized Crushed Stone Base Course.

The contract unit prices mentioned above will be full compensation for furnishing, hauling, and placing materials; for performing quality control and acceptance sampling and testing; for pulverizing, watering, mixing, compacting, finishing, and curing;

and for all labor, equipment, tools, and incidentals necessary to complete the work.

Payment will be made under:

<b>Pay Item</b>	<b>Pay Unit</b>
Processing Cement Stabilized Crushed Stone Base Course	Square Yard (Square Meter)
Cement in Cement Stabilized Crushed Stone Base Course	Ton (Metric Ton)
Aggregate in Cement Stabilized Crushed Stone Base Course	Ton (Metric Ton)

## **SECTION 309 PORTLAND CEMENT CONCRETE BASE**

**309.01 Description.** This item shall consist of constructing a course of Portland cement concrete base, with or without reinforcement as specified, on a prepared surface according to these specifications, in reasonably close conformity with the established lines, grades, and typical cross sections shown on the plans or established by the Engineer.

**309.02 Proportions.** The proportions of materials shall comply with Section 501 for paving concrete or Section 802 for Class A or Class S concrete. The Contractor shall prepare a mix design according to Subsection 501.03 or Subsection 802.05 as appropriate.

**309.03 Materials.** The material requirements shall be according to Section 501. Fly ash, if used, shall be according to Section 501.

**309.04 Construction Requirements.** Construction requirements shall comply with Section 501 with the following exceptions:

(a) No joints shall be required in Portland Cement Concrete Base other than construction joints.

(b) The surface shall be given a Class 1, Ordinary Surface finish.

(c) Surface evenness testing of Subsection 501.05(m) shall not be required. However, surface tolerances shall be 1/4" (6 mm) in 10' (3 m).

(d) The pavement shall not be opened to traffic until a minimum compressive strength of 2100 psi (15 MPa) is obtained.

**309.05 Tolerance in Base Thickness.** The tolerance in base thickness shall be according to Subsections 501.10 and 501.14. No thickness cores will be taken on sections less than 30' (10 m) in length or less than full lane width.

**309.06 Quality Control and Acceptance.** Quality control and acceptance sampling and testing shall be according to Subsection 501.04, except that compressive strength will be determined by cylinders obtained according to AASHTO T 23 and that coring will not be required to determine pavement thickness. Thickness will be determined by sounding after the fresh concrete has been struck off.

**309.07 Method of Measurement.** (a) Portland Cement Concrete Base will be measured by the square yard (square meter) and adjusted according to Subsections 501.04, 501.10 and 501.14.

(b) Reinforcing steel, when specified, will be measured according to Section 502.

**309.08 Basis of Payment.** Work completed and accepted and measured as provided above will be paid for as follows:

(a) Portland Cement Concrete Base will be paid for at the contract unit price bid per square yard (square meter) for Portland Cement Concrete Base of the thickness specified, which price shall be full compensation for preparing the subgrade and shaping the shoulders, unless otherwise specified; for furnishing, transporting, and placing materials; for preparing and processing materials; for mixing, spreading, vibrating, finishing, and curing; for performing mix designs and quality control and acceptance sampling and testing; and for all labor, equipment, tools, and incidentals necessary to complete the work.

(b) Reinforcing steel, when specified, will be paid for according to Section 502.

Payment will be made under:

<b>Pay Item</b>	<b>Pay Unit</b>
Portland Cement Concrete Base (__" [__mm] Uniform Thickness)	Square Yard (Square Meter)

**SECTION 310**  
**OPEN GRADED PORTLAND CEMENT**  
**CONCRETE BASE COURSE**

**310.01 Description.** This item shall consist of a permeable base course of coarse aggregate, Portland cement and water mixed in a central plant and spread and compacted on a prepared and previously accepted base course according to these specifications and in conformity with the lines, grades, compacted thickness, and typical section shown on the plans or as directed by the Engineer.

**310.02 Composition. Cement Content.** The Portland cement content shall be 150 lbs per cubic yard (89 kg per cu m) of open graded base course. The water-cement ratio shall be a maximum of 0.45.

**310.03 Materials.** The material requirements shall be according to Subsection 501.02 except that aggregate shall be crushed stone and conform to the following gradation limits:

SIEVE	PERCENT PASSING BY WEIGHT
1" (25.00 mm)	100
3/4" (19.0 mm)	90-100
3/8" (9.5 mm)	20-55
#4 (4.75 mm)	0-10
#8 (2.36 mm)	0-5

**310.04 Construction Requirements.** The methods employed in performing the work and the equipment, tools, and plant machinery used in executing the work shall conform to the requirements of Section 501 except as amended herein:

(a) **Joints.** No joints shall be required in open graded Portland cement concrete base course other than construction joints.

