

**SECTION 302-SUBGRADE TREATMENT
(LIME)**

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SECTION 302-SUBGRADE TREATMENT (LIME)

302.01-Description. Subgrade Treatment (Lime) shall consist of in-place subgrade material and lime uniformly mixed, moistened, compacted and cured, in accordance with these Specifications, and shaped in reasonably close conformity to the lines, grades, thickness and cross sections shown on the Plans or as directed by the Engineer.

302.02-General. Subgrade Treatment (Lime) shall consist of preparing the existing subgrade, distributing the specified percentage of lime, initial mixing, mellowing, final mixing, compacting, finishing and curing.

MATERIALS

302.03-Materials.

- (a) Lime.
Lime shall be either hydrated lime or quicklime meeting the requirements of **Subsection 918.04**.
- (b) Water.
Water shall be free of injurious quantities of oil, salt, acid, alkali, sugar, vegetable matter, or other detrimental substances.
- (c) Soil.
The soil used in this work shall consist of the in-place subgrade material, except that soil unsuitable for stabilization shall be removed and replaced with suitable material. Samples of the in-place material shall be taken before work is started, and tested in the laboratory to determine the percentage of lime required and the appropriate optimum moisture content of the lime-soil mixture as determined by AASHTO T 99, Method C.
- (d) Bituminous Material.
Bituminous material used as a curing agent shall conform to the following:

<u>Material</u>	<u>Subsection</u>
PG64-22, 70-22, 76-22 and 82-22	904.01
Emulsified Asphalt, Type SS-1, RS-2, TST-1P	904.03

The selection of the kind of bituminous material used for curing will be optional with the Contractor.

Emulsified asphalt shall be of the anionic kind, unless otherwise shown on the Plans or designated by the Engineer.

EQUIPMENT

302.04-Equipment. All equipment necessary for the satisfactory performance of this work shall be on the project and approved before work will be permitted to begin. The distributing equipment shall be of a type that will distribute the lime uniformly, at the required rate and without excessive loss. Mechanical mixers meeting the requirements of **Subsection 303.05** will be required for final mixing, except that in sections where stone, gravel or similar material is encountered in the subgrade in such quantity and size to prohibit the practical use of this type mixer, as determined by the Engineer, final mixing may be performed within such sections with disc harrows or other approved equipment. The mixing equipment shall be capable of attaining the degree of pulverization stipulated under **Subsection 302.10** and thoroughly mixing the soil and lime to the full required depth of the loose material. Compaction equipment shall be of the size and weight required to obtain the specified density and quality of finished surface.

CONSTRUCTION REQUIREMENTS

302.05-Limitations. Lime shall be handled and stored in moisture resistant containers until immediately before being transported to the site of the work. Storage bins shall be completely enclosed. Bagged lime shall be stored in weatherproof buildings with adequate protection from ground dampness.

No lime stabilization shall be performed that will not be covered with the succeeding stage of sub-base or base construction during the same construction season. Lime application will not be permitted when the subgrade material is frozen and unless the air temperature in the shade is at least 40° F(4° C) and rising.

Lime shall be applied only to such areas as can be initially mixed and sealed in accordance with **Subsection 302.09** during the day of application.

Any lime that has been exposed to the open air for a period of 6 hours or more will not be accepted for payment.

Lime(dry) shall not be applied during periods of high winds which cause excessive loss of lime.

No traffic or equipment shall be permitted on the spread lime other than that required for spreading, watering, or mixing.

302.06-Preparation of Existing Subgrade. The existing roadway shall be graded and shaped in reasonably close conformity with the lines, grades, and cross sections shown on the Plans or as directed by the Engineer.

All grass turfs or other deleterious substances shall be removed from the subgrade, and it shall be prepared in accordance with the provisions of **Subsection 207.03**.

If wet or unstable underlying foundation material is encountered, it shall be corrected as directed by the Engineer.

302.07-Extra Depth Stabilization. If deemed necessary, the Engineer shall designate extra depth lime stabilization in certain areas to be performed as described herein and as indicated by the Plans or designated by the Engineer.

The overlying material shall be bladed to the sides, and the lime slurry or, in dry applications, the hydrated lime and any necessary water shall be incorporated into the underlying material at the rate and to the depth specified. The lime-soil mixture shall be thoroughly mixed and compacted to obtain the required stability. The compacted surface shall then be moistened and covered by compacting the previously windrowed subgrade material thereon. The covering of compacted overlying subgrade material will serve as the curing medium. Curing and mellowing periods will not be required for the lime stabilized underlying material unless otherwise directed by the Engineer.

No direct compensation will be allowed for shifting the overlying material. The lime and water used, and the mixing of the underlying material with the lime and water, will be measured and paid for in accordance with the provisions of **Subsections 302.14 and 302.15.**

302.08-Application of Lime. When the subgrade has been prepared as provided for in **Subsection 302.06,** the application of lime shall be accomplished with hydrated lime by "Dry Application" or with either hydrated lime or quicklime by "Slurry Application". The Contractor shall use the slurry method of application unless otherwise specified by the Plans.

(a) Dry Application.

Hydrated lime shall be spread at the required rate, by means of an approved spreader which will uniformly distribute the material without excessive loss, or by bag distribution.

(b) Slurry Preparation and Application.

Lime shall be mixed with water in approved agitating equipment and applied to the roadway as a thin water suspension or slurry, through approved distributing equipment. The distributing equipment shall be equipped to provide continuous agitation of the mixture from the mixing site until applied on the roadbed. The proportion of lime shall be such that the "Dry Solids Content" will be at least thirty percent by weight.

Slurry shall be prepared, transported, distributed and mixed with the soil so that lime distribution will not cause injury, damage, discomfort or inconvenience to individuals or to private property.

302.09-Initial Mixing and Mellowing. In dry applications, immediately after the application of hydrated lime the course shall be scarified, if necessary, and mixed to the required depth, width, and cross section(s).

In slurry applications, the full width of the course to be treated shall be scarified or partially pulverized with approved mixing equipment as directed by the Engineer to the depth required for the stabilization prior to the application of the lime slurry. The desired distribution of lime slurry shall be attained by successive passes over a measured section until the specified percentage of lime has been distributed. After each successive pass the slurry shall be incorporated into the soil with approved mixing equipment.

It shall be the Contractor's responsibility to exercise whatever precautions are necessary to assure that the lime is incorporated into the soil to such depth to furnish a finished course of lime treated material conforming to the thickness and surface requirements hereinafter specified.

The mixing, and water application as necessary, shall be continued until a homogeneous mixture of soil, lime, and water is obtained. The quantity of water added during this initial mixing operation shall be in the amount needed to produce a moisture content of the mixture equal to five percentage points above its optimum moisture content, plus or minus three percentage points, unless otherwise directed.

When the lime is applied as a slurry, the water added with the slurry shall not cause a moisture content of the lime-soil mixture in excess of the above stipulated tolerance.

After the completion of mixing, the treated course shall be reshaped to the approximate lines, grades, and cross sections and sealed with a pneumatic-tire roller, and other approved equipment as necessary, and left to mellow for a minimum of two and a maximum of seven days as directed by the Engineer. During the mellowing period the entire surface of the treated course shall be maintained in a moist condition.

302.10-Final Mixing. After the required mellowing period the initially mixed material shall be reshaped and graded to the required lines, grades and cross sections.

The previously mixed material shall then be thoroughly mixed with approved mixers while water, if necessary, is added.

The mixing shall be continued until 100% of the material, exclusive of gravel and stone, will pass a 1 in. (25 mm) sieve and 60% by dry weight will pass the No. 4(4.75 mm) sieve.

The quantity of water added shall be such that at the end of the final mixing and during compaction and finishing operations the percentage of moisture in the mixture and the unpulverized soil lumps will not vary more than plus or minus 3 percentage points from the specified optimum moisture of the lime-soil mixture.

302.11-Compaction and Finishing. Immediately following the completion of the final mixing, the material shall be bladed to uniform thickness and shape, and compaction operations started. The material shall be compacted by using sheepfoot type rollers and the compaction efforts shall be continuous until the entire depth of the lime-soil mixture is uniformly compacted to the required density. The sheepfoot type rollers may be removed when a surface mulch not exceeding 1 in. (25 mm) remains. The resulting surface shall then be lightly scarified and shaped to the required

lines, grades, and cross sections within the tolerances hereinafter specified and thoroughly compacted. Final rolling shall be performed with the roller specified by the Engineer.

The completed lime stabilized subgrade shall be smooth, dense, well bonded, unyielding and free of cracks or loose material. The finished surface shall be in reasonably close conformity to the grades and cross sections shown on the Plans or designated by the Engineer.

The lime-soil mixture shall be compacted in layers as specified on the Plans. Determination of the maximum density and optimum moisture content of the lime-soil mixture shall be in accordance with AASHTO Designation T 99. The sample used to determine the maximum density and optimum moisture content shall be representative field samples of the lime-soil mixture which have undergone the same treatment as the lime treated subgrade being tested.

The completed subgrade treatment will be divided into lots of approximately 10,000 yd² (9,000 m²) for density testing purposes. Five density tests will be performed on each lot. The average dry density of each lot shall be not less than 95% of maximum density. Further, no individual test shall be less than 92% of maximum density. At the beginning of the project or at any time it is deemed advisable, smaller lots may be considered in order to evaluate rolling procedures or for any other reasons approved or directed by the Engineer.

Areas that have a density less than is required shall be immediately scarified moistened (if required), reworked, and compacted to the required density all in accordance with these Specifications and at the Contractor's expense.

302.12-Curing. After the lime-treated subgrade has been finished as specified above, the surface shall be sealed with one of the bituminous materials specified in **Subsection 302.03**, applied by means of a pressure distributor at the rate of 0.10 to 0.25 gal. per yd² (0.45 to 1.15 liters per m²) as directed by the Engineer or specified on the Plans. The bituminous material shall be heated or otherwise prepared to insure uniform distribution and shall be applied as soon as possible

302.13-Tolerances and Reconstruction. The thickness of the completed lime-treated subgrade will be determined from measurement of test holes at random locations at intervals not to exceed 500 ft. (150 m). The measured thickness at the locations shall not deviate from that shown on the Plans by more than plus 1 1/2 in. (40 mm) or minus 1 in. (25 mm).

Areas of lime-treated subgrade not meeting the thickness requirements set out above shall be reconstructed immediately. The reconstruction of areas that have a thickness greater than that allowed shall include the addition of sufficient lime to correct the deficiency in lime content. All reconstruction, including additional lime necessary due to thickness deviation shall be at the Contractor's expense.

Areas of lime treated subgrade which become unstable or lose the required density or surface finish shall be repaired as directed by the Engineer. The Contractor shall use additional lime and water if and as directed. If the repairs are made necessary by a cause beyond the

Contractor's control, payment will be allowed at the contract unit prices for the construction items involved.

