

## PART III—BASE COURSES

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## **Section 301**

### **Class I Base Course**

**301.01 DESCRIPTION.** Furnish and place class i roadway and shoulder base courses on a subgrade layer conforming to section 305 in accordance with these specifications and in conformance with the lines, grades, thicknesses, and typical cross sections shown on the plans or established. Control the selection, placement, mixing, and compaction of materials so that the completed base course is uniform and conforms to plan dimensions and other acceptance requirements.

Quality assurance requirements shall be as specified in the latest edition of the Department's publication titled *Application of Quality Assurance Specifications for Embankments and Base Course*.

When not specified, any of the following types may be used:

1. Soil Cement
2. Crushed Stone
3. Asphalt Concrete Base Course on Treated Layer
4. Recycled Portland Cement Concrete
5. Blended Calcium Sulfate

Select a base course type meeting the structural requirements for a specific pavement structure. Unless approved otherwise in writing, use the same type of Class I base course throughout the project in accordance with these specifications.

In areas inaccessible for mixing and compacting in turnouts, crossovers, or other isolated or irregular areas, portland cement concrete complying with Section 901, or asphalt concrete base course complying with Section 502, may be used in lieu of the specified base course material with approval. If using asphalt or portland cement concrete, the top half of the base thickness shall be asphalt or portland cement concrete. If used, portland cement concrete shall be a minimum thickness of 6 inches. The remaining thickness shall be the same type and construction as the top layer of embankment, treated layer, or subgrade. Do not place raw, untreated material between a treated embankment and the concrete. Place, consolidate, finish, and cure concrete as directed in accordance with Section 706.

Submit a dust control plan to address weather, sight clearance, operational procedures, traffic control, and any other project specific concerns. Failure to maintain sight clearance will result in the engineer stopping contractor operations.

The Department will identify dust-sensitive areas in the plans. In these specific areas, the dust control plan must also include environmental requirements.

**301.02 MATERIALS.** Materials shall comply with the following sections and subsections and requirements:

Asphalt Concrete	502
Portland Cement Concrete	901
Portland Cement	1001.01
Blended Hydraulic Cement	1001.02
Emulsified Asphalt	1002
Asphalt Materials	1002
Crushed Stone	1003.01 & 1003.03.1
Recycled Portland Cement Concrete	1003.01 & 1003.03.2
Water	1018.01
Blended Calcium Sulfate	1003.01 & 1003.03.3

**301.02.1 Soils for Soil Cement:** Soils for soil cement base course shall consist of materials that will stabilize with cement in accordance with DOTD TR 432. Such materials are those soils classified as A-1-a, A-1-b, A-2-4, A-2-6, A-4, and A-6 in accordance with DOTD TR 423. Do not use soil with a Liquid Limit greater than 35, a Plasticity Index greater than 12, or an organic content greater than 2 percent. Determine Liquid Limit and Plasticity Index in accordance with DOTD TR 428. Determine organic content in accordance with DOTD TR 413. Do not use soil with over 79 percent sand or 60 percent silt when tested in accordance with DOTD TR 407. Do not blend or treat soils which do not meet any of these requirements. Do not use topsoil. Obtain the material to be stabilized from outside right-of-way limits except as provided in 106.02.3. The engineer will take samples from the roadway or the stockpile in accordance with the Material Sampling Manual.

**301.02.2 Portland Cement:** Use Type I or II portland cement. The quantity of cement used shall be supported by proof of delivery.

**301.02.3 Blended Hydraulic Cement:** The cement shall be Type IP. The quantity of cement used shall be supported by proof of delivery.

**301.02.4 Asphalt Concrete Base Course:** The material requirements for asphalt concrete base course shall be as described in

Section 502. The top half of the base thickness shall be asphalt concrete and the remaining thickness shall be the same type and construction as the top layer of embankment, treated layer, or subgrade.

**301.02.5 Treated Layer Under Asphalt Concrete Base Course:**

The treated layer under asphalt concrete shall consist of the same material and treatment as the top layer of embankment, including the prime coat requirements. Do not place raw, untreated material between a treated embankment and the asphalt concrete.

**301.03 EQUIPMENT.** Obtain approval of equipment prior to use.

**301.03.1 Soil Cement:**

**301.03.1.1 General:** Obtain certification for central mix plants in accordance with current Department procedures. Central mix plants may be either batch or continuous mix process and shall proportion aggregates, soils, and additives in a manner that will meet specification requirements. Provide safe, convenient facilities for sampling mixture components prior to their introduction into the weigh hopper or pugmill. Mixing units shall have no dead areas which allow materials to remain unmixed or which permit improperly mixed materials to be discharged into hauling or storage units. The minimum capacity shall be 100 tons per hour.

Provide a control system that will automatically stop plant operations when the material in any storage facility or working bin becomes empty or interrupts the flow of material. Do not permit the plant to operate unless this automatic control system is in good working order. When this control system malfunctions during production, discontinue operations immediately. Interlock the soil or aggregate feeder system with the feeder system for cement, additives, and water such that the proportions of the components of the approved mix design maintain continuously.

The complete process, including the plant with necessary auxiliary equipment and controls, operating procedures, and sampling and testing methods, require approval by the Department prior to use. Any modifications to plant equipment or operations shall be approved prior to use.

Provide plant site and project site laboratories conforming to Section 722 at no direct pay.

Measuring devices shall be subject to approval and shall be tested, inspected and certified by an approved independent scale service or the Weights and Measures Division, Louisiana Department of Agriculture and

Forestry, at no direct pay, every 90 days or as often as deemed necessary to ensure their accuracy.

Scales shall be accurate to  $\pm 0.5$  percent throughout the range of use. Maximum graduation on scales shall be 0.1 percent of the rated scale capacity.

Equip the cement, soil and aggregate feeders, and water measuring devices with devices by which the rate of feed can be determined while the plant is in operation.

Water measuring devices shall be accurate to 1 percent of the metered quantity. Water meters shall have a maximum graduation of 1 gallon.

Methods and equipment for adding liquid additives shall be approved. Equipment for metering additives shall be capable of measuring the component to an accuracy of 3 percent of the required weight.

**301.03.1.2 Batch Process:** When using a batch mixing process, equip the mixer with a timing device, which will indicate by an obvious signal the completion of the mixing period. The time of mixing a batch shall begin after all components are in the mixer and shall continue until uniformly blended. The mixing time shall be approved. Weigh cement for each batch on scales separate from those weighing other components and meeting the requirements of this subsection.

**301.03.1.3 Continuous Mix Process:** When controlling a continuous mix operation by weight, provide belt scales for conveyor systems for all components except water.

**301.03.1.4 Hauling Equipment:** Haul the mixture from the plant in approved covered trucks that will maintain the moisture content and prevent segregation and the loss of fine material. The cover shall be waterproof, shall completely cover the bed of the truck, shall be equipped with tie downs, and shall not have any rips, tears, or holes.

**301.03.1.5 Compaction Equipment:** Compaction equipment shall be conventional sheepsfoot type roller or a self-propelled tamping foot compactor-type roller for initial compaction. The spikes shall be sufficient in size and number to provide uniform compaction for the full width and depth of the base course. Finish rolling shall be with a pneumatic tire roller.

**301.03.2 Asphalt Concrete:** Equipment for asphalt concrete shall conform to Section 503.

**301.03.3 Crushed Stone and Recycled Portland Cement Concrete.** Equipment used to mix crushed stone and recycled portland cement concrete shall produce a uniform blend conforming to the

requirements elsewhere herein. When using a central mix plant, it shall conform to 301.03.1.

**301.03.3.1 Hauling Equipment:** Haul crushed stone and recycled portland cement concrete in trucks with tight, smooth beds of sufficient size and condition to prevent segregation and the loss of material.

**301.03.3.2 Compaction Equipment:** Stone and recycled portland cement concrete compaction equipment shall be designed for the compaction of these materials and may be static or vibratory. Perform finish rolling with static, smooth steel wheel or pneumatic tire rollers. Pneumatic tires shall have smooth tread, shall be the same size and ply rating, and shall be inflated to a uniform pressure not varying more than  $\pm 5$  psi between tires. Wheels shall not wobble and shall be aligned such that gaps between tires on one axle are covered by tires of the other axle.

**301.03.4 Automatic Finishing Machine:** For all Class I base courses except asphalt concrete, use an approved automatic finishing machine. The approved automatic finishing machine shall be capable of operating from an erected stringline or Global Positioning System (GPS) and laser system, and be capable of automatically controlling grade and cross slope conforming to 502.08.2.2.

**301.04 STORAGE AND HANDLING OF MATERIALS PRIOR TO MIXING.** Stockpiles of materials shall be uniform; separation into material sizes may be required. Equipment and methods for stockpiling shall be such that no segregation will result. Do not allow foreign material to be incorporated into the stockpiled materials. Do not use contaminated materials. Stockpiles shall be of uniform moisture content and well drained.

Stockpile soils and aggregates in dedicated stockpiles. Obtain approval of the stockpiled material prior to mixing with cement. Control the moisture content of the stockpiles so that the blended mixture, when tested in accordance with DOTD TR 403, shall be within  $\pm 2.0$  percent of the optimum moisture content at the time of compaction. Equip storage facilities containing soil or fine aggregate with vibrators that will effectively vibrate the side walls of the feeder, prevent any accumulation of material, and ensure a constant, uniform supply of material to the mixing unit.

**301.04.1 Storage of Cement:** Transport cement in watertight conveyances and store in watertight buildings, silos, or other approved facilities to protect the cement from dampness or water intrusion. Cement that is contaminated, partially set, or contains lumps of caked cement will be rejected.

Cement shall be certified by the manufacturer in accordance with the Department's current procedure. Keep accurate records of cement deliveries and its use. Copies of these records shall be supplied to the engineer as required.

**301.04.2 Soils for Soil Cement:** Soils for soil cement shall be of one or more components, each meeting the requirements of 301.02.1.

**301.04.3 Asphalt Concrete:** Store and handle asphalt concrete in accordance with Section 502.

**301.04.4 Crushed Stone and Recycled Portland Cement Concrete:** Sample, test, and obtain approval of crushed stone and recycled portland cement concrete base courses from dedicated stockpiles prior to placement on the subgrade.

**301.05 GENERAL CONSTRUCTION REQUIREMENTS.** Place Class I base courses on a subgrade layer prepared in accordance with Section 305. Finished lift thickness shall be 9 inches maximum. The department may allow single lift construction for depths over 9 inches up to 12 inches based on a rolling pattern that obtains the required density.

**301.05.1 Cement Stabilized Base Course:** Mix all cement stabilized base courses in a central mix plant conforming to 301.03. Determine the percentage of cement for soil cement in accordance with DOTD TR 432 prior to mixing. Obtain samples for determination of the percent cement from material in stock piles. Depending on the type of cement and soil or soil-aggregate to be used, normal testing time to determine suitability of the soil and the required cement content may require up to 21 calendar days.

**301.05.2 Asphalt Concrete:** Construct asphalt concrete base course in accordance with Section 502. Construct the treated layer under asphalt concrete base course in accordance with Section 305.

**301.05.3 Crushed Stone, Recycled Portland Cement Concrete, and Blended Calcium Sulfate:** Do not permit crushed stone, recycled portland cement concrete, and blended calcium sulfate base courses to segregate during construction. Do not allow water added for facilitating compaction to cause moisture damage to the subgrade layer.

Do not use blended calcium sulfate in areas needed to facilitate traffic control. Do not place blended calcium sulfate within 10 feet of metal drainage structures. The contractor will be allowed to substitute any untreated Class I base course material listed in 301.01. Use flowable fill

under Section 710, or other approved backfill material in Section 701 to backfill the drainage structure.