(b) **Finish.** The surface shall be given a uniform screeded finish.

(c) **Curing.** The completed open graded base shall be cured by sprinkling the surface with a fine spray of water every 2 hours for a period of 8 hours. Curing shall start the morning after the open graded base has been placed.

**(d) Surface Tests.** Immediately behind the screed, the Contractor shall test the surface with a 10' (3 m) straightedge operated parallel to the centerline. The straightedge shall be held in contact with the surface in successive positions parallel to the pavement centerline and for the full width of the slab. Testing shall progress longitudinally in successive stages of not more than one-half the length of the straightedge. Depressions in excess of ¼" (6 mm) shall be filled with fresh mix and struck off. High areas in excess of ¼" (6 mm) shall be cut down. Straightedge testing and surface correction shall continue until the entire surface conforms to the required grade and section.

Care shall be exercised, at all times, to prevent deterioration of the permeability of the Open Graded Portland Cement Concrete Base Course by contamination of fines. Open Graded Portland Cement Concrete Base Course which, in the opinion of the Engineer, has been contaminated shall be corrected at no cost to the Department. Corrections shall be made by a method approved by the Engineer. Grinding or sawing of the base shall not be allowed.

**(e) Weight Limitations.** No traffic or Contractor's equipment shall be permitted on the open graded Portland cement concrete base course. The work of placing the subsequent layer shall not begin until the base course has been placed on the shoulders, after which only the paver will be permitted on the open graded Portland cement concrete base course. Placing the subsequent layer shall be accomplished by unloading materials from the haul trucks at the shoulder and then directly conveying them to the paver. The Contractor may propose alternates to the Engineer for the paving method but no haul trucks of any type shall be permitted on the open graded Portland cement concrete base course. Any damage to the open graded base shall be repaired promptly by the Contractor at no cost to the Department, as directed by the Engineer.

**(f) Base Thickness.** If the base thickness is not in conformity with the plans and specifications, the paving operations will cease until the problem is corrected and the deficient areas brought into conformity with the plans and specifications.

**310.05 Quality Control and Acceptance. (a) Quality Control.** The Contractor shall be responsible for quality control of materials during handling, blending, mixing, transporting, and placement



operations, and for necessary adjustments in proportioning of materials used to produce the specified concrete base.

The Contractor shall be responsible for determining gradation and moisture content of aggregates used in the concrete base mixture according to the Quality Control and Acceptance provisions contained in Section 306. The Contractor shall determine the specific locations for samples for quality control. When individual gradations fall outside the specified limits, the Contractor shall immediately make adjustments to bring the aggregates within specified limits.

There will be no minimum frequency for quality control sampling and testing.

The Contractor shall produce a mix conforming to the composition requirements in Subsection 310.02. If a mix is obviously defective, paving operations shall cease and not resume until proper adjustments have been made.

**(b) Acceptance Testing.** Acceptance testing for gradation by the Contractor will be based on lots. The size of standard lots will be 2500 square yards (2000 square meters). Partial lots, of any size, may be established by the Engineer at any time. Test methods for acceptance shall be the same as specified for quality control testing. The item of work being tested shall not be considered complete or accepted until passing test reports are submitted to the Engineer.

The Contractor shall take one test in each lot or partial lot at a location randomly selected by the Engineer under AHTD Test Method 465.

All acceptance testing performed by the Contractor is subject to observation by Department personnel. All test reports shall be signed and submitted to the Engineer by the next business day after the tests are performed.

The Contractor's acceptance sampling and testing procedures, equipments, and results will be subject to independent assurance sampling and testing conducted by the Department. Independent assurance sampling and testing will be conducted at the frequencies specified in the Department's *Manual of Field Sampling and Testing Procedures*. The Contractor shall be required to make changes to the equipment and/or procedures used if the results of the

independent assurance tests do not correlate with the Contractor's test results.

The Department will obtain and test a minimum of one sample, taken at the frequency established in the Department's *Manual of Field Sampling and Testing Procedures*, for verification testing in accordance with Subsection 106.11.

**310.06 Method of Measurement.** Open Graded Portland Cement Concrete Base Course will be measured by the square yard (square meter).

**310.07 Basis of Payment.** Open Graded Portland Cement Concrete Base Course completed and accepted and measured as provided above will be full compensation for furnishing, hauling, and placing materials; for performing quality control sampling and testing; for mixing, spreading, finishing, straightedging, correcting surface and thickness irregularities, and curing; and for all labor, equipment, tools, and incidentals necessary to complete the work.

Payment will be made under:

<b>Pay Item</b>	<b>Pay Unit</b>
Open Graded Portland Cement Concrete Base	Square Yard (Square Meter)