Hauling over the treated subgrade will not be permitted, except for the minimum amount necessary for access to the spreaders to construct a base or sub-base thereon.

When at least one course of base or sub-base has been constructed upon the treated subgrade, hauling may be permitted thereon, provided the layer or layers of base or sub-base are constructed and maintained in accordance with the provisions of **Subsections 303.09** and **303.10**.

COMPENSATION

302.14-Method of Measurement. Lime will be measured by the ton (metric ton), in accordance with the provisions of **Section 109**, Measurement and Payment, and this Subsection. Quantities and percentages of lime shown on the Plans are based on preliminary soil investigations and dry laboratory sample tests using hydrated lime. The actual application rate will be established from dry density tests made just prior to beginning stabilization work. If quicklime is used, the accepted quantity of quicklime will be measured as hydrated lime after converting the quicklime to an equivalent quantity of hydrated lime by use of the following formula:

$$EHL = 1.32 QL [1-(I/100)]$$

Where:

EHL = Equivalent amount of hydrated lime in tons(metric tons)

QL = Tons(metric tons) of quicklime accepted

I = Percent of impurities in the quicklime

Deductions will be made for quantities of lime that have been wasted or not actually used in the work.

If sacked lime is used, the net weight as packed by the manufacturer will be used for measurement.

Processing of Subgrade Treatment (Lime) will be measured by the $yd^2(m^2)$ of treated subgrade. The length used in computing the area will be determined from surface measurement of the treated subgrade. The width used in computing the area will be that shown on the Plans or designated by the Engineer.

Processing performed as described in **Subsection 302.07**, Extra Depth Stabilization, under "Direct Application Method", will be classified as Subgrade Treatment and will be measured for payment in accordance with the following:

1. When the thickness of the layers processed is equal to or greater than the thicknesses shown on the Plans for the normal stabilization, the processing will be measured by the square yard(square m^2) of each extra depth layer processed.

2. When layers of extra depth stabilization of less than Plan thickness for normal stabilization are processed, the processing of each layer will be measured by the $\text{yd}^2(\text{m}^2)$ and this area adjusted to determine the quantity for payment by multiplying the number of $\text{yd}^2(\text{m}^2)$ processed by the thickness of the layer and dividing by the Plan thickness for normal stabilization. The length and width used to determine the area of extra depth layers will be measured as stated above.

Water will be measured by the M. G. (1,000 gal.) (m^3) by means of calibrated tanks or distributors, or by means of accurate water meters. The quantity measured for payment will be the amount necessary for subgrade preparation, initial mixing, mellowing, final mixing, compacting, finishing and curing in accordance with these Specifications. No measurement for payment will be made for water used in connection with slurry preparation or application.

Bituminous Material will be measured by the ton (metric ton), in accordance with the provisions of **Section 109**, Measurement and Payment. The amount measured for payment will be the number of tons (metric tons) actually used and accepted.

Drilling necessary to complete Extra Depth Stabilization by the Drill-Lime Method will be measured by the linear foot (meter), from either the finished subgrade or from the top of base, as the case may be, to the bottom of the drilled hole. The quantity measured for payment will be the total linear feet (meters) of all holes, determined in the foregoing manner.

Materials, moved, furnished or disposed of, to prepare the subgrade in accordance with **Subsection 302.06** will be classified and measured for payment as provided for in **Section 207**, Subgrade Construction and Preparation.

302.15-Basis of Payment. The accepted quantities of Subgrade Treatment (Lime) will be paid for at the contract unit price per ton (metric ton) of Hydrated Lime; per ton (metric ton) of Bituminous Material; per $\text{yd}^2(\text{m}^2)$ of Soil-Lime Processing; per M. G. (1,000 gal.) (m^3) of Water; and per linear foot (meter) of Drilling for Subgrade Treatment.

Payment for material moved, furnished or disposed of will depend upon whether the Contract is (a) for combined grading, drainage and paving project, (b) for the construction of a base and/or pavement on a road that has been graded under a previous Contract, or (c) for a base and/or paving project that includes sections of grading. Payment will be made in accordance with the provisions of **Section 207**, Subgrade Construction and Preparation, which prescribes the basis of payment for each of these three cases.

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SECTION 303-MINERAL AGGREGATE BASE

303.01-Description. This work shall consist of furnishing and placing one or more courses of aggregates, and additives if required, on a prepared subgrade in accordance with these Specifications and in reasonably close conformity with the lines, grades, thickness and typical cross sections shown on the Plans or established by the Engineer.

Mineral aggregates base shall be Type A or Type B, whichever is shown on the Plans and called for in the bid schedule.

MATERIALS

303.02-Aggregate. The mineral aggregate shall meet the requirements of **Subsection 903.05** for Class A or Class B aggregates, depending upon whether Type A or Type B base is required in the construction. Type A Base will require the use of Class A aggregate, Grading D. Either Class A or Class B aggregate may be used for Type B base.

When the stationary plant method for mixing is used, the aggregate will be accepted for gradation immediately following mixing or immediately prior to mixing, based on periodic samples taken from the pugmill output, or from the belt feeding the pugmill.

When two or more materials are blended on the road by means of mechanical mixers, the aggregate will be accepted for gradation after mixing and before compaction, based on samples taken from each layer of base material. Aggregate that does not require blending will be accepted for gradation at the aggregate production plant, based on samples taken from stockpiles of plant production immediately prior to delivery to the road.

303.03-Calcium Chloride. Calcium Chloride shall meet the requirements of **Subsection 918.02** for Type 1, Type 2 or Calcium Chloride Liquor.

303.04-Sodium Chloride. Sodium Chloride shall meet the requirements of **Subsection 918.03**.

EQUIPMENT

303.05-Equipment. All equipment necessary for the satisfactory performance of this construction shall be on the project and approved before work will be permitted to begin. Such equipment shall include a stationary mixing plant, mechanical road mixer, or motor grader, whichever is applicable to the type of work to be performed, as specified under **Subsection 303.07**.

Stationary mixing plant. The mixing unit shall be an approved twin-shaft pugmill capable of producing a constant, uniform mixture. The mixer shall be equipped with a truck-loading hopper of sufficient size with a gate which will prevent segregation of the material when dumped into the truck. A spray bar capable of assuring an even wetting of the aggregate shall be mounted at the entrance of or above the pugmill. The flow of water through the spray bar shall be controlled by a meter, valve or other approved type of regulating device to maintain a uniform moisture content in the mixture. A

separate quick operating on-and-off device shall be required. The mixing plant shall be equipped with adjustable mechanical feeders for each size material capable of regulating a constant, uniform flow of material.

Mechanical mixer (for road mixing). The mechanical mixer shall be of the pugmill or rotary type capable of producing a uniform blend of all materials to the full depth of the course being placed. The mixer shall be either a self-propelled or trailer type.

Equipment shall include 1 or more rollers of a type and sufficient weight to obtain the required density and seal the surface of the base course.

CONSTRUCTION REQUIREMENTS

303.06-General. Mineral Aggregate Base, Type A or Type B, shall be constructed in one or more layers, the compacted thickness of which shall be as shown on the Plans.

The subgrade shall be prepared in accordance with the provisions of **Section 205, 207, or 302**, whichever is applicable.

The subgrade shall be checked and approved by the Engineer in advance of spreading any mineral aggregate. Subgrade that has been previously checked and approved and subsequently been subjected to freezing conditions or prolonged wet weather shall be rechecked for approval.

Mineral aggregate shall not be spread on a subgrade that is frozen or that contains frost.

Hauling over material already placed will not be permitted until it has been spread, mixed, shaped and compacted to the required density.

303.07-Mixing. Unless otherwise specified, the Contractor shall mix the base course material, including an additive if required on the Plans, by one or more of the following three methods:

For Mineral Aggregate Base, Type A, the stationary plant method will be required. For Mineral Aggregate Base, Type B, requiring the blending of two or more materials, either the stationary plant method or the road mix method (mechanical mixer) shall be used except as provided for in **Subsection 903.05**. For Mineral Aggregate Base, Type B, requiring additive, stationary plant mixing or road mixing shall be used.

Calcium Chloride, when used, shall be incorporated in either the solid or liquid form, at the approximate rate of 6 lbs/ton (3 kgs/metric ton) of aggregate.

6 lbs (3 kgs) is equivalent to 1.29 gal(4.88 liters) 60° F(15.5° C) 32% solution

6 lbs(3 kgs) is equivalent to 1.02 gal(3.86 liters) 60° F(15.5° C) 38% solution

If sodium chloride is used, it shall be incorporated at the approximate rate of 5 lbs(2.5 kgs)/ton (metric ton) of aggregate.

For stationary plant mixing, chloride material, in solid form shall be proportioned through a hopper equipped with an approved vibratory feeder

and an adjustable opening capable of accurately controlling the flow of material. Calcium chloride liquor shall be proportioned by an approved calibrated meter having a registering capacity capable of indicating the total amount of liquid used during any single day's operation.

For road mixing, the chloride material, shall be added to the aggregate at such point in the mixing operation and in such manner as may be approved by the Engineer.

Detailed requirements for the three types of mixing operation follows:

(a) Stationary Plant Method.

The base course material and water shall be mixed in an approved stationary mixing plant as described in **Subsection 303.05**. Water shall be added during the mixing operation in the amount necessary to provide a moisture content satisfactory for compacting. If combining of materials is required to meet the grading requirements, the blending shall be performed as provided for in **Subsection 903.05**, prior to mixing. All material fed into the plant shall travel the full length of the pugmill.

(b) Road Mix Method (Mechanical Mixer).

After the material for each layer of base course has been placed through an aggregate spreader or windrow-sizing device, the material shall be mixed by means of approved mechanical mixing machines as described in **Subsection 303.05**.

During mixing, water shall be added in the amount sufficient to provide a moisture content satisfactory for compacting.

(c) Road Mix Method (Motor Grader).

After material for each layer of base course has been deposited and spread uniformly, it shall be sprinkled with water in sufficient quantity to moisten all particles, but not in such quantity that segregation of sizes or softening of the subgrade will occur. Immediately following the application of water, the material shall be thoroughly mixed by windrowing and spreading with motor graders until the mixture is uniform throughout.

303.08-Spreading.

(a) Stationary Plant Mixing.

After mixing, material for each layer of base shall be transported to the job site while it contains the proper moisture content, and shall be spread to the required thickness and cross section by means of an approved mechanical spreader.

(b) Road Mixing (Mechanical Mixer).

Material to be mixed by mixing method (b) shall be spread prior to mixing with an approved mechanical spreader capable of being adjusted to spread the materials in the proper proportions.

(c) Road Mixing (Motor Grader).

After the aggregate and water have been thoroughly mixed, the base material shall be spread while at optimum moisture content in layers of specified thickness and cross section by means of approved motor graders.