**301.06 MIXING OF SOIL CEMENT.** Mix soil cement materials in a central mix plant by either batch or continuous mixing process. Soils, aggregates, additives, and water may be proportioned by either weight or volume. Calibrate the plant by weight and equip with a means to readily verify the quantity of each component. The time and points at which introducing each component into the mixing process must be approved. Combine and mix the components to produce a uniform, well-blended mixture. The total quantity of materials introduced into the mixing unit shall not exceed the approved capacity of the mixer.

When using a continuous mix process, draw the soils and aggregates from the storage area by a feeder or feeders that continuously supply the correct amount of soil or aggregate in proportion to the cement. Arrange the soil and aggregate storage areas or feed bins so that the proportion of each size can be separately adjusted if using more than one size.

Blend individual aggregates and soils within 2 percent of the individual weight of that component. The total weight of aggregate and soils shall be within 1 percent of the required weight of the total material. Incorporate cement within 1.0 percent of the required weight of cement.

Determine optimum moisture of the mixture in accordance with DOTD TR 415 or TR 418. Do not allow the percentage of moisture in the mixture, based on dry weight, to vary from optimum moisture by more than  $\pm 2.0$  percent at the time of compaction. Control moisture content at the time of mixing so that these tolerances are met. When these tolerances are not met and satisfactory control adjustments are not being made, discontinue operations until proper adjustments and uniform operations are established.

**301.07 QUALITY CONTROL OF PLANT OPERATIONS.** Provide a Certified Soil and Base Course Technician at the plant at all times when the plant is producing material for the Department.

The Certified Soil and Base Course Technician shall be capable of conducting any test or analysis necessary to put the plant into operation and producing cement stabilized mixtures conforming to the specifications. Do not begin daily plant operations without the Certified Soil and Base Course Technician present. The Soil and Base Course Technician certification will be awarded by the Department upon satisfactory completion of the Department's requirements.

**301.07.1 Soil Cement:** Implement and maintain quality control of materials during handling, storing, blending, mixing, and transport. Adjust equipment to provide the approved percent of each component in the mixture at optimum moisture content. Provide suitable equipment for the determination of moisture content, gradation, proper pulverization, and proper combination of components as required.

Build and maintain stockpiles of soils and aggregates in accordance with 301.04 and perform testing as necessary to ensure that materials delivered to the plant site meet the Department's specifications prior to requesting acceptance sampling and testing. Maintain the quality of materials placed in dedicated stockpiles already approved for use. When inspection by the Department indicates contamination or segregation of dedicated stockpiles, the affected materials will be rejected. Remove the rejected materials from the dedicated stockpile. Materials shall be sampled, tested, and approved by the Department prior to inclusion in an approved dedicated stockpile.

Incorporate water into the mixing chamber through a multi nozzle spray bar capable of spraying water uniformly, leaving no wet or dry areas. Add water after mixing soils, soil aggregates, and cement.

The contractor's Certified Soil and Base Course Technician shall continually monitor plant operations to ensure that systems function properly and that the proportions of materials are correct. At the beginning of each day's operation, check the percent cement being incorporated into the mixture, and then against the plant's print-out of cumulative totals every two hours. The contractor's Certified Soil and Base Course Technician shall test for moisture content of the soil or aggregate components in accordance with DOTD TR 403 at the beginning of each day's operations and at least twice per day during continuous operation. The contractor's Certified Soil and Base Course Technician shall test the moisture content of the mixture including the cement, as needed, to control the finished product within specification requirements. When specifying a composite gradation for the soil or aggregate material, check the gradation at least twice per day in accordance with DOTD TR 112 and TR 113. Document tests in accordance with the Department's current procedures.

The contractor's Certified Soil and Base Course Technician shall check the percent pulverization in accordance with DOTD TR 431 at least twice per day. At least 80 percent shall pass the No. 4 sieve.

When any quality control test does not meet the applicable specifications, make immediate corrections and notify Department personnel of the change, or otherwise the operations shall be discontinued.

**301.07.2 Asphalt Concrete:** Asphalt concrete plant operations shall conform to Section 502.

**301.08 LOADING, TRANSPORTING, AND PLACING ON SUBGRADE.** Do not allow base course materials to segregate during loading. Cover soil cement mixtures immediately with an approved waterproof cover to prevent loss of moisture, fines, or exposure to the elements. Tie the cover securely in place and do not remove until placement of the mixture.

Do not allow transportation, placing, and spreading methods to damage the subgrade. Place and spread sufficient material to obtain required width and compacted thickness within the tolerances set forth in 301.16. Place and spread soil cement within one hour of mixing cement with the soils or soil aggregates. Do not contaminate base course materials with subgrade layer. Any contamination will require retesting and correction of deficiencies. Do not place or spread base course material on portland cement concrete or asphalt concrete pavements. Do not damage pavement surfaces, edges, or joints during construction. Add water or use other suitable means to prevent dust during the transporting and placing of blended calcium sulfate.

**301.09 GRADE AND CROSS-SLOPE CONTROL.** Unless otherwise specified, construct Class I Base Courses (except asphalt concrete) to the required grade and cross slope, using an automatic finishing machine controlled from an erected stringline or GPS and laser system conforming to 502.08.2.2.

**301.10 COMPACTING AND FINISHING.**

**301.10.1 Soil Cement:** Compact the mixture immediately after placement. Complete initial compaction with an approved conventional sheepsfoot-type roller or a self-propelled tamping foot compactor-type roller in such a manner that no internal laminations occur in the completed base course. Use a pneumatic-tire roller for final compaction, operated so that no surface laminations occur. Keep the surface uniformly moist during compaction and shaping.

During the compaction and finishing, correct low-riding areas or areas with surface imperfections that need correction using fresh material. Thoroughly scarify the surface before placing and blending new base material. Complete final compaction of the corrected surface within the

same time limit applied to the initial placement of base materials as outlined in this subsection.

Complete compaction and initial finishing within two hours after initial mixing of cement with base course materials. Each lift of base course shall meet the requirements of 301.16. After compacting the base, uniformly apply water as needed to maintain the proper moisture content for intermediate finishing (tight blading). Thoroughly roll and finish the surface to grade; remove loosened material from the section. Finish rolling the surface with either a pneumatic-tire or static steel-wheel roller to provide a smooth, tightly knit surface conforming to finish grade or slightly higher.

Use an automatic finishing machine for final finishing and provide a surface free of cracks, ridges, waves, surface laminations, or loose material. Do not allow the cross-slope to vary by more than  $\pm 0.003$  foot/foot. Do not allow the grade to vary by more than  $\pm 0.04$  feet from plan grade. In areas inaccessible to the automatic finishing machine, final finishing will not be required, provided the grade and cross-slope satisfies the project engineer. Conduct final finishing far enough in advance to allow the Department to perform width and depth check tests.

At places inaccessible to rollers, such as edges adjacent to curb and gutter sections, compact the mixture using devices that will obtain the specified density without damage to adjacent structures.

Do not operate transport vehicles and heavy construction equipment on compacted base course for a period of 72 hours after placement.

**301.10.2 Asphalt Concrete Base:** Compaction and finishing requirements shall be as follows:

1. Compact and finish the asphalt concrete layer in accordance with Section 502. Do not use vibratory rollers when such use is detrimental to the underlying layers or areas with high water table.

2. The treated layer under asphalt concrete shall meet the requirements of the subgrade layer.

**301.10.3 Crushed Stone Recycled Portland Cement Concrete:** Compact and finish the same as specified in 301.10.1, except that the time limitations will not apply. Do not allow water added to facilitate compaction to damage underlying materials. Do not use vibratory rollers when it detrimental to the underlying layers or in areas with high water table.

**301.10.4 Blended Calcium Sulfate:** During placement of blended calcium sulfate, the percentage of moisture in the mixture, by dry weight, shall not vary from the optimum moisture by more than  $\pm 2.0$  percent. After application of water, allow the moisture to reach equilibrium in the base

before applying rolling techniques. Roll blended calcium sulfate to the edge of the embankment or subgrade. Compact each layer to at least 95 percent of maximum dry density before the next layer is placed. Determine optimum moisture and maximum density in accordance with DOTD TR 418 Method G modified to include a maximum drying temperature of 140°F.

Test all blended calcium sulfate base by proof rolling immediately prior to placement of surfacing material, including asphalt binder. Correct any irregularities or soft spots prior to placement of the surfacing material. Proof roll by using a load of 25 tons in a 12 to 14 cubic yard tandem dump truck with ten wheels or approved loaded truck determined by the project engineer. Proof rolling shall be a minimum of 5 passes in each direction at the same locations and at a maximum vehicle speed of 3 mph. Any rain event on the project site between the proof rolling and placement of the surfacing will require an additional proof rolling, as noted above.

### **301.11 QUALITY CONTROL OF ROADWAY OPERATIONS.**

Control the selection, placement, compaction, moisture content, density, thickness, width, surface finish, and grade so that the completed base course is uniform and conforms to plan dimensions and other acceptance requirements as provided herein. Construct the base course so that contamination, segregation, soft spots, wet spots, laminations, and other deficiencies are prevented. Do not damage the subgrade layer during compaction operations. Perform tests to control moisture content, thickness, width and density.

### **301.12 PROTECTION AND CURING.**

**301.12.1 Soil Cement and Treated Layer Under Asphalt Concrete:** Upon completion of intermediate finishing, immediately protect the base course against drying by applying an asphalt curing membrane in accordance with Section 506. Place asphalt curing membrane on the same day as treatment. Maintain complete coverage of curing membrane from initial application until the placement of the next course. When allowing traffic, including construction equipment, on the base course, place at least the first lift of surfacing within 30 calendar days unless otherwise directed.

**301.12.2 Crushed Stone, Recycled Portland Cement Concrete, and Blended Calcium Sulfate:** Cover the completed base course with asphalt prime coat in accordance with Section 505 as soon as practical to prevent water infiltration due to rainfall. Maintain complete coverage of the asphalt prime coat from initial application until the placement of the next course. When allowing traffic, including construction

equipment, on the base course, the prime coat application may be delayed. However, place the first lift of surfacing within 30 calendar days unless otherwise directed.

**301.13 CONSTRUCTION JOINTS.** On soil cement base courses, tie each day's construction into the completed work of the previous day by a straight transverse construction joint. Form the joint by cutting back into the total width of the base to form a true vertical face free of loose and broken material at a point where the base conforms to the typical section shown on the plans.

Longitudinal joints constructed between parallel lanes or similar joints between lanes and ramps, etc., shall be reasonably vertical and free of contaminated loose and/or broken material.

Construct the base at all joints so that the materials at and adjacent to the joint are stable, uniformly compacted and tightly knit.

**301.14 MAINTENANCE OF BASE COURSE.** Protect the completed base course from damage due to public traffic or the contractor's operations, and satisfactorily maintain the completed base course including the asphalt curing membrane or prime coat. Repair damaged base course at no direct pay. When requiring patching of the base course, in addition to removing damaged or unsound base course, remove a sufficient width and depth of base course to ensure satisfactory placement of patching material. The engineer must approve the type of patching material before use. Patching or other base course repair shall restore a uniform surface, shall conform to the requirements of the material being used, and shall be completed before paving operations begin. Patch failures detected during paving.

When not requiring maintenance of traffic, allow neither public traffic nor construction traffic on the completed base course during the 72-hour curing period. When requiring maintenance of traffic and conditions permit, route both public traffic and construction traffic off the completed base course onto shoulders or other suitable areas during the 72-hour curing period. When permitting traffic to use the completed base course subsequent to the 72-hour curing period and prior to construction of the surface course, further protect the base by additional applications of asphalt curing membrane or prime coat in accordance with 301.12 at no direct pay.