If the required compacted depth of the base course 6 in. (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 in. (150 mm) except when vibrating or other approved types of special compacting equipment are used, the compacted depth of a single layer of the base course may be increased to 8 in. (200 mm) upon approval of the Engineer.

In some cases, the Plans show the base as extending for the full width of the roadbed. In other cases, the edges of the base are shown as coinciding with the inside edges of the shoulders. In the latter case, shoulder material shall be placed to a minimum width of 3 ft. (1 m) prior to the spreading of each layer of base material in order to confine the base material and to permit proper compaction.

Any base material used for constructing detours, for maintenance of traffic, for backfilling rock cuts and capping rock fills may be spread and mixed under method (c).

303.09-Shaping and Compaction. Except where mechanical aggregate spreading equipment is used to place the base material, final shaping of each layer prior to compaction shall be accomplished by motor grader. In the event that mechanical spreading equipment fails to shape the base material properly, final shaping shall be done by motor grader or other approved means.

Immediately following spreading, the base material shall be shaped to the required degree of uniformity and smoothness and compacted to the required density prior to any appreciable evaporation of surface moisture. Compaction of each layer shall be continuous until the minimum density requirement is achieved. Any type of compacting equipment may be used provided the required density is attained.

If the density requirement does not apply as provided for below, compaction shall progress gradually from the edges of the base to the center, parallel with the center-line of the road, and shall continue until the base layer has been compacted to its full width as directed by the Engineer. Where lifts of shoulder materials are placed to confine the base material, the initial pass of the compacting equipment shall overlap the shoulder to a width of not less than 12 in. (300 mm).

For density testing purposes each completed layer will be divided into lots of approximately 10,000 s.y. (9,000 m²). Five density tests will be performed on each lot and the results averaged. Smaller lots may be considered when directed or approved by the Engineer.

The average density of each lot of Type A base, unless otherwise specified, shall be not less than 100 percent of maximum density

determined in accordance with AASHTO T 99, Method D with no individual test less than 97% of maximum density. The average density of each lot of Type B base, unless otherwise specified, shall be not less than 97% of maximum density determined in accordance with AASHTO T 99, Method D with no individual test less than 95% of maximum density.

If the specified density is not obtained for either type of base, the material shall be reworked or replaced in order to comply with the density requirement.

Unless otherwise specified, the above density requirements will not apply to Type A or Type B base construction on projects that do not include the construction of a surface upon the base, nor to projects which have a specified total base thickness less than 4 in. (100 mm). When the specified density requirements do not apply, the desired degree of compaction will be considered to have been reached when the surface is tightly bound and shows no undue rutting or displacement under operation of the roller or other equipment. The compaction of each layer shall be approved before material for the next successive layer is placed. Placing and compacting areas shall be kept separate.

The surface of each layer shall be so constructed that the aggregates become firmly keyed and a uniform texture produced and shall be maintained in that condition until covered by the following stage of construction or until final acceptance of the project. Any irregularities that develop shall be corrected by loosening the material at those places and adding or removing material as required.

Approved distributors shall be used to apply water uniformly over the base materials during compaction in sufficient quantity for proper compaction. Softening of the underlying subgrade resulting from use of excess water is especially to be avoided.

303.10-Maintenance. After construction of the base has been completed satisfactorily, it shall be maintained, when required by the Engineer, smooth and uniform until covered by the following stage of construction or until the project has been completed and accepted. Maintenance and protection shall further consist of complying with the requirements of **Subsection 104.06** of these Specifications.

303.11-Thickness Requirements. The thickness of the completed base shall be in reasonably close conformity to the thickness shown on the Plans. The thickness shall be measured at such frequency as established by the Department by means of test holes or other approved methods.

303.12-Surface Requirements. The surface of the finished base shall be in reasonably close conformity to the lines, grades and cross sections shown on the Plans or established by the Engineer and shall have a satisfactorily smooth riding quality.

COMPENSATION

303.13-Method of Measurement. Mineral Aggregate for Mineral Aggregate Base, Type A or Type B, will be measured by the ton (metric

ton) in accordance with the provisions of **Section 109**, Measurement and Payment.

When mixing is performed in a stationary plant, the weight of all surface moisture on the aggregate at the time of weighing in excess of eight percent will be deducted. No direct payment for water will be made.

When mixing is performed on the road, the weight of surface moisture on the aggregate at the time of weighing in excess of 8%, will be deducted. Water added to the materials on the road at the direction of the Engineer will be measured for payment.

Water measured for payment as provided above will be measured by the M. G. (1,000 Gal.) (m³) by means of calibrated tanks or distributors, or by means of accurate water meters.

Sodium Chloride will be measured by the ton (metric ton) in accordance with the provisions of **Section 109**, Measurement and Payment.

Calcium Chloride will be measured by the ton (metric ton).

Calcium chloride received in liquid form will be weighed as provided for in **Section 109**. The weight of liquid calcium chloride will be converted to tons(metric tons) by using the following formulae:

32% Solution

$$((\text{Total tons(metric tons) 32\% Soln.}) \times 0.32)/(0.94) = \text{tons(metric tons)}$$

38% Solution

$$((\text{Total tons(metric tons) 38\% Soln.}) \times 0.38)/(0.94) = \text{tons(metric tons)}$$

When Calcium Chloride Liquor in a solution of 32% or more, but less than 38% is used, it will be paid for as a 32% solution. A solution of 38% or greater will be paid for as a 38% solution.

303.14-Basis of Payment. The accepted quantities of Mineral Aggregate Base of the type specified will be paid for at the contract unit price per ton (metric ton) for Mineral Aggregate, per ton (metric ton) for Calcium Chloride, per ton (metric ton) for Sodium Chloride, and per M. G. (1,000 Gal.) (m³) for Water, complete in place.

The work required for preparation of subgrade as provided for under **Subsection 303.06** will be measured and paid for in accordance with the provisions of the applicable Section or Subsection under which the work is performed.

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SECTION 304-SOIL-CEMENT BASE

304.01-Description. Soil-Cement Base shall consist of natural soil in the roadway, or of selected soil, and Portland cement mixed, moistened and compacted in one or more courses in accordance with these Specifications, and shaped in reasonably close conformity with the lines, grades, thickness, and typical cross section(s) shown on the Plans or as directed by the Engineer.

MATERIALS

304.02-Materials. Materials used in this construction shall meet the requirements of the following Subsections of **Part 9-Materials**.

<u>Material</u>	<u>Subsection</u>
Portland Cement, Type I	901.01
Portland-Pozzolan Cement, Type IP	901.01
Select Material for Soil-Cement Base	918.13
Bituminous Curing Seal	
Emulsified Asphalt, Type SS-1, RS-2	904.03
Cut-back Asphalt, Grade RC-250	904.02

Water shall meet the requirements of **Subsection 302.03(b)**.

The selection of the kind of bituminous material used for curing will be optional with the Contractor.

A sample of the cement and the Select Material to be used shall be submitted by the Contractor to the Materials and Tests Laboratory for approval at least 15 days prior to use.

EQUIPMENT

304.03-Equipment. All equipment necessary for the satisfactory performance of this work shall be on the project and approved before work will be permitted to begin.

Such equipment shall include a mechanical cement spreader of a type that will distribute the cement uniformly at the required rate without excessive loss and mechanical mixers meeting the requirements of **Subsection 309.03**; or a stationary mixing plant meeting the requirements of **Subsection 309.03**.

CONSTRUCTION REQUIREMENTS

304.04-Limitations. No Soil-cement shall be processed that will not be covered with the succeeding stage of base or pavement construction during the same construction season. No cement shall be applied to subgrade or select material that is frozen and unless the air temperature in the shade is at least 40° F(4° C) and rising.

Application of cement shall be limited to an area of such size that all operations can be continuous, and all but final surface finish completed within three hours, from the time the cement is applied. No uncompacted soil-cement mixture shall be left undisturbed for more than 30 minutes.

When the uncompacted soil-cement mixture is wetted by rain so that the average moisture content exceeds the specified tolerance, the entire section shall be reconstructed in accordance with the provisions of **Subsection 304.13**.

304.05-Preparation of Existing Subgrade. When in-place soil is to be used, the area to be treated shall be graded and shaped as required to construct the soil-cement base in reasonably close conformity with the lines, grades, thickness and cross sections shown on the Plans. Any additional soil needed shall be placed as directed and blended with the in-place material. Unsuitable soil or material shall be removed and replaced with acceptable soil. Removal and replacement, and addition of soil shall comply with the pertinent provisions of **Section 203**.

Where select material only is used, the subgrade shall be prepared in accordance with the provisions of **Section 205, 207**, or 302 whichever is applicable.

The Subgrade shall be dampened slightly just before the select material or soil-cement mixture is spread thereon.

304.06-Pulverizing. If required prior to the application of cement, the soil to be treated shall be scarified and pulverized for sufficient depth and width to give, after treatment and compaction, the cross section shown on the Plans. The soil-cement mixture shall be so pulverized that, at the completion of mixing, 100% will pass a 1 in. (25 mm) sieve, and minimum of 80% by dry weight will pass a No. 4(4.75 mm) sieve, exclusive of gravel or stone retained on these sieves. Any material retained on a 3 in. (75 mm) sieve, and other unsuitable material, shall be removed.

304.07-Cement Application, Mixing and Spreading. Select material to be spread on the subgrade prior to mixing shall be spread to the required thickness, width and cross section by means of an approved mechanical spreader. The percentage of cement to be used will be established by the Engineer, based on tests of the in-place soil or select material for use on the project. The specified quantity of Portland cement shall be applied uniformly over the spread select material or in-place soil. No cement shall be applied if the moisture content of the soil exceeds by more than three percentage points the optimum moisture content specified by the Engineer for the soil-cement mixture. Spread cement that has been lost due to negligence of the Contractor shall be replaced without additional compensation before mixing is started.

Road mixing shall be accomplished by means of the mechanical mixer. At least one pass of the mixer may be required before water is added. When required, water shall be uniformly added by distributors or other approved methods to bring the mixture to the required moisture content. Mixing shall continue until the pulverization requirements of **Subsection 304.06** are met and until a homogeneous mixture of soil, cement and water is obtained.

When stationary plants or mixers are used, they shall be equipped with feeding and metering devices which will introduce the cement, soil and water into the mixer in the quantities specified. All material fed into the plant shall travel the full length of the pugmill. Mixing shall continue until a

uniform and intimate mixture of cement, soil and water has been obtained. The mixture shall be transported from the plant to the road in numbered trucks, equipped with tight metal rear-end dump beds. Trucks shall be sufficient in number to insure satisfactory progress of construction operations. The material shall be spread by approved mechanical spreaders within one hour after being discharged from the mixer and in ample time to secure compaction during daylight hours. If the moisture content of the uncompacted mixture exceeds the specified tolerance, the material shall be reconstructed in accordance with **Subsection 304.13**. In mixing, handling and placing the base material, care shall taken to prevent segregation.

When select material is used, shoulder material shall be placed for a width of at least 3 ft. (1 m) prior to the spreading of the base material in order to confine the base material and permit satisfactory compaction along the edges of the base.

304.08-Compaction. At the start of compaction the percentage of moisture in the mixture and in the pulverized soil lumps, based on oven-dry weights, shall not vary more than two percentage points above or below the specified optimum moisture content, and shall be less than the quantity that will cause the soil-cement mixture to become unstable during compaction and finishing. Compaction shall be accomplished by the use of any type of equipment that will produce the required results. Rolling shall extend over the edges of the base material into the shoulders.

After initial compaction and during final rolling, the surface of the base course shall be reshaped and lightly scarified to loosen any imprints left by the compacting or reshaping equipment.

The soil-cement base shall be divided into lots of approximately 10,000 yd²(9,000 m²) for density testing purposes. Five density tests shall be performed on each lot. The average dry density of each lot shall be not less than 95% of maximum density as determined by AASHTO Designation T 134. Further, no individual test shall be less than 92% of the maximum density. Material not meeting the required density shall be reworked at the Contractor's expense, unless conditions exist as outlined in **Subsection 304.13**. At the beginning of a project or at any time it is deemed advisable, smaller lots may be considered in order to evaluate rolling procedure or for other reasons which are approved and/or directed by the Engineer. Compaction and final shaping operations shall be completed within three hours from the time the cement is mixed with the soil or select material.

304.09-Finishing. After compaction, the surface of the soil-cement shall be shaped to the required lines, grades, and cross sections. The surface shall be sprinkled until it is damp, but not wet, and clipped with motor grader as directed by the Engineer. The material removed by clipping shall be wasted. Following clipping, the surface shall be sealed with a roller.

304.10-Construction Joints. At the beginning of each day's construction a straight transverse construction joint shall be formed by cutting back into the previously completed work to form a true vertical face free of loose or shattered material.

304.11-Thickness and Surface Tolerances. The finished base shall meet the requirements specified under **Subsection 407.18** and when tested in accordance with the provisions of that Subsection the deviation of the surface from the testing edge of the straight edge shall not exceed ½ in. (13 mm).

The thickness of the base will be determined from the measurement of test holes dug at random locations at intervals not to exceed 500 ft. (150 m). The measured thickness shall not deviate from that shown on the Plans by more than plus 1 1/2 in. (40 mm) or minus 1 in. (25 mm.) Work found not to be within the above tolerance shall be reconstructed or replaced in accordance with the provisions of **Subsection 304.13**, Reconstruction and Replacement.

304.12-Curing. After the soil-cement has been finished as specified herein, it shall be protected against drying for 7 days by the application of one of the bituminous materials specified in **Subsection 304.02**. The curing material shall be applied at the rate specified on the Plans as soon as possible after completion of the base construction, but in no case later than 24 hours after the completion of finishing operations. The finished soil-cement shall be kept continuously moist until the curing material is placed.

Should it be necessary for construction equipment or other traffic to use the bituminous-covered surface before the bituminous material has dried sufficiently to prevent pickup, sufficient granular cover, consisting of clean sand passing a 3/8 in. (9.5 mm) sieve or other approved material, shall be applied before such use. All costs of furnishing and spreading granular cover shall be included in the price bid for other items of construction.

The curing material shall be maintained by the Contractor during the seven day protection period so that all of the soil-cement will be covered effectively during this period.

Finished portions of soil-cement that are traveled on by equipment used in constructing an adjoining section shall be protected in such a manner as to prevent equipment from marring or damaging completed work.

Sufficient protection from freezing shall be given to soil-cement for seven days after its construction.

304.13-Reconstruction and Replacement. When reconstruction becomes necessary, it shall be required that all construction procedures and time limitations specified herein shall be repeated; however, the amount of cement to be used in the reconstructed soil-cement base will be determined by the Engineer.

When necessary reconstruction is due to negligence on the part of the Contractor, no additional payment will be made for the additional cement or processing.

Faulty work shall be replaced for the full depth of treatment. Any low areas shall be remedied by replacing the material for the full depth of treatment rather than adding a thin layer of soil-cement to the completed work.

304.14-Traffic. Completed portions of soil-cement may be opened to local traffic after the 7 day curing period, provided the soil-cement has hardened

sufficiently to prevent marring or distorting of the surface by equipment or traffic. However, ingress and egress shall be provided for property owners and public crossroads prior to the seven day curing period.

304.15-Maintenance. The Contractor shall be required to maintain the soil-cement 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 at his own expense and repeated as often as may be necessary.

COMPENSATION

304.16-Method of Measurement. Processing will be measured by the $\text{yd}^2(\text{m}^2)$ of completed base. The length shall be the actual length measured along the center-line of the roadbed. The width shall be that shown on the Plans or designated by the Engineer.

Any material moved in accordance with the provisions of **Subsection 304.05** will be measured and paid for in accordance with the appropriate provisions of **Sections 203** or **207**.

Portland Cement incorporated in the work will be measured by the ton (metric ton) in accordance with the provisions of **Section 109**, Measurement and Payment.

Bituminous Material used for curing seal will be measured by the ton (metric ton) in accordance with the provisions of **Section 109**, Measurement and Payment.

Water will be measured by the M. G. (1,000 Gal.) (m^3) by means of calibrated tanks or distributors, or by means of accurate meters. Only that water used in mixing and finishing operations will be measured. Water added to emulsified asphalt used for curing will not be measured for payment.

Select Material for Soil-Cement Base, added to that already on the road, will be measured for payment by the cross section method in approved borrow pits, in conformity with the provisions of **Subsection 203.09**.

304.17-Basis of Payment. The accepted quantities of Soil-Cement Base will be paid for at the contract unit price bid per ton (metric ton) of Cement, per M. G. (1,000 Gal.) (m^3) of Water, per ton (metric ton) of Bituminous Material, per $\text{yd}^2(\text{m}^2)$ for Processing Soil-Cement Base and per $\text{yd}^3(\text{m}^3)$ of Select Material.

**SECTION 306-PORTLAND CEMENT CONCRETE
BASE**

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SECTION 306-PORTLAND CEMENT CONCRETE BASE

306.01-Description. This work shall consist of constructing a single course of Portland Cement Concrete Base, with or without reinforcement, as specified, on a prepared surface in accordance with these Specifications, in reasonably close conformity with the lines, grades and typical cross section shown on the Plans or as directed by the Engineer.

MATERIALS

306.02-Materials. Materials shall meet the requirements of the following Sections or Subsections of Part 3-Materials:

<u>Material</u>	<u>Section or Subsection</u>
Fine Aggregate	903.01
Coarse Aggregate	903.03
Portland Cement, Type I	901.01
Water	918.01
Air Entraining Admixtures	918.09
Curing Materials	913
Concrete Reinforcement	907
Chemical Additives	918.09

EQUIPMENT

306.03-Equipment. All equipment necessary for the satisfactory performance of the construction shall be on the project and approved before work will be permitted to begin. The equipment shall meet the requirements of **Subsection 501.04**.

CONSTRUCTION REQUIREMENTS

306.04-Proportioning. The proportioning of materials for concrete base shall be in accordance with the provisions of **Subsection 501.03**.

306.05-Construction Requirements. The subgrade shall be prepared in accordance with the provisions of **Section 205, 207, or 302**, whichever is applicable. Sub-base or subgrade treatment, when specified, shall be performed as prescribed in the applicable Subsections of **Part 3, Bases and Subgrade Treatments** of these Specifications.

The methods and procedures used in constructing cement concrete base shall meet the applicable requirements of **Subsections 501.07, 501.09 through 501.15, 501.16(a) through 501.16(f), and 501.17 through 501.24**.

306.06-Surface Finish and Tolerances. The surface of the concrete base shall be slightly roughened by brooming. Surface tolerances shall be as prescribed in **Subsection 501.17**.

306.07-Integral Curb. Edging (integral curb), when indicated on the Plans or required, shall be constructed of the same concrete mixture as is used in the base. It shall be constructed to the width and height indicated on the typical cross section by securely fastening auxiliary forms to the regular side forms of the base. Except as otherwise directed, it shall be constructed immediately after the final floating of the base and before the concrete in the base upon which the edging is to be constructed has taken its initial set. The surface of base under the edging shall be roughened prior to placing edging material thereon. The curb may be temporarily omitted from a section of the base at the end of the day's work sufficient in length to provide for backing-up the paving train the following day provided the base upon which the curb is to be placed is roughened sufficiently to bond the curb to the base. All laitance shall be removed from this section for the full width of the curbs by wire brushes or other satisfactory means. The concrete placed in the edging shall be well tamped and spaded to avoid honeycomb. The top of the edging shall be smooth and uniform and given a wood float finish. The inside and outside edges shall be rounded with edging tools to the radii shown on the Plans. The final finish of the edging shall be secured by wiping the surface with a soft brush having a width not less than the width of the edging.

306.08-Tolerance in Base Thickness. The tolerance in base thickness will be the same as described and stipulated for tolerance in pavement thickness, **Subsection 501.24**.

COMPENSATION

306.09-Method of Measurement. Portland Cement Concrete Base (Plain) and Portland Cement Concrete Base (Reinforced) of the various thicknesses specified will be measured for payment by the yd^2 (m^2) in accordance with the provisions of **Section 109**.

If during construction the Department orders the cement increased or decreased from that approved for the job mix by more than 8 lbs./ yd^3 (4.5 kgs/m^3), the quantity of increased or decreased cement shall be calculated in accordance with the provision of **Subsection 501.25**.

These calculations will comprise the basis for payment to the Contractor for additional cement, or for reimbursement to the Department for reduction in cement, as the case may be.

306.10-Basis of Payment.

- (a) General.

Payment will be made to the Contractor for additional cement required if the cement is increased by more than 8 lbs./ yd^3 (4.5 kgs/m^3) at the purchase price, F.O.B. the unloading point, as

verified by invoices, and no compensation will be allowed for further handling.

If the cement is decreased by more than 8 lbs./yd³ (4.5 kgs/m³), the State will be reimbursed from any monies due the Contractor an amount equal to the purchase price of the cement, F.O.B. the unloading point and no other charges will be included. No payment will be allowed for any changes in the proportions of the other aggregates. No additional payment will be made for concrete slab the thickness of which is more than the specified thickness shown on the Plans.

No payment will be made for any concrete base removed by order of the Engineer for deficiency in thickness or otherwise not meeting Specification requirements. The accepted quantities of Portland Cement Concrete Base will be paid for at the contract unit price/yd²(m²), for the various types and thicknesses specified, which payment shall be full compensation for furnishing and placing all materials therefore, including edging when specified, and any reinforcing, dowels and joint materials; provided. However, for any base found deficient in thickness more than ¼ in. (6 mm), but no more than 1 in. (25 mm), only the reduced price stipulated in **Subsection 306.10(b)** will be paid.