Prior to surface course construction, correct deficiencies and weak spots, clean the base course surface, repair any damages caused by traffic, and keep surface true to grade and cross-section at no direct pay. Apply additional

asphalt curing membrane or prime coat as directed at no direct pay. Complete this work at least 24 hours prior to construction of the next layer.

When allowing traffic, including construction equipment, on the asphalt concrete surfacing, place the first lift of surfacing within 30 calendar days.

**301.15 WEATHER LIMITATIONS.** Do not construct the base course when the subgrade or stockpiles are frozen, when raining, when the ambient air temperature is below 35°F, in the case of cement treated bases, or the temperature is forecasted by the U.S. Weather Service to be 25°F or less within the 24-hour period following placement.

**301.16 ACCEPTANCE REQUIREMENTS.** Soils and aggregates will be sampled and tested for acceptance by the department prior to the addition to a dedicated stockpile. Sampling will be in accordance with the materials sampling manual.

Plant operations will be checked for uniformity and the proportioning of the components. The percent cement will be checked at least twice per day in accordance with DOTD TR 436. The percent cement being incorporated into the mixture shall not be more than 0.1 percent by weight of the total material below the approved percent cement, or operations shall be discontinued until corrections have been made.

The moisture content of the soil cement or cement stabilized mixtures will be tested at placement at least twice per day for conformance to optimum moisture content in accordance with DOTD TR 403. When the moisture content is not within specification limits, take immediate corrective actions or operations shall be discontinued. When the moisture content is not within specification limits, the engineer may require removal of the in-place material.

Pulverization of the soil cement or cement stabilized mixtures will be tested in accordance with DOTD TR 431 at the plant at least twice per day. At least 80 percent shall pass the No. 4 sieve.

Base courses, except asphalt concrete, will be checked for determining acceptance in increments of 1000 linear feet per roadway or 2000 linear feet per shoulder constructed separately. Asphalt concrete base course will be accepted in accordance with Section 502.

**301.16.1 Density Requirements:** Upon completion of compaction operations, base course density, except asphalt concrete, will be determined in accordance with DOTD TR 401. Density requirements of asphalt concrete base course shall be in accordance with Section 502. Density requirements

for Class I base course materials other than asphalt concrete shall be a minimum of 95.0 percent maximum dry density in accordance with DOTD TR 418.

**301.16.1.1 Soil Cement and Treated Layer Under Asphalt Concrete:** When the density test value for the section falls below 95.0 percent, a payment adjustment will be applied in accordance with Table 301-1.

**Table 301-1  
Density Acceptance and Payment Schedule**

Density Test Value, (percent)	Percent of Contract Unit Price
95.0 & above	100
94.0 to 94.9	90
93.0 to 93.9	75
Below 93.0	50 or Remove <sup>1</sup>

<sup>1</sup> At the option of the Chief Engineer.

**301.16.1.2 Asphalt Concrete:** The density requirements for asphalt concrete base course shall be as specified in Section 502.

**301.16.1.3 Crushed Stone, Recycle Portland Cement Concrete, and Blended Calcium Sulfate:** When any test value is less than 95.0 percent maximum dry density, continue compaction until the density is obtained.

The acceptance requirements for blended calcium sulfate base course shall be the same as stone base course with the following modifications. Upon completion of compaction operations, determine the density in accordance with DOTD TR 401 except that all moisture content determinations for density calculations shall be conducted by oven drying the material for 24 hours at 140°F. A forced draft type oven capable of maintaining the temperature shall be provided by the contractor for field moisture content determination for density control.

**301.16.2 Thickness Tolerances:** The thickness of the completed base course will be determined in accordance with DOTD TR 602. The under-thickness tolerances for asphalt concrete base course shall be in accordance with Section 502.

Under-thickness of base courses, except asphalt concrete, shall not vary from plan thickness in excess of 1/2 inch. Correct base course thickness deficiencies in excess of this tolerance as specified herein at no direct pay.

When using reconstruction as a method of correction, this tolerance shall apply.

Over-thickness may be waived at no direct pay when meeting grade requirements. When not meeting grade requirements and not permitting grade adjustments, correct as required at no direct pay.

Failing areas will be isolated longitudinally for purposes of correction for the entire width.

When using crushed stone base or recycled concrete base over soil cement base, the individual base layer tolerances shall be as noted above, and the total base course under-thickness shall not exceed 3/4 inch.

**301.16.2.1 Soil Cement and Treated Layer Under Asphalt Concrete:** When not permitting grade adjustments, correct under-thickness deficiencies by removing and replacing the full depth of base course in deficient areas with one of the following materials:

1. The same type of base course.
2. Asphalt concrete complying with Section 502.
3. Concrete complying with Section 901.

When permitting grade adjustments, under-thickness deficiencies may be corrected by furnishing and placing a supplemental layer of asphalt concrete conforming to Section 502 for the full width of base course in lieu of removing and replacing deficient base course. Thickness of the supplemental layer of asphalt concrete shall be in accordance with Table 301-2 as follows.

**Table 301-2  
Supplemental Asphalt Concrete Layer Thickness**

Under-Thickness, Inches	Minimum Thickness of Supplemental Asphalt Concrete, Inches <sup>1</sup>
$\frac{3}{4}$ to $1\frac{1}{4}$	$1\frac{1}{4}$
$1\frac{1}{2}$ to $1\frac{3}{4}$	$1\frac{1}{2}$
2 to $2\frac{1}{2}$	2
Over $2\frac{1}{2}$	Remove and Replace <sup>2</sup>

<sup>1</sup> May be included in the subsequent lift.

<sup>2</sup> At the option of the Department after investigation.

**301.16.2.2 Asphalt Concrete Base Course:** When not permitting grade adjustments, correct under-thickness in excess of the tolerances given in 502.12 to plan thickness by removing and replacing the full depth of base course. When permitting grade adjustments, correct under-

thickness by placing and compacting a 1<sup>1</sup>/<sub>4</sub> inch thick minimum supplemental layer of asphalt concrete complying with Section 502 at no direct pay.

**301.16.2.3 Crushed Stone and Recycled Portland Cement Concrete:** When permitting grade adjustments, correct under-thickness in excess of 1/2 inch to plan thickness by furnishing, placing, mixing, reworking, shaping, and compacting an additional thickness of the same type of base course material. When not permitting grade adjustments, remove and replace the base course.

**301.16.3 Width Requirements:** The width of the completed base course will be determined in accordance with DOTD TR 602. Roadway base course width shall not vary from plan width in excess of +6 inches. Shoulder base course width shall not vary from plan width in excess of +3 inches. Do not allow underwidths for shoulder or roadway bases. When the base course for both roadway and shoulders are constructed at the same time, the 6-inch tolerance will be applied. Correct base course width deficiencies in excess of the above tolerances as follows at no expense to the Department:

**301.16.3.1 Overwidth:** Overwidths on all base courses may be waived at no direct pay.

**301.16.3.2 Underwidth:** Correct underwidth of all base courses to plan width by furnishing and placing additional materials; however, the width of widening materials shall be no less than 12 inches. The thickness of the widening shall be plan thickness. Materials for widening deficient base course shall be one of the following:

1. The same type of base course.
2. Asphalt concrete complying with Section 502.
3. Concrete complying with Section 901.

**301.16.4 Correction of Other Deficiencies.** Correct deficiencies in surface finish, grade, contamination, segregation, soft spots, wet spots, laminations, and other deficiencies at no direct pay. Correct these deficiencies by removing and replacing or as directed.

**301.16.5 Grade and Cross-Slope:** The finished grade shall be within  $\pm 1/2$  inch of the established grade. The cross-slope shall not vary by more than  $\pm 0.003$  foot/foot.

**301.17 MEASUREMENT.** The quantities of Class I base course for payment will be the design volumes or areas specified in the plans and adjustments thereto. Design quantities are based on the horizontal dimensions and theoretical compacted thickness of the completed base

course shown on the plans. Design quantities will be adjusted if the engineer makes changes to adjust to field conditions, plan errors are proven, or design changes are necessary.

**301.18 PAYMENT.** Payment for Class I base course will be made at the contract unit price, adjusted as specified in 301.16 and the following provisions, which include furnishing and placing required base course materials, portland cement, portland-pozzolan cement, water, grade control, asphalt curing membrane, and prime coat.

When the density test value for the section falls below 95.0 percent, a payment adjustment will be applied in accordance with Table 301-1.

Failure to add the specified amount of cement in soil cement will result in a payment adjustment in accordance with Table 301-3 below. For materials other than asphalt concrete, payment adjustments that are made for more than one deficiency shall be cumulative. Any payment adjustment in asphalt concrete shall be in accordance with Section 502 and shall apply to the cubic yard total quantity of base course.

**Table 301-3  
Payment Adjustment Schedule**

	Percent of Contract Unit Price			
	100	90	80	50 or Remove and Replace <sup>1</sup>
Cement content (Percent by dry weight) less than required	0.0 – 0.1	0.2 – 0.4	0.5 – 1.0	more than 1.0

<sup>1</sup> At the option of the Chief Engineer.

Payment will be made under:

<b>Item No.</b>	<b>Pay Item</b>	<b>Pay Unit</b>
301-01	Class I Base Course	Cubic Yard
301-02	Class I Base Course ____in Thick	Square Yard
301-03	Class I Base Course for Shoulders	Cubic Yard
301-04	Class I Base Course for Shoulders _____in Thick	Square Yard

## Section 302 Class II Base Course

**302.01 DESCRIPTION.** Furnish and place Class II roadway and shoulder base course on a prepared surface in accordance with these specifications, in conformity with the lines, grades, thickness, and typical sections shown on the plans or established. Control the selection, placement, mixing and compaction of materials so that the completed base course is uniform and conforms to plan dimensions and other acceptance requirements.

Quality assurance requirements shall be as specified in the latest edition of the Department's publication titled *Application of Quality Assurance Specifications for Embankment and Base Course*.

When not specified, any of the following types may be used:

1. Soil Cement
2. Crushed Stone
3. Asphalt Concrete Base Course on Embankment Layer
4. Recycled Portland Cement Concrete
5. Blended Calcium Sulfate

Unless approved otherwise in writing, use the same base course material throughout the project in accordance with these specifications.

In areas that are inaccessible for mixing and compacting, in turnouts, crossovers, and in other isolated or irregular areas, portland cement concrete complying with Section 901 or asphalt concrete base course complying with Section 502 may be used in lieu of the specified Class II base course material with approval. If using asphalt or portland cement concrete, the top half of the base course thickness shall be asphalt or portland cement concrete. If used, portland cement concrete shall be a minimum thickness of 6 inches. The remaining thickness shall be the same type and construction as the top layer of embankment, treated layer, or subgrade. Do not place raw, untreated material between a treated layer and the concrete. Place, consolidate, finish, and cure concrete as directed in accordance with Section 706.

Submit a dust control plan to address weather, sight clearance, operational procedures, traffic control, and any other project specific concerns. Failure to maintain sight clearance will result in the engineer stopping contractor operations.

The Department will identify dust sensitive areas in the plans. In these specific areas, the dust control plan must also include environmental requirements. In order to meet air quality standards, the contractor may be required to use central plant mixing of cement treated mixtures in dust

sensitive areas at no direct pay. The contractor may use other types of Class II base course in dust sensitive areas at no direct pay.