The work required for preparation of subgrade or sub-base as provided for under **Subsection 306.05** will be measured and paid for in accordance with the provisions of the applicable Section or Subsection under which the work is performed.

Where the average thickness of base is deficient in thickness by more than 0.25 in. (6 mm), but not more than 1 in. (25 mm), payment will be made at an adjusted price as specified in the following table:

CONCRETE BASE DEFICIENCY

Deficiency in Thickness as Determined by Cores In. (Mm)	Proportional Part of Contract Price Allowed
1/4 (0.0 through 6)	100 %
>1/4(6.1) through 1/2(13)	75 %
>1/2(13.1) through 3/4(19)	60 %
>3/4(19.1) through 1(25)	50 %

Where the thickness of base is deficient by more than 1 in. (25 mm) and the judgment of the Engineer is that the area of such deficiency should not be removed and replaced, there will be no payment for the area retained.

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**SECTION 307-BITUMINOUS PLANT MIX BASE
(HOT MIX)**

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**SECTION 307-BITUMINOUS PLANT MIX BASE
(HOT MIX)**

307.01-Description. This work shall consist of a foundation composed of a hot mixture of aggregate and asphalt prepared in a hot bituminous mixing plant. It shall be constructed in one or more layers, on a prepared subgrade, granular sub-base, or base, in accordance with these Specifications and in reasonably close conformity with the lines, grades, thicknesses and typical cross sections shown on the Plans or as directed by the Engineer.

MATERIALS

307.02-Materials. The materials used in this construction shall conform to the requirements of the following Subsection of **Part 9-Materials**.

<u>Materials</u>	<u>Subsection</u>
Asphalt Cement, Grade PG 64-22, 70-22, 76-22, 82-22	904.01
Aggregate for Mixture, Grading A, ACRL, AS, B, BM, BM2, C, CS, or CW	903.06
Chemical Additive	918.09(B)

The specific grading of aggregate to be used will be specified in the Contract or shown on the Plans. Mineral aggregate, bituminous material and the plant mix will be accepted as provided for in **Subsection 407.02**.

307.03-Composition of Mixtures.

(a) General

The bituminous base and/or leveling course shall be composed of aggregate and bituminous materials. The hot plant mixes shall comply with the applicable requirements of **Subsection 407.03**.

The specified mineral aggregate and asphalt cement shall be combined in such proportions as to produce mixtures within the following design composition limits.

Proportions of Total Mixture, Per Cent by Weight		
Mixtures	Combined Mineral Aggregate %	Asphalt Cement%
Grading AS and ACRL	96.3-97.7	2.3-3.7*
Grading A	95.8-96.7	3.3-4.2*
Grading B, BM and BM2	93.8-95.8	4.2-6.2*
Grading C and CW	93.8-95.8	4.2-6.2*
Grading CS	92.3-94.7	5.3-7.7*

* If the effective combined specific gravity of the aggregate exceeds 2.80, the above proportions may be adjusted as directed by the Engineer.

In addition, the combination of materials shall be such that when combined with the required amount of bitumen, the resultant mixture shall have:

Mix***	Stability Min. lbf* (kN)	Design void% content *	Production void %* content	Min. % VMA *	Dust-asphalt ratio**
307-B	2,000(9.0)	4.0±0.2	3-5.5	11.5	0.6-1.5
307- BM	2,000(9.0)	4.0±0.2	3-5.5	13.5	0.6-1.5
307-BM-2	2,000(9.0)	4.0±0.2	3-5.5	13.5	0.6-1.5
307-C	2,000(9.0)	4.0±0.2	3-5.5	13.0	0.6-1.5
307-CS	2,000(9.0)	3.0±0.5	1-5	---	---
307-CW	1,500(6.75)	4.0±0.2	3-5	13.0	0.6-1.5

*Tested in accordance with AASHTO T 245 with 75 blows with the hammer on each end of the test specimen, using a Marshall Mechanical Compactor.

**The dust to asphalt ratio is the percent of the total aggregate sample that passes the 200 mesh(75 µm) sieve as determined by AASHTO T 11 divided by the percent asphalt in the total mix.

***In order to identify critical mixes and make appropriate adjustments, the mix design shall have these required design properties for the bitumen content range of Optimum Asphalt Cement ±0.25%.

Except that on low volume roads(ADT 1,000 or below) the minimum stability shall be 1,500 lb-ft (6.75 kN) and the VMA and Dust-Asphalt Ratio shall be waived for 307-B, 307-BM, 307-BM2 and 307-C mixes.

If the above design criteria cannot be achieved with the materials proposed for use, other sources of materials shall be required. If the material at the asphalt plant will not combine within the tolerances of the Job Mix Formula, a new design will be required.

(b) Recycled Asphalt Pavement.

The Contractor may utilize asphaltic concrete removed from a Department project or other State Highway Agency project by cold planing or other approved means in combination with appropriate aggregate, asphalt cement and antistripping additive if required, to produce a mixture which will otherwise meet all the requirements of **Subsection 903.06** and (a) above. Or the Contractor shall furnish a

mixture composed of all new materials that will comply with the requirements of **Subsection 903.06** and (a) above. The Contractor shall document, to the satisfaction of the Department, the sources of all stockpiled recyclable material proposed for use in the construction.

The stockpile of processed recycled material must be of uniform quality as documented by asphalt content and gradation tests. In any event, at least 65% of the asphalt cement in the final mix shall be new material. Stockpiled material that becomes contaminated will be subject to rejection by the Engineer.

** Mix Type	%RAP* (Non-processed)	%RAP* (Processed)	Maximum Particle size
307ACRL	0	00	-
307AS	0	00	-
307A	15	20	1 ½ in. (38 mm)
307B	15	30	1 ½ in. (38 mm)
307BM	15	30	¾ in. (19 mm)
307BM2	15	30	¾ in. (19 mm)
307C	15	30	3/8 in. (9.5 mm)
307CW	15	30	½ in. (13 mm)
307CS	0	15	5/16 in. (8 mm)

***RAP** that has been crushed and screened or otherwise sized such that the maximum recycled material particle size is less than that listed in the table above prior to entering the dryer drum, shall qualify as "Processed". "Non processed" **RAP** shall be similar material that has not been crushed and screened or otherwise sized previous to its use.

**All mixes shall contain at least 65% virgin asphalt.

The Contractor shall obtain a representative sample from the recycled material stockpile and establish a gradation and asphalt cement content as required. The Contractor shall determine the gradation and asphalt content of the recycled material at the beginning of a project and every 2,000 tons(2,000 metric tons) thereafter. The stockpile asphalt cement content for all recycled material shall not vary by more than 0.8%. The stockpile gradation tolerance for all recycled material on each sieve is listed below.

3/8 in. (9.50 mm) sieve and larger ± 10%
 No. 4(4.75 mm) sieve ± 8%
 No. 8(2.36 mm) sieve ± 6%
 No. 30(600 µm) sieve ± 5%
 No. 200(75 µm) sieve ± 4%

The mixture will be accepted for aggregate gradation and asphalt content based on extractions.

A special design with asphalt content in the range of 5 to 7% shall be required where 307 C Mix is used as a surface on the shoulder.

The Contractor shall be responsible for his own sampling and testing of the planings as well as new materials for bid purposes, and for the submission of the job mix formula in accordance with **Subsection 407.03**. All additives shall be submitted to the Engineer for approval at the same time other materials are submitted for design verification.

If the Department has performed tests on the pavement to be cold planed, the results of all tests will be available at the Materials and Tests Division in Nashville, Tennessee during normal working hours. This information is advisory only and shall not be construed as necessarily complete nor accurate.

Where it is necessary to obtain a sample of the existing pavement for mix design, the Contractor shall mill the existing pavement to the full depth shown on the plans for pavement removal for a length of approximately 300 ft. (100 m) in an area approved by the Engineer. The removed pavement shall be replaced as specified on the plans or directed by the Engineer.

After mixing, the moisture content of the total mix shall be no more than 0.1% as determined by oven drying, and the provisions for lowering the temperature because of boiling or foaming shall not apply.

(c) Anti-Strip Additive - Asphaltic concrete mixtures (Grading A, AS, ACRL, B, BM, BM2, C, CS and CW) shall be checked for stripping by the following methods:

1. The Ten Minute Boil test for dosage rate and the Root-Tunnecliff procedure (ASTM D 4867) for moisture susceptibility.
2. For mixtures not requiring design - the Ten Minute Boil test for dosage rate and moisture susceptibility.

* Root-Tunnecliff procedure (ASTM D 4867) shall not be used with the following mixtures: Grading A, AS, ACRL and B

If moisture susceptibility is indicated, then an approved anti-strip agent shall be mixed with the asphalt cement at the dosage recommended by the respective test and as specified in **Subsection 918.09(B)**.

EQUIPMENT

307.04-Equipment. All the equipment necessary for the satisfactory performance of this construction shall be on the project, and approved, before work will be permitted to begin. The equipment shall meet the requirements of **Subsection 407.04** through **407.08** of these Specifications.

If recycled mix is used, the asphalt plant shall be modified as approved by the Engineer to accommodate the asphalt planings which are to be added. If a batch plant is used to produce recycled mix, the aggregate shall

be heated to a temperature that will transfer sufficient heat to the cold planings to produce a mix of uniform temperature within the specified range.

CONSTRUCTION REQUIREMENTS

307.05-General. The construction requirements shall be as prescribed in **Subsection 407.09** and **Subsection 407.11** through **407.17** of these Specifications and the following Subsections.

307.06-Preparation of Subgrade, Sub-base, or Surface. The Plans will indicate whether the plant-mixed base is to be constructed on a treated or untreated subgrade or sub-base, on a granular base, or on an existing surface. The surface upon which the plant mix base is to be placed shall meet the requirements of **Section 205, 207, 302, 303, 304,** or **Section 309,** whichever is applicable. Conditioning of surface, when called for on the Plans, shall be in accordance with the provisions of **Subsection 407.10.** Conditioning existing mineral aggregate base shall be in accordance with the provisions of **Section 310.** Prime coat or tack coat, when specified on the Plans, shall be constructed in accordance with the provisions of **Section 402** or **403,** respectively.

Bituminous plant-mix base mixture shall be placed only upon a surface that is dry, and cleaned of loose particles and other undesirable materials.

307.07-Thickness and Surface Requirement. Thickness shall be controlled during the spreading operation by frequent measurements of the freshly spread mixture to establish relationship between the uncompacted mixture and the completed course. Thickness or spread rate in lbs/yd²(kgs/m²) shall be within reasonably close conformity with that specified on the Plans. Each course shall have a thickness after compaction of not more than 4 in. (100 mm), unless otherwise authorized by the Engineer.

The surface of the bases shall meet the requirements specified under **Subsection 407.18** and when tested in accordance with the provisions of that Subsection, the deviation of the surfaces from the testing edge of the straightedge shall not exceed the amounts shown below for the several types of mixtures:

Grading A, ACRL and AS Mixture	1/2 in. (13 mm)
Grading B, BM, BM2, C, CS and CW Mixture	3/8 in. (10 mm)

COMPENSATION

307.08-Method of Measurement. Aggregate and Asphalt Cement for Bituminous Plant Mix Base (Hot Mix) will be measured by the ton (metric ton) in accordance with the provisions of **Subsection 407.19.** Materials for

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prime or tack coat, if specified, will be measured as prescribed in **Section 402** or **403**, respectively.

If recycled mix is permitted, the completed mix, including new mineral aggregate, planings, asphalt cement and additive, shall be measured by the ton (metric ton) in accordance with **Section 109**. For bidding purposes, the asphalt cement content of the specified mixes shall used in the chart below:

In the event that the Engineer sets an asphalt content other than that stated above, a price adjustment will be made based on the asphalt content set by the Engineer and the invoice price of the asphalt cement F.O.B. the asphalt plant. The price adjustment will be calculated according to the following formula:

$$PA = [IP \times (DA - BA) \times T] / 100$$

Where:

PA = Price Adjustment
 IP = Invoice price of asphalt cement
 DA = Percent asphalt set on the mix design
 BA = Percent asphalt specified above to be used for bidding
 T = Total tons(metric tons) asphalt mix for price adjustment

The liquid anti-strip additive will be measured by the gallon(liter) and paid as outlined in **Subsection 307.09**. Hydrated Lime will be measured by the ton (metric ton) and paid as outlined in **Subsection 307.09**.

No direct payment will be made for polymer or latex additives and cost thereof shall be included in the price bid for the modified asphalt cement or modified mixture.

307.09-Basis of Payment. The accepted quantities of Bituminous Plant Mix Base(Hot Mix) complete in place, will be paid for at the contract unit price per ton (metric ton) for the Aggregate and/or the Asphalt Cement. Accepted quantities of Prime Coat or Tack Coat will be paid for in accordance with the provisions of **Section 402** or **403**, respectively.

In cases where the effective combined specific gravity of the mineral aggregate exceeds 2.80, the tonnage(metric tonnage) of mineral aggregate, or plant produced mixture will be adjusted for payment by multiplying the tonnage(metric tonnage) of mineral aggregate, or plant produced mixture used by a specific gravity of 2.80 and dividing by the higher specific gravity.

The work required for preparation of subgrade, sub-base, base, or surface as provided for under **Subsection 307.06** will be measured and paid for in accordance with the provisions of the applicable Section or Subsection under which the work is performed.

If recycled mix is used, the accepted quantities of Bituminous Plant Mix Base(Hot Mix) complete in place, will be paid for at the contract unit price per ton (metric ton) of the total mix, which will include mineral aggregate, planings, asphalt cement and additive. Payment will be made to the Contractor for additional asphalt cement as provided for above at the purchase price F.O.B. the asphalt mixing plant, as verified by invoice, and no compensation will be allowed for further handling or processing. The Department will be reimbursed from monies due the Contractor for a

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decrease in asphalt cement content in the amount equal to the purchase price F.O.B. the asphalt plant.

The liquid anti-strip additive will be paid for based on certified invoices of material cost not to exceed \$15/gal. (\$4/liter). Hydrated Lime anti-strip additive will be paid for based on certified invoices of material cost not to exceed \$90/ton (\$100/metric ton). This payment shall be full compensation for all labor, materials, equipment and other incidentals incurred in utilizing the anti-strip additive.

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SECTION 309-AGGREGATE-CEMENT BASE COURSE

309.01-Description. This work shall consist of constructing a base composed of mineral aggregate and Portland cement in accordance with these Specifications and in reasonably close conformity with the lines, grades, thickness and typical cross section shown on the Plans or as directed by the Engineer.

MATERIALS

309.02-Materials. Materials used in this construction shall meet the requirements of the following subsections of **Part 9-Materials**:

<u>Material</u>	<u>Subsection</u>
Portland Cement, Type I	901.01
Portland-Pozzolan Cement, Type IP	901.01
Aggregate,	
Crushed or Uncrushed Gravel or Chert	903.15
Crushed Stone or Slag--Grading D	903.05
Bituminous Material for Curing,	
Emulsified Asphalt, Type SS-1, RS-2	904.03
Water shall meet the requirements of	302.03(b)

A sample of the cement and aggregate to be used shall be submitted by the Contractor for approval to the Materials and Test Laboratory at least 15 days prior to use.

EQUIPMENT

309.03-Equipment. All equipment necessary for the satisfactory performance of this construction shall be on the project and approved before work will be permitted to begin. Such equipment shall include a stationary mixing plant or mechanical road mixer(s).

Stationary Mixing Plant

The mixing unit shall be an approved twin-shaft pugmill capable of producing a constant, uniform mixture. The mixer shall be equipped with a suitable truck loading hopper with gate which will prevent segregation of the material being dumped into the truck. A spray bar capable of assuring an even wetting of the material shall be mounted at the entrance or above the pugmill. The flow of the water through the spray bar shall be controlled by a meter, valve, or other approved regulating device to maintain uniform moisture content in the mixture. A separate quick operating on-and-off device shall be required to shut the water off instantly when the pugmill stops. The mixing plant shall be equipped with adjustable mechanical feeders for each size and type material capable of regulating a constant,

uniform flow and designed to facilitate calibration. The cement feeder shall include a surge tank between the cement supply and the pugmill. The feeder system shall be so designed that the aggregate feeder will not operate unless the cement feeder operates. The plant shall not be used for other operations during production of aggregate cement base.

Mechanical Mixer (for Road Mixing)

Mechanical mixers shall be of the pugmill or rotary type capable of producing a uniform blend of all materials to the full depth of the course being placed. At least 1 mixer shall be capable of adding a regulated amount of water under pressure and uniformly mixing it with the aggregate and cement. The mixers may be either a self-propelled or trailer type.

CONSTRUCTION REQUIREMENTS

309.04-Limitations. No aggregate-cement base shall be processed which will not be covered with the succeeding stage of base or pavement construction during the same construction season. No aggregate-cement base processing shall proceed unless the ambient air temperature is at least 40° F(4° C) in the shade and rising. No cement shall be added to aggregate that is not free of frost, whether the aggregate is stockpiled for plant mixing or spread for roadway mixing.

When roadway mixing is employed, application of cement shall be limited to an area of such size that all operations can be continuous and all but final surface finish completed within 3 hours from the time cement is applied.

When a stationary mixing plant is used, approved mechanical spreaders shall spread the material within 1 hour after being discharged from the mixer and all operations completed except final surface finishing within 3 hours after being discharged from the mixer.

Processing of the uncompacted aggregate-cement mixture shall continue with no delay of more than 30 minutes. When the uncompacted aggregate-cement mixture is wetted by rain so that the average moisture content exceeds the specified tolerance, it shall be reconstructed in accordance with the provision of **Subsection 304.13**.

309.05-Preparation of Existing Subgrade. Before other construction operations are begun, the subgrade upon which the base is to be placed shall be prepared in accordance with the provisions of **Section 205, 207, or 302**, whichever is applicable.

309.06-Cement Application, Mixing and Spreading. The quantity of cement to be added to the aggregate shall be between 3 and 5%, by weight, of the dry material. The exact percentage of cement within the above range will be established by the Engineer based on tests of the aggregate selected for use on the project.

When roadway mixing is employed, the aggregate shall be spread on the subgrade to the required thickness, width, and cross section by means of an approved mechanical spreader. The specified quantity of Portland cement shall be applied uniformly over the spread aggregate by means of an

approved mechanical cement spreader. No cement shall be applied if the moisture content of the aggregate exceeds by more than 4 percentage points, the optimum moisture content specified by the Engineer for the aggregate-cement mixture. Spread cement that has been lost due to negligence of the Contractor shall be replaced without additional compensation before mixing is started. Road mixing shall be accomplished by means of the mechanical mixer(s) and at least one mixer pass may be required before water is added. When required, water shall be added through the mixer or by other approved methods to bring the mixture to the required moisture content. Mixing shall continue until a uniform mixture is obtained.

When a stationary plant is used, mixing shall continue until a uniform and intimate mixture of cement, aggregate, and water has been obtained. All material fed into the plant shall travel the full length of the pugmill. The quantity of cement expended shall be checked periodically by emptying the cement storage bin. The mixture shall be transported from the plant to the road in numbered trucks equipped with tight, metal, rear-end dump beds. Trucks shall be sufficient in number to insure satisfactory progress of the construction operations. An approved mechanical spreader shall spread the material. In mixing, handling, and placing the base material, care shall be taken to prevent segregation.

Shoulder material shall be placed for a width of at least 3 ft. (1 m) prior to the spreading of the base material in order to confine the base material and permit satisfactory compaction along the edges of the base.

309.07-Compaction. Compaction shall be accomplished by the use of any type of compacting equipment that will produce the required result. At the start of compaction, the percentage of moisture in the mixture based on oven dry weight shall not vary more than 3 percentage points above or 1 percentage point below the specified optimum moisture. Rolling shall extend over the edges of the base material onto the shoulders.

The completed base shall be divided into lots of approximately 10,000 yd² (9,000 m²) for density testing purposes. Five density tests shall be performed on each lot. The average dry density of each lot shall be not less than 95% of maximum density as determined by AASHTO Designation T 134. Further, no individual test shall be less than 92% of maximum density. If the specified density is not obtained, the material shall be reworked or replaced in order to comply with the density requirement. At the beginning of a project or at any time it is deemed advisable, smaller lots may be considered in order to evaluate rolling procedure or for other reasons which are approved and/or directed by the Engineer.

309.08-Finishing. Finishing operations shall be performed in the same manner as prescribed for soil-cement base construction in **Subsection 304.09.**

309.09-Construction Joints. At the beginning of each day's construction, a straight transverse construction joint shall be formed by cutting back into the completed work to form a true vertical face.

Aggregate-cement base for large, wide areas shall be built in a series of parallel lanes of convenient length and width meeting the approval of the Engineer. Straight longitudinal joints shall be formed at the edge of each day's construction by cutting back into the completed work to form a true vertical face free of loose or shattered material.

309.10-Thickness and Surface Tolerances. The thickness of the base will be determined from the measurement of test holes dug at random locations or other approved methods. The measured thickness shall not deviate from that shown on the Plans or directed by the Engineer by more than plus 1 1/2 in. (38 mm) or minus 1 in. (25 mm). Work found not to be within the above tolerance shall be reconstructed or replaced in accordance with the provisions of **Subsection 304.13**.

The surface of the completed base shall be in reasonably close conformity to the lines, grades, and cross section shown on the plans or established by the Engineer and shall have a satisfactorily smooth riding quality.

309.11-Curing. Curing of the finished base shall be performed as prescribed for soil-cement base construction in **Subsection 304.12**.