**302.02 MATERIALS.** Materials shall comply with the following sections or subsections and requirements.

Geotextile Fabric	203.11 & 1019
Asphalt Concrete	502
Portland Cement Concrete	901
Portland Cement	1001.01
Blended Hydraulic Cement	1001.02
Asphalt Materials	1002
Stone	1003.01 & 1003.03.1
Recycled Portland Cement Concrete	1003.01 & 1003.03.2
Blended Calcium Sulfate	1003.01 & 1003.03.3
Water	1018.01

**302.02.1 Soils for Soil Cement:** Soils for soil cement base course shall consist of materials that will stabilize with cement in accordance with DOTD TR 432. Such materials are those soils classified as A-1-a, A-1-b, A-2-4, A-2-6, A-4, and A-6 in accordance with DOTD TR 423. Do not use soil with a Liquid Limit greater than 35, a Plasticity Index (PI) greater than 15, or an organic content greater than 2 percent.

Determine Liquid Limit and Plasticity Index in accordance with DOTD TR 428. Determine organic content in accordance with DOTD TR 413. Do not use soil with over 79 percent sand or 60 percent silt when tested in accordance with DOTD TR 407. Soils may be blended to adjust the percentages of sand or silt to meet specification requirements; however, in-place blending is not allowed. Do not blend or treat soils that do not meet Liquid Limit or PI requirements to reduce Liquid Limit or PI. Do not use topsoil. Obtain the material to be stabilized from outside right-of-way limits except as provided in 106.02.3. The engineer will take samples from the roadway or stockpile in accordance with the Material Sampling Manual. The District Laboratory Engineer will approve materials prior to blending and the final product.

Acceptance of soils with organic contents between 2 to 5 percent may be allowed based on determination of increased cement percentages in accordance with DOTD TR 432 Method B or C, whichever is applicable, using the design compressive strength criteria listed for stabilization.

Maximum cement rate allowed will be 14 percent by volume. Perform the laboratory testing specified above at no expense to the Department. The laboratory used must be approved by the Materials Engineer Administrator.

Take samples in the presence of the engineer in accordance with the Material Sampling Manual. Obtain sufficient material to provide the District laboratory with approximately 200 pounds of the base material to be treated for verification testing. The engineer will take immediate possession of the verification samples. Also provide approximately 10 pounds of the selected cementitious material to the District laboratory. Provide materials for verification testing at no cost to the Department.

Submit all design data used to determine the recommended cement rate to the District Laboratory Engineer for approval. Prior to approval of the design, the District Laboratory will perform verification testing. Verification testing by the District Laboratory will consist of molding, curing and testing a minimum of three specimens in accordance with TR 432, at the percentage of cementitious material and at the optimum moisture determined by the contractor's laboratory. The recommended cement rate will be considered verified if test results indicate that the minimum strength criteria have been met and that the optimum moisture are within 2 percent of that submitted by the contractor. Normal testing time for verification testing may require up to 21 calendar days. Do not begin construction operations until the design is approved.

**302.02.2 Portland Cement:** Use Type I or II portland cement. The quantity of cement used shall be supported by proof of delivery.

**302.02.3 Blended Hydraulic Cement:** The cement shall be Type IP. The quantity of cement used shall be supported by proof of delivery.

**302.02.4 Asphalt Concrete Base Course:** The material requirements for asphalt concrete base course shall be as described in Section 502. The top half of the base thickness shall be asphalt concrete and the remaining thickness shall be the same type and construction as the top layer of embankment, treated layer, or subgrade. Do not place raw, untreated material between a treated layer and the asphalt concrete.

**302.02.5 Blended Calcium Sulfate:** Take gradation samples in accordance with 1003.03.3 from the dedicated stockpiles at the point of material origin.

**302.03 EQUIPMENT.** Obtain approval of equipment prior to use. When using in-place mixing, the equipment shall conform to 303.03. When using

central mixing, the equipment shall conform to 301.03.1. Compaction equipment shall conform to 301.03.1.5.

**302.04 GENERAL CONSTRUCTION REQUIREMENTS.** Place base course material on a subgrade prepared in accordance with Sections 203, 304, 305, 306 as specified. Construct asphalt concrete base course in accordance with Section 502. Do not use blended calcium sulfate in areas needed to facilitate traffic control. Do not place blended calcium sulfate within 10 feet of metal drainage structures. The contractor will be allowed to substitute any untreated Class II base course material listed in 302.01.

Finished lift thickness shall be 9 inches maximum. The Department may allow single lift construction for depths exceeding 9 inches and up to 12 inches based on a rolling pattern that obtains the required density.

Use a Class D geotextile separator fabric if an aggregate base course is to be placed on untreated or lime-treated soils.

### **302.05 MIXING.**

**302.05.1 Soil Cement:** Combine soil with cement and water by in-place mixing or in a central plant and shape on the subgrade. When in-place mixing is done, spread and mix the cement prior to adding any more water.

A minimum of 70 percent of the pulverized soil, as determined by DOTD TR 431, shall pass the No. 4 sieve after mixing. Determine the optimum moisture of the mixture in accordance with DOTD TR 415 or TR 418. The percentage of moisture in the mixture, by dry weight, shall not vary from the optimum moisture by more than  $\pm 2.0$  percent at the time of compaction when tested in accordance with DOTD TR 403.

**302.05.1.1 In-Place Mixing:** Samples to determine optimum moisture and maximum dry density will be taken by the project engineer. Determine maximum dry density in accordance with DOTD TR 415 or TR 418 and in-place density in accordance with DOTD TR 401. After placement of soil and prior to mixing with cement, shape the soil to required section and compact to at least 93.0 percent of maximum dry density at the required grade.

From materials sampled in-place on the project, the engineer will determine the percentage of cement in accordance with DOTD TR 432 prior to mixing. Depending on the type of cement and soil to be used, normal testing time to determine required cement content may require 21 calendar days. Add water as needed to bring the moisture content of the mixture within the tolerance and uniformly mix with the materials. During the

mixing process, add water only through the spray bar of the in-place mixer which is adjusted to provide uniform coverage across the completed width of the roadway for the full depth of the base. Do not allow wet streaks or spots.

The method of cement distribution shall be such that the amount of cement used can be readily determined. Determine the spread rate of cement in accordance with DOTD TR 436.

When the moisture content is not within  $\pm 2.0$  percent of optimum, discontinue operations and do not resume until the moisture content is controlled within this tolerance. Do not place and pulverize more than one transport until moisture content is within  $\pm 2.0$  percent of optimum.

**302.05.1.2 Central Plant Mixing:** Mixing in a central mix plant shall conform to Section 301. When using central plant mixing, a reduction of 1.0 percent in the volume of cement required will be permitted.

**302.05.2 Crushed Stone and Recycled Portland Cement Concrete:** Do not allow crushed stone or recycled portland cement concrete base courses to segregate during construction. Take gradation samples in accordance with 1003.03 from the dedicated stockpiles at the point of material origin.

**302.05.3 Blended Calcium Sulfate:** Do not use for crossovers, drives, or in areas needed to facilitate traffic control. In lieu of blended calcium sulfate, substitute any untreated Class II base course material listed in 302.01. Do not place blended calcium sulfate within 10 feet of metal drainage structures. Use approved backfill material in Section 701.

**302.06 TRANSPORTING AND PLACING ON SUBGRADE.** Use only transportation and spreading methods that do not damage the subgrade. Place and spread sufficient base course material to obtain required width and compacted thickness within the tolerances set forth in 302.12. Do not allow subgrade material to contaminate the base course. Any contamination will require retesting and correction of deficiencies. Do not place, spread, or mix base course material on portland cement concrete or asphalt concrete pavements. Do not allow base course construction operations to damage adjacent pavement surfaces, edges and joints. Add water or use other suitable means to prevent dust during the transporting and placing of materials.

## **302.07 COMPACTING AND FINISHING.**

**302.07.1 General:** The finished base course shall have a smooth, uniform, closely knit surface, free from ridges, waves, laminations or loose material. Thoroughly roll the surface and finish to grade. The cross-slope shall not vary by more than  $\pm 0.003$  foot/foot. Density requirement shall be in accordance with 302.12. Do not damage the subgrade layer during compaction operations.

**302.07.2 Soil Cement:** When using central plant mixing, compact the material and finish in accordance with 301.10, except that the automatic grade machine will not be required. When using in-place mixing, compact the material and finish in accordance with 303.06.

Begin mixing operations within one hour of placement. Complete compaction and finishing operations within three hours after initial mixing of cement with base course materials. Upon expiration of the three-hour period after initial mixing, only intermediate finishing (tight blading) of the base course surface will be allowed. Dispose of excess bladed material. Do not drift bladed material along the base. Use stabilized material in the base course except for that small amount necessary for tight blading. Excessive blading, exceeding 10 percent of the base thickness, to achieve plan depth will not be allowed. Complete operations, including tight blading, within 24 hours of mixing. The finished base course shall have a smooth, uniform, closely-knit surface, free from ridges, waves, laminations, or loose materials. Do not spread cement within 2 hours of sunset, unless otherwise approved by the project engineer.

**302.07.3 Crushed Stone and Recycled Portland Cement Concrete:** Compact these materials using an approved sheepsfoot-type roller and finish-roll with an approved pneumatic tire roller or a smooth steel wheel roller. Keep the surface uniformly moist during compaction and final finishing.

**302.07.4 Asphalt Concrete:** Compact and finish asphalt concrete in accordance with Section 502. The soil layer shall be compacted and finished in accordance with the top layer of embankment or subgrade.

**302.07.5 Blended Calcium Sulfate:** During placement of blended calcium sulfate, the percentage of moisture in the mixture, by dry weight, shall not vary from the optimum moisture by more than  $\pm 2.0$  percent. After application of water, allow the moisture to reach equilibrium in the base before applying rolling techniques. Roll blended calcium sulfate to the edge of the embankment or subgrade. Compact each layer to at least 95 percent of maximum dry density. Determine optimum moisture and maximum

density in accordance with DOTD TR 418 Method G modified to include a maximum drying temperature of 140°F.

Proof roll by using a load of 25 tons in a 12 to 14 cubic yard tandem dump truck with ten wheels or approved loaded truck determined by the project engineer. Proof rolling shall be a minimum of 5 passes in each direction at the same locations and at a maximum vehicle speed of 3 mph.

Test all blended calcium sulfate base by proof rolling immediately prior to placement of surfacing material, including asphalt binder. Correct any irregularities or soft spots prior to placement of the surfacing material. Any rain event on the project site between the proof rolling and placement of the surfacing will require an additional proof rolling as noted above.

### **302.08 QUALITY CONTROL OF ROADWAY OPERATIONS.**

Control the selection, placement, compaction, cement spread, mixing, moisture content, density, thickness, width, surface finish, cross-slope, and grade to produce a completed base course that is uniform and conforms to plan dimensions and other acceptance requirements as provided herein. Control operations to prevent contamination, segregation, soft spots, wet spots, laminations, and other deficiencies. Perform tests necessary to adequately control the work.

### **302.09 PROTECTION AND CURING.**

**302.09.1 Soil Cement:** Upon completion of intermediate finishing, immediately protect the base course against drying by applying an asphalt curing membrane in accordance with Section 506. Place asphalt curing membrane on the same day as treatment. Maintain complete coverage of the curing membrane from the initial application until the placement of the next course. When allowing traffic, including construction equipment, on the base course, place at least the first lift of surfacing within 30 calendar days unless otherwise directed.

**302.09.2 Crushed Stone, Recycled Portland Cement Concrete, Soil Layer Under Asphalt Concrete, and Blended Calcium Sulfate:** Cover the base course with asphalt prime coat in accordance with Section 505 as soon as practical to avoid water infiltration due to rainfall. Maintain complete coverage of asphalt prime coat from the initial application until the placement of the next course.