309.12-Traffic and Maintenance. Requirements pertaining to opening portions of completed base to traffic, and requirements regarding maintenance of completed base shall be as prescribed for soil-cement construction in **Subsection 304.14** and **304.15**, respectively.

COMPENSATION

309.13-Method of Measurement. Mineral Aggregate for Aggregate-Cement Base Course will be measured by the ton (metric ton) in accordance with the provisions of **Section 109**, Measurement and Payment.

When mixing is performed in a stationary plant, the weight of all moisture on the aggregate at the time of weighing, in excess of 8% will be deducted. No direct payment for water will be made.

When mixing is performed on the road, the weight of all surface moisture on the aggregate at the time of weighing in excess of 8% will be deducted. Water added to the materials on the road at the direction of the Engineer will be measured for payment.

Any earth moved in accordance with the provisions of **Subsection 309.05** will be measured and paid for in accordance with appropriate provisions of **Section 203** and **207**.

Portland Cement incorporated in the work will be measured by the ton (metric ton) in accordance with the provisions of **Section 109**, Measurement and Payment.

Bituminous Material used for curing seal will be measured by the ton (metric ton) in accordance with the provisions of **Section 109**, Measurement and Payment.

Water will be measured by M.G. (1,000 gal.) (m³) means of calibrated tanks or distributors, or by means of accurate meters. Only that water used in mixing and finishing operations as specified above will be measured for

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payment. Water added to emulsified asphalt used for curing will not be measured for payment.

309.14-Basis of Payment. The accepted quantities of Aggregate-Cement Base, complete in place, will be paid for at the contract unit price bid per ton (metric ton) of Mineral Aggregate and Portland Cement, respectively. Bituminous Material will be paid for at the contract unit price bid per ton (metric ton), complete in place. Water will be paid for at the contract unit price bid per M. G. (1,000 gal.) (m³), of Water, complete in place.

**SECTION 310-CONDITIONING MINERAL
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SECTION 310-CONDITIONING MINERAL AGGREGATE BASE

310.01-Description. Conditioning Mineral Aggregate Base shall consist of reshaping and compacting an existing mineral aggregate base or surface in accordance with these Specifications and in reasonably close conformity with the lines and grades, and cross sections indicated on the Plans or as directed by the Engineer.

MATERIALS

310.02-Materials. Materials used in this construction shall meet the requirements of the following subsections of these Specifications.

<u>Material</u>	<u>Subsection</u>
Aggregate for conditioning base	903.05
Calcium Chloride, Type 1, Type 2 or	
Calcium Chloride Liquor	918.02
Sodium Chloride	918.03

EQUIPMENT

310.03-Equipment. All equipment necessary for the satisfactory performance of this work shall be on the project and approved by the Engineer before this construction will be permitted to begin. The required equipment shall include motor graders and water distributors in the number necessary for satisfactory prosecution and completion of the work.

Equipment shall include one or more rollers of a type and sufficient weight to obtain the required density and seal the surface of the base course.

CONSTRUCTION REQUIREMENTS

310.04-Construction Requirements. The existing base shall be conditioned by the application of water, blading and compacting as directed. Sections of existing base that are pot-holed shall be scarified to the full depth of the pot holes. Warped and distorted sections shall be scarified and shaped as directed by the Engineer. The material shall then be moistened as necessary, mixed, shaped and rolled until the base is uniformly and thoroughly compacted. Application of water, blading and rolling shall continue until a smooth, dense, well-bonded surface is obtained meeting the approval of the Engineer.

The completed base shall be divided into lots of approximately 10,000 yd² (9,000 m²) for density testing purposes. Five density tests shall be performed in each lot. The average dry density shall be not less than 100% of maximum density as determined by AASHTO T 99 Method D. Further, no individual test shall be less than 97% of maximum density. Smaller lots may be considered when approved or directed by the Engineer.

Calcium Chloride or Sodium Chloride, when specified, shall be distributed at the approximate rate of 1 lbs./yd² (0.5 kg/m²) and incorporated in the base material during blading and rolling operations as directed by the Engineer.

When additional material is to be added to the existing base, the existing base shall be lightly scarified, the material added and construction procedures for conditioning the base as set out above shall then be performed.

310.05-Surface Requirements. The surface of the conditioned base shall be in reasonably close conformity with the lines, grades and cross sections indicated on the Plans or as directed by the Engineer and shall provide a satisfactory riding surface.

COMPENSATION

310.06-Method of Measurement. Conditioning Mineral Aggregate Base will be measured by the linear mile (km). Such measurement will be a horizontal measurement made along the median centerline of the project for divided sections and along the centerline of the pavement for 2 lane sections, excluding bridges.

When the Contract requires the construction of a mineral aggregate base and a surface course, conditioning the base will not be paid for directly but shall be considered a necessary part of the construction, and the cost shall be included in the unit price bid for the base material.

When the Contract requires the addition of base material to sections or the entire length of a previously constructed base, on the sections where base material is added, conditioning base will not be paid for directly but shall be considered a necessary part of the construction, and the cost will be included in the unit price bid for the base material. Sections where base material is not added will be measured for payment by the linear mile (km).

When the Contract requires a surface to be constructed on a previously constructed base and no additional material is added to the base, conditioning base will be measured for payment by the linear mile (km). Calcium Chloride will be measured by the ton (metric ton) in accordance with the provisions of **Subsection 303.13**.

Sodium Chloride will be measured by the ton (metric ton) in accordance with the provisions of **Section 109**, Measurement and Payment.

Water will be measured by M.G. (1,000 gal.) (m³) means of calibrated tanks or distributors, or by means of accurate water meters.

310.07-Basis of Payment. The accepted quantity of conditioned base will be paid for at the contract unit price bid per linear mile (km), measured as prescribed above, and such payment shall be full compensation for conditioning all base on interchanges, approaches, service roads, ramps, frontage roads, roadside rest areas, and all other base within the limits of the project that requires conditioning to receive a succeeding stage of construction under the Contract.

The accepted quantity of Calcium Chloride or Sodium Chloride will be paid for at the contract unit price per ton (metric ton).

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Water will be paid for at the contract unit price per M. G. (1,000 gal.)
(m³).

**SECTION 312-AGGREGATE-LIME-FLY ASH
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SECTION 312-AGGREGATE-LIME-FLY ASH STABILIZED BASE COURSE

312.01-Description. This work shall consist of constructing a base composed of mineral aggregate, hydrated lime and fly ash in accordance with these specifications and in reasonably close conformity with the lines, grades, thickness and typical cross section shown on the plans or as directed by the Engineer.

MATERIALS

312.02-Materials. Materials used in this construction shall meet the following requirements:

<u>Materials</u>	<u>Subsection</u>
Crushed Limestone Aggregate Class A, Grading C	903.05
Lime	918.04
Bituminous Material for Curing Emulsified Asphalt, Type SS-1, RS-2	904.03
Water	918.01

Fly Ash shall meet the requirements of ASTM C 593 except that loss on ignition shall not exceed 10% when tested according to ASTM C 311, Section 11 and 12, and the combined silicon dioxide (SiO₂), aluminum oxide (Al₂O₃) and iron oxide (Fe₂O₃) shall be more than 60% when tested according to ASTM C 311, Section 13 and 14.

312.03-Proportioning. The lime, fly ash and aggregate design shall be proportioned within the following limits based on dry weight:

<u>Material</u>	<u>Range of percent by weight of total dry mix</u>
Lime	3.5
Fly Ash	11
Aggregate	85.5

The mixture will be within $\pm 2\%$ of the optimum moisture of the mixture, as determined from the AASHTO T 99, Method C (with replacement) procedure.

The design of the mixture shall be such that when compacted into cylinders, cured for 28 days at 100° F(37.8° C), and tested in accordance with ASTM C 593, the cylinders will have minimum average compressive strength of 950 psi(6.5 MPa) and no individual test lower than 800 psi(5.5 MPa).

At least 45 days prior to the production of the stabilized mixture, the Contractor shall submit for the Engineer's approval, a mix design, a

statement naming the source and percentage of each component, and a report showing the results of the applicable tests meeting the above requirements of the Specifications. The Contractor shall submit the following quantities of components for material testing and verification of the mix design:

Hydrated Lime	25 lbs. (12 kgs.)
Fly Ash	50 lbs. (25 kgs.)
Aggregate	200 lbs. (100 kgs.)

At the Engineer's option, verification of the mix design may be done on an annual basis provided the properties and proportions of the material do not change appreciably. Mix designs complying with the above requirements will be approved. The approved proportions of material will govern during the progress of the work and no change in source or character of any material shall be made without approval. Approval will be based on verification of the new mix design.

EQUIPMENT

312.04-Equipment. All equipment necessary for the satisfactory performance of this construction shall be on the project or at the mixing site, and approved by the Engineer before work will be permitted to begin. Such equipment shall include an approved mixing plant. The mixing plant shall be a stationary or portable batch or continuous mix type. The mixing plant shall be equipped so as to permit the Engineer to verify the component percentages at any time. Stationary or portable batch type plants shall be equipped with batching devices and scales for proportioning the individual components by weight and shall be of such accuracy that the material percentages based on the total dry weight will be maintained within the following tolerances:

Hydrated Lime	$\pm 0.25\%$
Fly Ash	$\pm 0.75\%$
Water	$\pm 2.0\%$

Stationary or portable batch type plants shall have scales meeting the requirements of **Subsection 501.04(a)3**. Separate scales and hoppers shall be used for weighing the aggregate and the lime and the fly ash. The fly ash, however, may be weighed cumulatively in the weigh hopper with the lime, provided the lime is added first.

Continuous type mixing plants shall be equipped with metering devices and scales for proportioning the lime and fly ash by weight so as to maintain the above stated tolerances. The scales and/or metering devices shall be equipped with out-of-range alarm systems which will sound an audible alarm when the lime or fly ash is not within the established tolerances. An approved method of checking and calibrating the weighing system shall be located within easy access on the plant. The flow of water into the continuous type plant shall be controlled by a meter or other approved regulating device to positively maintain a uniform moisture

content in the mixture. A separate, quick, and automatically operating on-off device shall be required to shut the water off instantly when the mixer stops.

Rollers shall be either pneumatic tire or vibratory type and meet the requirements of **Subsection 407.07**.

The spreader shall be self-propelled or tractor drawn and be capable of maintaining a uniform rate of travel while spreading. The spreader shall be capable of laying a lift of uniform consistency and thickness with proper grade control. The mixture shall be transported from the central plant in clean, tight trucks having a cover of canvas, securely fastened on all sides of the truck bed, or other suitable material of such size as to maintain the moisture content and prevent the loss of fines.