**302.10 MAINTENANCE OF BASE COURSE.** Protect the base course from damage from public traffic or the contractor's operations and

satisfactorily maintain the base course, including the asphalt curing membrane or prime coat. Repair damaged base course at no direct pay. When requiring patching of the base course, in addition to removing damaged or unsound base course, remove a sufficient width and depth of sound base course to ensure satisfactory placement of patching material. The engineer's approval of the type of patching material will be required before use. Patching or other base course repair shall restore a uniform surface, shall conform to the requirements of the material being used, and shall be completed before paving operations begin. Patch any failures detected during paving.

Do not allow public traffic or construction traffic on the completed base course during the 72-hour curing period. If conditions permit, route both public traffic and construction traffic off the completed base course onto shoulders or other suitable areas during the 72-hour curing period. Traffic may be permitted on the base course during the curing period if conditions warrant and approved by the engineer. When permitting traffic to use the completed base course subsequent to the 72-hour curing period and prior to construction of the surface course, further protect the base by additional applications of asphalt curing membrane or prime coat in accordance with 301.12 at no direct pay.

Prior to surface course construction, correct deficiencies and weak spots, clean the base course surface, repair any damages caused by traffic, and keep the surface true to grade and cross section at no direct pay. Apply and maintain additional asphalt curing membrane or prime coat as directed at no direct pay.

When surfacing with asphalt concrete, place the first lift of surfacing within 30 calendar days.

**302.11 WEATHER LIMITATIONS.** Do not construct base course when the subgrade or stockpiles are frozen, when raining, when the ambient air temperature is below 35°F, in the case of cement treated bases, or the temperature forecasted by the U.S. Weather Service is to be 25°F or less within the 24-hour period following placement.

**302.12 ACCEPTANCE REQUIREMENTS.** Soils and aggregates will be sampled for acceptance by the Department in accordance with the Materials Sampling Manual.

For central plant mixing, determine the cement content in accordance with 301.16. For in-place mixing, determine the cement content in

accordance with 302.05. Test the moisture content of the soil cement or cement treated mixtures for conformance to optimum moisture content in accordance with DOTD TR 403.

Test the pulverization of the soil cement or cement treated mixtures in accordance with DOTD TR 431. At least 70 percent shall pass the No. 4 sieve.

Check base course, except asphalt concrete, for acceptance in increments of 1000 linear feet per roadway or 2000 linear feet per shoulder constructed separately. Asphalt concrete acceptance will be in accordance with Section 502.

**302.12.1 Density Requirements:** Upon completion of compaction operations, determine base course in-place density, except asphalt concrete, in accordance with DOTD TR 401. Determine density requirements for asphalt concrete base course in accordance with Section 502.

The density requirements for Class II base course materials other than asphalt concrete shall be a minimum of 95.0 percent maximum dry density in accordance with DOTD TR 418.

**302.12.1.1 Soil Cement and Treated Layer Under Asphalt Concrete:** When the density test value for the section falls below 95.0 percent, a payment adjustment will be applied in accordance with Table 302-1 as follows.

**Table 302-1  
Density Acceptance and Payment Schedule**

Density Test Value (percent)	Percent of Contract Unit Price
95.0 & Above	100
94.0 to 94.9	90
93.0 to 93.9	75
Below 93.0	50 or Remove <sup>1</sup>

<sup>1</sup> At the option of the Chief Engineer.

**302.12.1.2 Crushed Stone, Recycled Portland Cement Concrete, Blended Calcium Sulfate, and Soil Layer under Asphalt Concrete Base Course:** When any test value is less than the required density, continue compaction until obtaining the specified density.

The acceptance requirements for blended calcium sulfate base course shall be the same as stone base course with the following modifications. Upon completion of compaction operations, determine the density in accordance with DOTD TR 401 except that all moisture content

determinations for density calculations shall be conducted by oven drying the material for 24 hours at 140°F. A forced draft type oven capable of maintaining the temperature shall be provided by the contractor for field moisture content determination for density control.

**302.12.2 Thickness Requirements:** Determine the thickness of the completed base course in accordance with DOTD TR 602.

Do not allow the completed base course to vary from plan thickness in excess of the tolerances in Table 302-2 below. Correct base course thickness deficiencies in excess of these tolerances at no direct pay.

**Table 302-2  
Base Course Thickness Tolerance**

(All Bases Except Asphalt Concrete) Under-Thickness, Inches	(Stabilized & Treated Bases) Over-Thickness, Inches
$\frac{3}{4}$	$1\frac{1}{2}$

When using crushed stone base or recycled concrete base over soil cement base, the individual base layer tolerances shall be in accordance with Table 302-2, and the total base course under-thickness shall not exceed 1 inch.

Any failing area will be isolated for purposes of correction.

Determine asphalt concrete base thickness in accordance with Section 502.

When using central plant mixing, over-thickness may be waived at no direct pay.

**302.12.2.1 Soil Cement, and Treated Layer Under Asphalt Concrete:** When not permitting grade adjustments, correct under-thickness deficiencies in excess of tolerance by removing and replacing the full depth of base course in deficient areas with one of the following materials:

1. The same type of base course.
2. Asphalt concrete complying with Section 502.
3. Concrete complying with Section 901.

When permitting grade adjustments, correct thickness deficiencies either by furnishing and placing a supplemental layer of asphalt concrete complying with Section 502 for the full width of base course or by removing and replacing deficient base course. When approved, corrections may be

made by re-stabilizing the existing material in accordance with this section, and the cement content may be reduced from design contents with approval of the District Laboratory Engineer.

Thickness of the supplemental layer of asphalt concrete shall be in accordance with Table 302-3 as follows.

**Table 302-3  
Supplemental Asphalt Concrete Layer Thickness**

Under-Thickness, Inch	In-Place Mixing Over-Thickness, Inches	Minimum Thickness of Supplemental Asphalt Concrete, Inch <sup>1</sup>
1 to 1 1/4	1 3/4 to 2	1 1/4
1 1/2 to 1 3/4	2 1/4 to 2 1/2	1 1/2
2 to 2 1/2	2 3/4 to 3	2
Over 2 1/2	Over 3	Remove and Replace <sup>2</sup>

<sup>1</sup> May be included in the subsequent lift.

<sup>2</sup> At the option of the Department after investigation.

When using reconstruction as the method of correction, the above tolerances shall apply.

**302.12.2.2 Crushed Stone, Blended Calcium Sulfate, and Recycled Portland Cement Concrete:** When allowing grade adjustments, correct under-thickness in excess of 3/4 inch to plan thickness by furnishing, placing, reworking, shaping, and compacting additional base course material as required. When not allowing grade adjustments, remove the material and replace at no direct pay.

**302.12.2.3 Asphalt Concrete Base Course:** When not allowing grade adjustments, correct under-thickness in excess of the tolerances given in 502.12 to plan thickness by removing and replacing the full depth of base course. When allowing grade adjustments, correct under-thickness in excess of the tolerances given in 502.12 to plan thickness by placing and compacting an 1 1/4-inch thick minimum supplemental layer of asphalt concrete complying with Section 502 at no direct pay.

**302.12.3 Width Requirements:** Determine the width of the completed base course in accordance with DOTD TR 602. Do not allow roadway base course width to vary from plan width in excess of +6 inches. Do not allow shoulder base course width to vary from plan width in excess of +3 inches. No under-widths are allowed for shoulder or roadway bases. When the base course for both roadway and shoulders are constructed at the same time, the 6-inch tolerance will be applied. Correct base course width

deficiencies in excess of the above tolerances as follows at no expense to the Department:

**302.12.3.1 Soil Cement and Asphalt Concrete Base Course**

**302.12.3.1.1 Over-Width:** Over-widths of asphalt concrete and treated base courses mixed in a central plant may be waived at no additional cost to the Department. When not allowing grade adjustments, remove the full depth and width of base course in areas having over-widths in excess of the foregoing tolerances and replace to the plan width with one of the following materials:

1. The same type of base course.
2. Asphalt concrete complying with Section 502.
3. Concrete complying with Section 901.

In lieu of removing and replacing the over-width areas of base course, at the Department's option, any base course less than 12 inches over-width will be allowed to remain in place at an adjusted payment of 90 percent of the contract unit price for the complete section. Remove over-width in excess of 12 inches and replace as indicated above. When approved, corrections may be made by restabilizing the existing material in accordance with this subsection, and the cement content may be reduced from design contents with approval of the District Laboratory Engineer.

When permitting grade adjustments, correct base course width deficiencies by removing and replacing as specified above, or by furnishing and placing a 1<sup>1</sup>/<sub>4</sub>-inch thick supplemental layer of asphalt concrete complying with Section 502 on the 1000-foot section for the full width of the base course.

**302.12.3.1.2 Under-Width:** Correct under-widths of base course in excess of the foregoing tolerances to plan width and thickness by furnishing and placing additional materials; however, the width of widening materials shall be not less than 12 inches. When approved, corrections may be made by restabilizing the existing material in accordance with this section, and the cement content may be reduced from design contents with approval of the District Laboratory Engineer. Materials for widening deficient base course may be asphalt concrete complying with Section 502 or concrete complying with Section 901.

**302.12.3.2 Crushed Stone, Blended Calcium Sulfate, and Recycled Portland Cement Concrete:** Over-widths will be waived at no additional cost to the Department. Correct under-widths in excess of the

foregoing tolerances to plan widths by furnishing, placing, reworking, shaping, and compacting additional base course material as required.

**302.12.4 Grade and Cross-Slope:** The finished grade shall be within  $\pm 1/2$  inch of the established grade. Do not allow the cross-slope to vary by more than  $\pm 0.003$  foot/foot.

**302.12.5 Correction Deficiencies:** Correct deficiencies in surface finish, cross-slope, grade, contamination, segregation, soft spots, wet spots, laminations, and other deficiencies at no direct pay. Correct deficiencies by removing and replacing or as directed.

**302.13 MEASUREMENT.** The quantities of Class II base course for payment will be the design volumes or areas specified in the plans and adjustments thereto. Design quantities are based on the horizontal dimensions and compacted thickness of the completed base course shown on the plans. Design quantities will be adjusted if the engineer makes changes to adjust to field conditions, if plan errors are proven, or if design changes are necessary.

Geotextile fabric used beneath the base course will not be measured for payment.

**302.14 PAYMENT.** Payment for Class II base course will be made at the contract unit price, adjusted as specified in 302.12 and the following provisions, which includes furnishing and placing required base course materials, portland cement, blended hydraulic cement, water, asphalt curing membrane, and prime coat.

Any payment adjustment in asphalt concrete shall be in accordance with Section 502 and shall apply to the cubic yard total quantity of base course when payment is by cubic yard. For other materials, when making payment adjustments for more than one deficiency, they shall be cumulative.

Payment for geotextile fabric will be included in the contract unit price for base course.

Payment will be made under:

<b>Item No.</b>	<b>Pay Item</b>	<b>Pay Unit</b>
302-01	Class II Base Course	Cubic Yard
302-02	Class II Base Course ____ in Thick	Square Yard

## **Section 303**

### **In-Place Cement Stabilized and Treated Base Courses**

**303.01 DESCRIPTION.** Scarify, pulverize, blend, shape, and stabilize roadbed material with portland cement, blended hydraulic cement, or portland blast-furnace slag cement in accordance with the lines, grades, thickness, and sections established or shown on the plans.

Cement stabilization and cement treatment is primarily for existing roadbed materials. When specified, furnish and place materials under different pay items to be stabilized or treated in accordance with this section.

In areas that are inaccessible for mixing and compacting in turnouts and crossovers, and in other isolated or irregular areas, portland cement concrete complying with Section 901 or asphalt concrete complying with Section 502 may be used in lieu of the specified base course material with approval. If using asphalt or portland cement concrete, the top half of the base thickness shall be asphalt or portland cement concrete. If used, portland cement concrete shall be a minimum thickness of 6 inches. The remaining thickness shall be the same type and construction as the top layer of embankment, treated layer, or subgrade. Place, consolidate, finish, and cure concrete as directed in accordance with Section 706.

Remove and satisfactorily dispose of existing materials as required to accommodate placement of the portland cement concrete or asphalt concrete at no direct pay. Dispose of excess material in accordance with 202.02.

Submit a dust control plan to address weather, sight clearance, operational procedures, traffic control, and any other project specific concerns. Failure to maintain sight clearance will result in the engineer stopping contractor operations.

The Department will identify dust sensitive areas in the plans. In these specific areas, the dust control plan must also include environmental requirements.

Quality assurance requirements shall be as specified in the latest edition of the Department's publication titled *Application of Quality Assurance Specifications for Embankment and Base Course*.

**303.01.1 Cement Stabilization:** Cement stabilization is primarily used for existing roadbed materials, typically 8.5 inches thick, unless specified otherwise. The design compressive strength criteria for cement stabilization shall be 300 psi as determined in accordance with DOTD

TR 432, Method B or C.

**303.01.2 Cement Treatment:** Cement treatment is primarily used for existing roadbed materials typically 12 inches thick, unless specified otherwise. The design compressive strength criteria for cement treatment shall be 150 psi as determined in accordance with DOTD TR 432, Method B or C.

**303.02 MATERIALS.** Materials shall comply with the following sections or subsections:

Portland Cement	1001.01
Blended Hydraulic Cement	1001.02
Ground Granulated Blast-Furnace Slag Cement	1001.05
Emulsified Asphalt	1002
Water	1018.01

Portland cement shall be Type I or II. Blended hydraulic cement shall be Type IP. Ground granulated blast-furnace slag cement shall be Type IS. The quantity of cement used shall be supported by proof of delivery.

Portland blast-furnace slag cement shall contain a maximum of 50 percent ground granulated blast-furnace slag by weight. Pre-blending of Types I or II portland cement and ground granulated blast-furnace slag will be allowed if blended at an approved blending facility and mixed thoroughly to ensure a uniform blend. The ground granulated blast-furnace slag used in pre-blending shall be from the Approved Materials List and meet the requirements of 1001.05.

Furnish soils or soil-aggregate combinations for cement stabilization or treatment in accordance with this section that comply with the requirements of 302.02.1. If an A-4 or A-6 Soil Group material is used for cement treatment, it shall meet the durability requirements of DOTD TR 432.

**303.02.1 Determination of Cement Rate**

**303.02.1.1 Predetermined (Plan Specified):** For portland cement, mix the roadbed material with the rate of cement by volume as shown on the plans.

**303.02.1.2 Non-Predetermined:** If the percent cement has not been predetermined, the District Laboratory will determine the percent of cement by volume in accordance with DOTD TR 432 from materials sampled in-place on the project. The Department will take samples for percent cement determination from isolated random areas selected by the

project engineer, prepared for sampling by the contractor. Thoroughly pulverize and mix the sampling area to the satisfaction of the project engineer. Resurface sampling areas as directed after samples are taken and maintain to the satisfaction of the project engineer. Payment for resurfacing will be made under the appropriate asphalt concrete roadway or maintenance aggregate items.

Depending on materials to be stabilized, normal testing time to determine the required cement content may require up to 21 calendar days.

**303.02.1.3 Contractor Selected Cement Type:** If selecting Type IP or IS as the cementitious material, determine the rate of blended cement prior to mixing using TR 432, Method B or C, whichever applies, using the design compressive strength criteria listed for treatment or stabilization. In addition, determine the durability of the base course mixture using Type IP or IS in accordance with DOTD TR 432 with the rate of cementitious material determined from Method B or C. Perform the laboratory testing specified above for Types IP or IS cement at no expense to the Department. The laboratory used must be approved by the Materials Engineer Administrator.

Take samples, in the presence of the engineer, by methods described in 303.02.1.2 above. Payment for resurfacing and subsequent maintenance to the satisfaction of the engineer shall be at no expense to the Department.

During sampling operations, obtain sufficient material to provide the District laboratory with approximately 200 pounds of the base material to be treated for verification testing. Take samples for verification from randomly spaced locations, determined by the engineer, throughout the project length. The engineer will take immediate possession of the verification samples. Also provide approximately 10 pounds of the selected cementitious material to the District laboratory. Provide materials for verification testing at no cost to the Department.

Submit all design data used to determine the recommended cement rate to the District Laboratory Engineer for approval. Prior to approval of the design, the District Laboratory will perform verification testing. Verification testing by the District Laboratory will consist of molding, curing, and testing a minimum of three specimens in accordance with TR 432, at the percentage of cementitious material and at the optimum moisture determined by the contractor's laboratory. The recommended cement rate will be considered verified if test results indicate that the minimum strength and durability criteria as specified have been met and that the optimum moisture are within 2 percent of that submitted by the

contractor. Normal testing time for verification testing may require up to 21 calendar days. Do not begin construction operations until the design is approved.

**303.03 EQUIPMENT.** Furnish and maintain the equipment necessary to produce a finished base course meeting specification requirements. Equipment shall be approved prior to use. Pulverize using an approved in-place mixer.

Use an in-place mixer equipped with a spray bar that can apply water across the full width of the cut and be adjusted to prevent overlap of water on adjacent paths.

Distribute cement from transports using spreader bars approved by the engineer. The engineer may require the use of a cement spreader capable of width adjustment and equipped with a calibrated spreader box if a uniform cement spread cannot be achieved. The Department may verify the distribution of dry additives using DOTD TR 436, Method A. Perform initial compaction using a conventional sheepsfoot-type roller or a self-propelled tamping foot compactor-type roller. The spikes shall be sufficient in size and number to provide uniform compaction for the full width and depth of the base course. Perform finish rolling with a pneumatic tire roller.

**303.04 PREPARATION OF ROADBED.** Unless otherwise designated on the plans, remove all existing asphalt concrete surfacing except the bottom 1 inch in accordance with Section 509 prior to cement stabilization. During these removal and replacement operations, maintain the areas used by public traffic in a safe condition in accordance with 105.15. Scarify and pulverize materials to be stabilized for the full width and depth of the base course. Pulverize the remaining existing asphalt surfacing and uniformly mix it with materials below the surfacing.

Do not prepare roadbed in excess of 2 miles in advance of roadway base course stabilization or treatment. When approved by the project engineer, the 2-mile limit may be extended. However, when the 2-mile limit is extended, the lag between preparation of roadbed and base stabilization or treatment shall not exceed 5 working days. When stabilizing or treating shoulders separately from roadway base, the 2-mile limitation will not apply to shoulders.

Blend the scarified and pulverized material to achieve uniform blending. When existing material is not uniform across the full width to be stabilized, blend the material to form a uniform blend for the full width and depth of the

base course.

Scarify and pulverize the roadbed to at least 60 percent passing the No. 4 sieve in accordance with DOTD TR 431 prior to mixing with cement. Identify and remove existing concrete or asphalt concrete patches encountered during roadbed preparation operations. Remove patches and disposed of in accordance with 202.02.

After the roadbed has been prepared as specified above, shape the roadbed to the required section and uniformly compact the roadbed material to at least 93.0 percent of maximum dry density prior to mixing with cement. Determine maximum dry density in accordance with DOTD TR 415 or TR 418. Determine in-place density in accordance with DOTD TR 401. Correct areas which cannot be compacted to 93.0 percent of maximum dry density at no direct pay.

**303.05 MIXING.** The method of spread shall be such that the amount of cement used can be readily determined when tested in accordance with DOTD TR 436. Uniformly spread and mix cement with the material. Make a minimum of two passes with the mixer (stabilizer). Shape the mixture to the required section.

Add water as needed by means of the mixer and uniformly incorporate the mixture in amounts required to attain optimum moisture for the mixture. During the mixing process, add water only through the spray bar of the in-place mixer, adjusted to provide uniform coverage across the completed width of the roadway for the full depth of the base. Do not allow wet streaks or spots.

Determine optimum moisture of the mixture in accordance with DOTD TR 415 or TR 418. Do not allow the percentage of moisture, determined in accordance with DOTD TR 403, in the mixture by dry weight to vary from optimum moisture by more than  $\pm 2$  percent at the time of compaction.

**303.06 COMPACTING AND FINISHING.** Uniformly compact the mixture immediately upon completion of mixing to the specified depth and width shown in the plans. Complete initial compaction with an approved sheepsfoot-type roller or a self-propelled tamping foot compactor-type roller in such a manner that no internal laminations occur in the completed base course. Complete final compaction with a pneumatic tire roller.

Keep the surface uniformly moist during compacting and final finishing. Continue compaction until each lift of base course has met the requirements of 303.11.

At places inaccessible to rollers, such as edges adjacent to curb and gutter sections, compact the mixture using devices that will obtain the specified density without damaging adjacent structures.

Begin mixing operations within one hour of placement. Complete compaction and finishing operations within three hours after initial mixing of cement with base course materials. Upon expiration of the three-hour period after initial mixing, only intermediate finishing (tight blading) of the base course surface will be allowed. Dispose of excess bladed material. Do not drift bladed material along the base. Use stabilized or treated material in the base course except that small amount necessary for tight blading. Excessive blading, exceeding 10 percent of the base thickness, to achieve plan depth will not be allowed. Complete operations, including tight blading, within 24 hours of mixing. The finished base course shall have a smooth, uniform, closely-knit surface, free from ridges, waves, laminations, or loose material. Do not spread cement within two hours before sunset, unless otherwise approved by the project engineer.

**303.07 QUALITY CONTROL.** Control the preparation of roadbed, selection and placement of materials, cement spread, mixing, compaction, moisture content, density, thickness, width, surface finish, grade, and cross slope so that the completed base course is uniform and conforms to plan dimensions and other acceptance requirements as provided herein. Control operations so that contamination, segregation, soft spots, wet spots, laminations, and other deficiencies are prevented. Take such tests as necessary to adequately control the work.

**303.08 PROTECTION AND CURING.** Upon completion of final finishing, immediately protect the base against rapid drying by applying an asphalt curing membrane in accordance with Section 506. Maintain complete coverage of curing membrane from the initial application until the placement of the next course. When allowing traffic, including construction equipment, on the base course, place at least the first lift of surfacing within 30 calendar days unless otherwise directed.

**303.09 MAINTENANCE.** Protect the completed base course from damage due to either public traffic or the contractor's operations, and satisfactorily maintain the completed base course including asphalt curing membrane. Repair damaged base course at no direct pay. When requiring patching of the base course, in addition to removing damaged or unsound

base course, remove a sufficient width and depth of base course to ensure satisfactory placement of patching material. Submit the proposed type of patching materials to the engineer for review and comment before use. Complete patching or other repairs of the base course to restore a uniform surface, conforming to the requirements of the material used, prior to surfacing operations.

Do not allow public traffic or construction traffic on the completed base course for a 72-hour curing period. If conditions permit, route both public traffic and construction traffic off the completed base course onto shoulders or other suitable areas during the 72-hour curing period. Traffic may be permitted on the base course during the curing period, if conditions warrant and if approved by the engineer.

When permitting traffic to use the completed base prior to the construction of the surface course, further protect the base by additional applications of asphalt curing membrane in accordance with 302.10 as directed at no direct pay. Prior to surface course construction, clean the base course and apply and maintain additional asphalt curing membrane as directed at no direct pay.