CONSTRUCTION REQUIREMENTS

312.05-Construction Requirements. Stabilization will be permitted from March 1st through September 30 except that from October 1 through November 30 stabilization may be continued provided that Type I Portland cement is substituted for the lime on a pound by pound basis. Stabilization shall not be permitted when the aggregate or the surface on which the base course is to be placed is wet or frozen or when it is raining, sleeting or snowing or when the temperature is 40°F(4° C) or less. Processing operations for this material shall not be started unless the air temperature in the shade is at least 40° F(4° C) and rising. The construction of the aggregate-lime-fly ash stabilized base course shall be covered with the succeeding stage of base or pavement construction prior to December 15.

312.06-Subgrade Preparation. The subgrade shall be prepared in accordance with **Section 205, 207, or 302** whichever is applicable.

312.07-Mixing. The aggregate shall be mixed with the proper amount of lime, fly ash and water in an approved mixer and mixing shall continue until a thorough and uniform mixture is obtained. The aggregate shall be handled in a manner, which will prevent contamination and segregation. The plant will be capable of discharging the mixture without undue segregation.

312.08-Spreading. After mixing, the material shall be transported to the job site while it contains the proper moisture content, and shall be spread to the required thickness and cross section by an approved spreader. If the required compacted depth of the base exceeds 8 in. (200 mm), the base shall be constructed in 2 or more approximately equal layers. The maximum compacted thickness of any 1 layer shall not 8 in. (200 mm).

312.09-Compacting. Compaction shall be accomplished by the use of any type of compacting equipment that will produce the required result. At the start of compaction, the percentage of moisture in the mixture based on oven dry weight shall not vary more than 3 percentage points above or one percentage point below the specified optimum moisture. Rolling shall extend over the edges of the base material onto the shoulders.

The completed base shall be divided into lots of approximately 10,000 yd² (9,000 m²) for density testing purposes. Five density tests shall be performed on each lot. The average dry density of each lot shall be not less than 100% of the maximum density as determined by AASHTO T 99, Method C (with replacement) procedure. Further, no individual test shall be less than 97% of the maximum density. If the specified density is not obtained, the material shall be reworked or replaced in order to comply with the density requirement.

The Engineer may employ a control strip and random sampling to evaluate and adjust the Contractor's rolling procedure.

The number of compaction and finishing units shall be sufficient to insure the initial compaction of the processed section of the stabilized base course within 4 hours from the time the water is added at the mixer. The final finishing and compaction shall be within 8 hours from the time of mixing. The Engineer may extend this time if the material has not reached an initial set. If for any reason construction operations are delayed or suspended and the Engineer orders any loose or uncompacted material removed and disposed of, the Contractor shall perform this work at his own expense. No aggregate-lime-fly ash base course may be salvaged.

312.10-Finishing. As per **Subsection 304.09.**

312.11-Construction Joints. As per **Subsection 309.**

312.12-Thickness and Surface Requirements. As per **Subsection 309.10.**

312.13-Curing. After the aggregate-lime-fly ash base has been finished, the surface shall be sealed with 1 of the bituminous materials specified above, applied by a pressure distributor at the rate of 0.10 to 0.25 gal./yd² (0.5 to 1.1 liters/m²) or as directed by the Engineer. The bituminous material shall be heated or otherwise prepared to insure uniform distribution and shall be applied no later than 24 hours after completion of finishing operations unless in the judgment of the Engineer it should be delayed. The finished base shall be kept continuously moist until the bituminous curing seal has been applied. The Contractor shall maintain the curing material during a 7-day protection period so that all of the aggregate-lime-fly ash base course will be covered effectively during this period. Only pneumatic tired equipment required for applying the curing seal will be permitted on the base until the mixture has cured for 7 days. However, ingress and egress shall be provided for property owners prior to the 7-day curing period.

312.14-Traffic and Maintenance. As per **Subsection 309.12.**

COMPENSATION

312.15-Method of Measurement. Bituminous material for curing seal and the mineral aggregate, lime, and fly ash mixture shall be measured by the ton (metric ton) in accordance with **Section 109.**

The weight of moisture in the aggregate at the time of weighing in excess of 8% will be deducted. No direct payment for mixing water will be

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made; however, water added on the road at the direction of the Engineer will be measured by the M.G. (1,000 gal.) (m³) in accordance with **Section 109**.

312.16-Basis of Payment. The accepted quantities of mineral aggregate, lime, and fly ash mixture and bituminous material will be paid for by the ton (metric ton) and the water will be paid for by the M.G. (1,000 gal.) (m³) complete in place.

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SECTION 313-TREATED PERMEABLE BASE

313.01-Description. This work shall consist of the construction of treated permeable base composed of either a mixture of aggregate, Portland cement and water or a mixture of aggregate with asphalt binder. The Contractor may use either cement treated or asphalt treated permeable base as described in these specifications. It shall be constructed on a prepared sub-base in accordance with these Specifications and in reasonably close conformity with the lines, grades, thickness, and typical sections as shown on the Plans or as directed by the Engineer.

MATERIALS

313.02-Materials.

<u>Materials</u>	<u>Subsection</u>
Portland Cement, (Type I)	901.01
Aggregate for Portland cement	
Treated Mixture	903.03
Water	918.01
Asphalt Cement, Grade PG 64-22, 70-22,	
76-22, 82-22	904.01
Aggregate for Bituminous Treated Mixture	903.06

313.03-Composition of Mixtures.

- (a) Portland Cement Treated Permeable Base.

The water-cement ratio of the mixture shall be approximately 0.43 and shall contain no less than 282 lbs of Portland cement per yd³ (168 kgs/m³). The design shall produce a workable mixture having a compressive strength at 7 days of not less than 500 psi. (3.5 MPa) when tested in accordance with AASHTO T 22. The Contractor shall submit the proposed concrete mix design to the Engineer for approval in accordance with **Section 604**.

- (b) Bituminous Treated Permeable Base.

Asphalt treated permeable base shall be Bituminous Plant Mix Base (Hot Mix) in accordance with **Section 307** and **407**. Liquid asphalt shall be PG64-22 and shall be used at the rate of 3% by weight of the total mixture. Asphalt content shall be such that all aggregate is visibly coated. The Contractor shall submit a mix design to the Engineer for approval in accordance with **Subsection 407.03** of these specifications.

EQUIPMENT

313.04-Equipment. All the equipment necessary for the satisfactory performance of this construction shall be on the project, and approved, before work will be permitted to begin. The equipment needed to construct the Portland cement treated base shall meet the requirements of **Subsection 501.04 (a) and (b)**. The spreading equipment shall meet either **Subsection 501.04 (d) 11 or 407.06**.

The equipment needed to construct the bituminous treated base shall meet the requirements of **Subsection 407.04 through 407.08**.

CONSTRUCTION REQUIREMENTS

313.05-Construction Requirements. Cement treated permeable base and asphalt treated permeable base shall conform to the requirements of **Section 309** and **Section 307** respectively unless otherwise stipulated below.

(a) Cement Treated Permeable Base.

1. **Consolidation and Finishing.** Immediately after placement of the cement treated permeable base, the mixture shall be consolidated using a steel-wheel roller weighing not less than 6 tons(5.5 metric tons). Rolling shall continue until maximum densification is achieved but shall cease immediately if aggregate breakage occurs. Vibratory rollers will not be allowed.
2. **Curing.** Immediately after spreading and compacting, the cement treated permeable base shall be cured by covering the entire surface and exposed edges with transparent or white polyethylene sheeting in accordance with **Subsection 501.18**. The polyethylene sheeting shall have a thickness of at least 4 mils(100 μ m) and shall be held in place for a minimum of 7 days by a method approved by the Engineer. The surface of the cement treated permeable base shall be thoroughly wetted prior to placing the sheeting.

Curing by the use of curing compounds is not allowed.

(b) Asphalt or Cement Treated Permeable Base.

The Contractor shall protect the treated permeable base from severe weather conditions particularly freezing rain, snow or icing and from contamination by dust, dirt, mud or other fine grained material. The base shall be protected from the time of placement until placement of the following pavement layer. Any portion(s) of the treated permeable base that becomes contaminated to the extent that drainage is reduced or inhibited, shall be removed and replaced at the Contractor's expense.

No traffic will be permitted on the treated permeable base. Equipment required to place the following layer of pavement will be allowed provided that it enters and exits as near as possible to

the paving operation. The Contractor at his expense shall repair any damage to the treated permeable base caused by the Contractor's equipment.

313.06-Limitations. If asphalt treated permeable base is used, the limitations prescribed in **Subsection 407.09** shall apply to this construction. No treated permeable base is to be placed that cannot be covered by the next course of pavement within the same construction season.

313.07-Surface Requirements. The finished surface of treated permeable base shall be uniform and shall not vary by more than ½ in. (13 mm) from the lower edge of a 12 ft. (3.6 m) straightedge. Surface testing with the 12 ft. (3.6 m) straightedge shall be performed in both transverse and longitudinal directions.

If the surface of the treated permeable base varies, more than ½ in. (13 mm) when tested as described above, the Contractor shall adjust the surface to a new grade established by the Engineer as follows:

- (a) fill the low areas with Portland cement concrete during the concrete paving operation or
- (b) apply emulsified asphalt, RS-2, at a rate not to exceed 0.2 gal./yd² (1 liter/m²) as determined by the Engineer over the specified low areas, and fill the low areas with size No. 8 mineral aggregate. The size No. 8 mineral aggregate shall be seated with a pneumatic tire roller.

No additional compensation will be allowed for leveling of the treated permeable base except on ramps that contain 4,500 yd² (4,000 m²) or less of Portland cement concrete pavement. Measurement and payment for additional concrete used on these ramps shall be as specified in **Subsection 501.25** and **501.26**.

313.08-Tolerance in Pavement Thickness. Treated permeable base shall be placed to the thickness designated on the Plans. Before any further work is begun, the Contractor shall take core samples from the treated permeable base at locations established by the Engineer. Locations for coring will be determined in accordance with the provisions of **Subsection 501.24**. All core samples taken by the Contractor will be given to the Engineer for verification of base thickness. Adjustment of the contract unit price will be made in accordance with **Subsection 501.26** if the base thickness is determined by the Engineer to be deficient.

COMPENSATION

313.09-Method of Measurement. Treated permeable base shall be measured by the yd²(m²) complete in place for the width and thickness specified.

313.10-Basis of Payment. The accepted quantities of treated permeable base shall be paid for at the contract unit price per $\text{yd}^2(\text{m}^2)$, complete in place. Such payment shall be full compensation for all materials, labor, equipment and incidentals required to complete the work. However, the provisions of **Subsection 501.26 (b)** shall apply for any base found deficient in thickness by more than $\frac{1}{4}$ in. (6 mm). No additional payment over the contract unit price will be made for base, which has an average thickness in excess of that shown on the Plans.

If the Department orders any increase or decrease in the cement content of the Cement Treated Base from the approved mix design, measurement and payment for this change shall be computed in accordance with **Subsection 501.25** and **501.26** of the Standard Specifications.

All cost of taking cores for verification of pavement thickness shall be included in the contract unit price of treated permeable base.