Correct any weak spots that develop. Keep the base course free from deficiencies and true to grade and cross section at no direct pay. When the surfacing is asphalt concrete, place the first lift of surfacing within 30 calendar days.

**303.10 WEATHER LIMITATIONS.** Do not mix when the base course material is frozen, when raining, when the ambient air temperature is below 35°F, or the temperature forecasted by the U.S. Weather Service is to be 25°F or less within the 24-hour period following placement.

**303.11 ACCEPTANCE REQUIREMENTS.** The department will test soils and aggregates from samples taken after preparation of the roadbed.

Test cement spread rate in accordance with DOTD TR 436. Test the moisture content of the cement stabilized or treated mixtures for compliance with optimum moisture content in accordance with DOTD TR 403 at placement at least twice per day.

Test the pulverization of the prepared roadbed in accordance with DOTD TR 431, and must be at least 60 percent passing the No. 4 sieve.

Check the completed base course for determining acceptance in increments of 1000 linear feet per roadway or 2000 linear feet per shoulder constructed separately.

**303.11.1 Density Requirements:** Upon completion of compaction operations, determine in-place density in accordance with DOTD TR 401.

The density requirement as based on DOTD TR 415 or TR 418 shall be 95.0 percent of maximum dry density.

When the density test value for the section is below 95.0 percent, apply a payment adjustment in accordance with Table 303-1.

**Table 303-1  
Density Acceptance and Payment Schedule**

Density Test Value (percent)	Percent of Contract Unit Price
95.0 & Above	100
93.0 to 94.9	90
90.0 to 92.9	75
Below 90.0	50 or Remove <sup>1</sup>

<sup>1</sup> At the option of the Chief Engineer.

**303.11.2 Thickness Requirements:** Determine the thickness of the completed base course in accordance with DOTD TR 602.

The completed base course shall not vary from plan thickness in excess of the tolerances in Table 303-2 as follows. Base course thickness deficiencies in excess of these tolerances shall be corrected as specified herein at no direct pay.

**Table 303-2  
Base Course Thickness Tolerance**

Under-Thickness, Inches	Over-Thickness, Inches
$\frac{3}{4}$	$1\frac{1}{2}$

Isolate any failing area for purposes of correction. Correct base course thickness deficiencies in excess of the foregoing tolerances as follows.

When not permitting grade adjustments, correct thickness deficiencies by restabilizing or retreating with cement or removing and replacing the full depth of base course in deficient areas with one of the following materials:

1. Cement stabilized or treated base course.
2. Asphalt concrete complying with Section 502.
3. Concrete complying with Section 901.

When permitting grade adjustments, deficiencies may be corrected by furnishing and placing a supplemental layer of asphalt concrete complying with Section 502 for the full width of base course in lieu of removing and replacing deficient base course. When approved, corrections may be made

by restabilizing or retreating the existing material in accordance with this section and the cement content may be reduced from design contents with approval of the District Laboratory Engineer. Thickness of the supplemental layer of asphalt concrete shall be in accordance with Table 303-3 as follows.

**Table 303-3  
Supplemental Asphalt Concrete Layer Thickness**

Under-Thickness, Inch	Over-Thickness, Inch	Minimum Thickness of Supplemental Asphalt Concrete <sup>1</sup> , Inch
1 to 1 <sup>1</sup> / <sub>2</sub>	1 <sup>3</sup> / <sub>4</sub> to 2	1 <sup>1</sup> / <sub>4</sub>
1 <sup>3</sup> / <sub>4</sub> to 2	2 <sup>1</sup> / <sub>4</sub> to 2 <sup>1</sup> / <sub>2</sub>	1 <sup>1</sup> / <sub>2</sub>
2 <sup>1</sup> / <sub>4</sub> to 2 <sup>1</sup> / <sub>2</sub>	2 <sup>3</sup> / <sub>4</sub> to 3	2
Over 2 <sup>1</sup> / <sub>2</sub>	Over 3	Remove and Replace <sup>2</sup>

<sup>1</sup> May be placed with subsequent lift of asphalt concrete.

<sup>2</sup> At the option of the Department after investigation.

**303.11.3 Width Requirements:** Determine the width of the completed base course in accordance with DOTD TR 602. Do not exceed roadway base course plan width by more than 6 inches. Do not exceed shoulder base course plan width by more than 3 inches. Under-widths of shoulder or roadway bases are not allowed. When the base course for roadway and shoulders are constructed at the same time, the 6-inch width tolerance will be applied. Correct base course width deficiencies in excess of foregoing tolerances as follows at no expense to the Department.

**303.11.3.1 Over-Width:** When not permitting grade adjustments, the full depth and width of base course in isolated areas with over-widths in excess of the foregoing tolerances shall be re-stabilized or retreated full width with cement, and the cement content may be reduced from design contents with approval of the District Laboratory Engineer. Otherwise, remove and replace to the plan width with asphalt concrete complying with Section 502 or concrete complying with Section 901.

In lieu of removing and replacing over-width base course, allow areas of the deficient base course to remain in place at a payment adjustment of 90 percent of the contract unit price for the entire lot.

When permitting grade adjustments, correct base course width deficiencies by removing and replacing as specified above, or by furnishing and placing a 1<sup>1</sup>/<sub>4</sub>-inch thick supplemental layer of asphalt concrete complying with Section 502 for the full width of the roadway.

**303.11.3.2 Under-Width:** Correct under-widths of base course in excess of the foregoing tolerances to plan width by restabilizing or retreatment the full width with cement or by furnishing and placing additional materials; however, do not allow the width of the widening materials to be less than 12 inches. Materials used for widening the deficient base course shall be the same as specified for over-width correction in 303.11.3.1.

**303.11.4 Grade and Cross-Slope:** The finished grade shall be within  $\pm 1/2$  inch of the established grade. Do not allow the cross slope to vary by more than  $\pm 0.003$  foot/foot.

**303.11.5 Correction of Deficiencies:** Correct deficiencies in surface finish, grade, contamination, segregation, soft spots, wet spots, laminations, and other deficiencies at no direct pay. Correct deficiencies by removing and replacing or as directed.

**303.12 MEASUREMENT.** The quantity of in-place cement stabilized or treated base course for payment will be the design areas as specified in the plans and adjustments thereto. The design quantity is based on the horizontal dimensions of the completed base course shown on the plans. The design quantity will be adjusted if the engineer makes changes to adjust to field conditions, if design errors are proven, or if design changes are necessary.

Removal of existing patches will be measured by the square yard. This measurement will be determined and documented jointly by the contractor and project engineer. If including items in the contract, measurement will be in accordance with 109.04.

**303.13 PAYMENT.** Payment for in-place cement stabilized or in-place treated base course will be made at the contract unit prices per square yard, adjusted as specified in 303.11 and the following provisions, which include furnishing required portland cement, water, and asphalt curing membrane, and performing necessary roadbed preparation. Payment for removing all existing asphalt concrete surfacing will be made under section 509 except for the bottom 1 inch. No direct payment will be made for removal and disposal of the remaining bottom 1 inch of asphalt surfacing or maintaining the areas in safe condition for traffic.

If the actual required percent of cement differs from that required by the contract documents, payment will be increased or decreased based on the difference in required quantity of cement at the price of cement shown on paid invoices (total of all charges). The contractor shall provide copies of

paid invoices for this determination. If the contract documents do not specify a percent cement, 8 percent cement will be used for stabilized base course and 6 percent will be used for treated base courses for bid purposes.

Removal of existing patches will be paid at the contract unit price per square yard or if no item is provided, in accordance with 109.04. However, no payment will be made unless the contractor identifies the patches and participates in the measurement and documentation.

Payment adjustments will be applied for specification deviations of asphalt materials in accordance with Section 1002 based on the invoice price per gallon. The Materials and Testing Section will provide the payment adjustment percentage for properties of asphalt materials.

<b>Item No.</b>	<b>Pay Item</b>	<b>Pay Unit</b>
303-01	In-Place Cement Stabilized Base Course ___in Thick	Square Yard
303-02	Removal of Existing Patches	Square Yard
303-03	In-Place Cement Treated Base Course ___in Thick	Square Yard

## Section 304 Lime Treatment

**304.01 DESCRIPTION.** Construct one or more courses of a mixture of lime, soil, or soil-aggregate, and water in accordance with these specifications and Table 304-2, in conformity with the lines, grades, thickness and sections shown on the plans.

Lime treatment will be designated as Type B, C, D, or E. Use Type B for base or subbase. Use Type C for conditioning for cement treatment or stabilization. Use Type D for working table treatment under or within an embankment. Use Type E for conditioning and drying of subgrades under a base course.

**304.02 MATERIALS.** Materials shall comply with the following sections and subsections:

Emulsified Asphalt	1002
Water	1018.01
Lime	1018.02

Quality assurance requirements shall be as specified in the latest edition of the Department's publication titled *Application of Quality Assurance Specifications for Embankment and Base Course*.

Submit a dust control plan to address weather, sight clearance, operational procedures, traffic control, and any other project specific concerns. Failure to maintain sight clearance will result in the engineer stopping contractor operations.

The Department will identify dust sensitive areas in the plans. In these specific areas, the dust control plan must also include environmental requirements. In order to meet air quality standards, the contractor may be required to use central plant mixing, lime-slurry, or granular lime in dust sensitive areas at no direct pay.

**304.03 EQUIPMENT.** Furnish and maintain equipment necessary to produce a finished product meeting specification requirements. Use an approved in-place mixer meeting the requirements of 303.03 for Type B and C treatments. Use an approved in-place mixer meeting the requirements of 303.03 for Types D and E treatments unless the engineer allows other equipment.

**304.04 GENERAL CONSTRUCTION REQUIREMENTS.** Protect dry lime from moisture prior to use. Add water as needed during mixing and remixing operations, during the curing period, and to keep the cured material uniformly moist until covered.

When applying granular quicklime in dry form, take precautions to prevent injury to persons, livestock, and plants. Immediately collect quicklime spilled or deposited outside areas designated for treatment and bury or satisfactorily slake.

Do not apply lime on a frozen foundation or when the ambient air temperature is below 35°F.

**304.04.1 Type B Treatment:** Incorporate lime in the following sequence: Spread the lime; initially mix; water; seal and mellow for at least 48 hours; and then mix until pulverization requirements are met; compact; finish; and maintain in accordance with 304.09. Determine the percent of lime for Type B treatment in accordance with DOTD TR 416. After lime treatment, the treated soil shall have a maximum Liquid Limit of 40 and a maximum PI of 10.

**304.04.2 Type C Treatment:** Incorporate lime in the following sequence: Spread the lime; initially mix; water; seal and mellow for a minimum of 48 hours; then mix until pulverization requirements are met; compact; finish; and maintain. The percent of lime for Type C treatment will be as required by the plans or as directed.

**304.04.3 Type D Treatment:** Spread and mix one increment of lime with materials to be treated, water as required, and compact to the satisfaction of the engineer. The percent of lime for Type D treatment will be as required by the plans or as directed.

**304.04.4 Type E Treatment:** Spread and mix one increment of lime with materials to be treated and compacted, and finish in accordance with Section 203. Unless specified, determine the percent of lime for Type E treatment in accordance with DOTD TR 416.

**304.05 SPREADING AND MIXING.** Incorporate the specified percentage of lime. When not specified, the District Laboratory will determine the required percentage of lime in accordance with DOTD TR 416.

Use a unit weight of 35 pounds per cubic foot to compute the required application rate of hydrated lime or granular quicklime regardless of the actual unit weight of the lime used.

Furnish lime in bags or bulk and distribute in powder or granular form or as slurry in the required proportion. Prevent dry lime from blowing by adding water or by other suitable means.

Uniformly spread lime and mix with the soil to the width and depth shown on the plans or as directed. The Department will determine lime spread rate in accordance with DOTD TR 436. Discontinue any procedure that results in excessive loss or displacement of lime.

Process areas on the same day that lime application is made. Reject any lime not processed within 6 hours and lime lost or damaged before incorporation due to rain, wind, or other cause, and deduct from measured quantities. Replace all rejected lime. Payment will not be made more than once for lime treatment of a section of roadway.

**304.05.1 Type B Mixing:** After the 48-hour mellowing period, keep the lime treated mixture moist and manipulate with an in-place mixer until the pulverization requirements of 304.06 have been met.

**304.05.2 Type C Mixing:** After the 48-hour mellowing period, thoroughly manipulate the lime treated mixture with an in-place mixer to the satisfaction of the engineer. The mixture shall meet the pulverization requirements of 304.06 prior to subsequent stabilization or treatment with portland cement.

**304.05.3 Types D and E:** Mix with an in-place mixer unless the engineer approves other equipment.

**304.06 PULVERIZATION.** For Types B and C treatment, the pulverized mixture, when tested in accordance with DOTD TR 431, shall meet the gradation requirements in Table 304-1.

**Table 304-1  
Gradation Requirements for Types B & C Lime Treatment**

U. S. Sieve, Inches	Percent Passing By Weight
$\frac{3}{4}$	95
No. 4	50

Meet pulverization requirements for Type B and C treatments prior to final compaction and finishing.

### **304.07 COMPACTING AND FINISHING.**

**304.07.1 Type B:** After meeting the pulverization requirement, uniformly compact the mixture to at least 95.0 percent of maximum dry density. Determine the maximum dry density in accordance with DOTD TR 415 or TR 418 and in-place density in accordance with DOTD TR 401. Complete compaction and finishing operations within 6 hours after meeting pulverization requirements. The Department will perform one density test per 1000 linear feet of roadway (or 2000 linear feet) of shoulder constructed separately in accordance with DOTD TR 401.

At places inaccessible to rollers, such as edges adjacent to curb and gutter sections, compact the mixture using devices that will obtain uniform compaction to required density without damage to adjacent structures. Reconstruct any section not meeting the required density in accordance with these specifications at no direct pay. Reconstruction shall include the addition of the specified amount of lime.

The final finish shall meet grade and cross-slope requirements and shall have a smooth, uniform, closely-knit surface, free from ridges, waves, loose material, or laitance.

**304.07.2 Type C:** Shape and uniformly compact Type C lime conditioned materials to the required sections. Uniformly compact the mixture to at least 93.0 percent of maximum dry density. Determine the maximum dry density in accordance with DOTD TR 415 or TR 418 and in-place density in accordance with DOTD TR 401. When conditions, such as a yielding subgrade, make this impractical or detrimental, establish an optimum rolling pattern to the satisfaction of the engineer.

**304.07.3 Type D:** Uniformly compact and finish Type D lime treated materials to the satisfaction of the engineer. Make reasonable efforts to conform to the compaction requirements of 304.07.1. When conditions, such as a yielding subgrade, make this impractical or detrimental, establish an optimum rolling pattern to the satisfaction of the engineer.

**304.07.4 Type E:** Compact and finish Type E lime treated materials in accordance with Section 203.

When traffic conditions warrant, and an adequate rolling pattern has been established that demonstrates density has been achieved, the engineer may reduce density frequency testing requirements to expedite construction. A change in subgrade materials will require testing at the original frequency until a new rolling pattern is established.

**304.08 QUALITY CONTROL.** Construction methods shall prevent contamination, segregation, soft spots, wet spots, laminations, and other deficiencies. Perform such tests as necessary to adequately control the work. Construct a completed course that is uniform and conforms to the acceptance requirements.

**304.09 PROTECTION, CURING, AND MAINTENANCE.** Maintain these treatments to prevent damage to the lime treated layer as directed.

For Type B Treatment, protect the material against rapid drying for 72 hours by applying an asphalt curing membrane, complying with Section 506, after finishing operations have been completed. Place the application immediately following smooth rolling and maintain it adequately during the curing period. Maintain Type B Lime Treatment in accordance with 303.09.

**304.10 DIMENSIONAL TOLERANCES (TYPE B TREATMENT).**

**304.10.1 General:** The Department will check thickness and width of completed lime treated courses for acceptance in accordance with DOTD TR 602.

Delineate areas not meeting tolerances specified herein and correct to plan dimensions by scarifying, adding lime, remixing, and recompacting deficient areas at no direct pay.

**304.10.2 Thickness Requirements:** Do not allow under-thickness to exceed 3/4 inch and over-thickness to exceed 1 inch.

**304.10.3 Width Requirements:** Do not allow roadway base course width to vary from plan width in excess of +6 inches. Shoulder base course width shall not vary from plan width in excess of +3 inches. No under-widths are allowed for shoulder or roadway bases. When the base course for roadway and shoulders are constructed at the same time, the 6-inch width tolerance will be applied. Correct base course width deficiencies in excess of foregoing tolerances at no expense to the Department.

**304.11 MEASUREMENT.** Lime will be measured by the ton. When furnishing lime in bags, the number of bags used and the weight per bag will be used for measurement. When furnishing lime in bulk, the contractor shall furnish certified weights for each transport load.

The quantities of lime treatment for payment will be the design areas as specified on the plans and adjustments thereto. Design quantities are based on the horizontal dimensions of the completed lime treatment shown on the

plans. Design quantities will be adjusted if the engineer makes changes to adjust to field conditions, design errors are proven, or design changes are necessary.

Water and asphalt curing materials will not be measured for payment.

**304.12 PAYMENT.** Payment for lime will be made at the contract unit price per ton. If using quicklime in a slurry, payment will be made at the unit price for hydrated lime after converting the quicklime to the equivalent weight of hydrated lime by multiplying the weight of quicklime by 1.32 and then multiplying that product by the purity of the lime.

Payment for lime treatment will be made at the contract unit prices per square yard. Type B lime treatment will be adjusted as specified in Sections 506 and 1002 for specification deviations of asphalt curing membrane. The Materials and Testing Section will provide the payment adjustment percentage for properties of asphalt materials.

Payment will be made under:

<b>Item No.</b>	<b>Pay Item</b>	<b>Pay Unit</b>
304-01	Lime	Ton
304-02	Lime Treatment (Type B) ___ in Thick	Square Yard
304-03	Lime Treatment (Type C) ___ in Thick	Square Yard
304-04	Lime Treatment (Type D) ___ in Thick	Square Yard
304-05	Lime Treatment (Type E) ___ in Thick	Square Yard

**Table 304-2  
Types of Lime Treatment**

B	Base or Subbase	<ol style="list-style-type: none"> <li>1. One application of lime</li> <li>2. Initial mixing</li> <li>3. 48-hour mellowing or aging period</li> <li>4. Pulverization <sup>1</sup></li> <li>5. Density control</li> <li>6. Minimum thickness and width</li> <li>7. 72-hour cure with asphalt curing membrane</li> </ol>
C	Conditioning for Cement Treatment or Stabilization	<ol style="list-style-type: none"> <li>1. One application of lime</li> <li>2. Initial mixing</li> <li>3. 48-hour mellowing or aging period</li> <li>4. Pulverization <sup>1</sup></li> <li>5. Density control</li> <li>6. No cure required</li> </ol>
D	Working Table	<ol style="list-style-type: none"> <li>1. One application of lime</li> <li>2. Mixing <sup>2</sup></li> <li>3. Compact to engineer's satisfaction</li> <li>4. No cure required</li> </ol>
E	Conditioning and Drying (Subgrades Under a Base Course)	<ol style="list-style-type: none"> <li>1. One application of lime per lift</li> <li>2. Mixing <sup>2</sup></li> <li>3. Embankment construction requirements including density</li> <li>4. No cure required</li> </ol>

<sup>1</sup> In-place mixer shall be required.

<sup>2</sup> In-Place mixer shall be required unless the engineer approves other equipment.

## Section 305 Subgrade Layer

**305.01 DESCRIPTION.** Subgrade layer is primarily used for new roadway construction.

Treat subgrade soil materials with portland cement, portland-pozzolan blended hydraulic cement, or a combination of portland cement and lime, or construct a subgrade layer of stone, recycled portland cement concrete, blended calcium sulfate, or asphalt concrete in accordance with plan details or as directed. When requiring traffic to be placed on the completed, unsurfaced subgrade layer, or when the subgrade layer falls below natural ground, blended calcium sulfate will not be allowed. When not specified, the subgrade layer may be composed of any of the types of materials listed above, at the option of the contractor. Use the same subgrade layer throughout the project unless otherwise approved by the project engineer. The plans may limit the types of subgrade layer allowed.

These specifications set forth the minimum requirements for construction of the subgrade layer; however, construct a subgrade layer that will provide adequate support for construction equipment and processes.

Quality assurance requirements shall be as specified in the latest edition of the Department's publication titled *Application of Quality Assurance Specifications for Embankment and Base Course*.

Submit a dust control plan to address weather, sight clearance, operational procedures, traffic control, and any other project specific concerns. Failure to maintain sight clearance will result in the engineer stopping contractor operations.

The Department will identify the dust-sensitive areas on the plans. In order to meet air quality standards, the contractor may be required to use central plant mixing of cement or cement and lime treated mixtures in dust sensitive areas at no direct pay.

**305.02 MATERIALS.** Materials shall comply with the following sections and subsections:

Geotextile Fabric	203.11 & 1019
Asphalt Concrete	502
Portland Cement	1001.01
Blended Hydraulic Cement	1001.02
Emulsified Asphalt	1002
Stone	1003.01 & 1003.04.1

Recycled Portland Cement Concrete	1003.01 & 1003.04.1
Blended Calcium Sulfate	1003.01 & 1003.04.2
Water	1018.01
Lime	1018.02

Sample blended calcium sulfate in accordance with the requirements for stone in Section 302 of the *Materials Sampling Manual*.

Asphalt concrete shall meet the requirements of Section 502 base course.

When the contractor elects to use blended hydraulic cement, the rate of cement shall be determined in accordance with 303.02.1.3 at no expense to the Department. The design compressive strength criteria for cement treated subgrade layer shall be 100 psi as determined in accordance with DOTD TR 432, Method B or C.

**305.03 EQUIPMENT.** Furnish and maintain equipment necessary to produce a finished product meeting specification requirements. The equipment must be approved prior to use.

**305.04 CONSTRUCTION REQUIREMENTS.**

**305.04.1 Treated Subgrade Layer:** Materials to be treated shall be existing or placed under other pay items.

**305.04.1.1 Subgrade Soils:** Subgrade soils to be treated shall be no more than 79 percent sand or 69 percent silt, when tested in accordance with DOTD TR 407, and shall have a Plasticity Index (PI) not exceeding 35 when tested in accordance with DOTD TR 428. Do not blend to adjust the percents sand or silt for subgrade layers for Class I base course. Do not blend or treat to reduce PI.

**305.04.1.2 Treatment:** Treat subgrade soils by mixing with portland cement or a combination of portland cement and lime conditioning, and compact, finish, and cure. In-place treatment with portland cement shall be in accordance with Section 303. When central plant mixing is used, conform to Section 301. Treatment with lime shall be in accordance with Section 304 for Type C treatment. Use the minimum quantities of portland cement and lime in accordance with Table 305-1.

**Table 305-1  
Minimum Quantities of Portland Cement and Lime**

P. I.	Percent by Volume
0 – 15	6% cement
16 – 25	6% lime and 6% cement
26 – 35	9% lime and 6% cement

The engineer has the option of increasing or decreasing the percentages of cement and lime based on field conditions. The contract unit price for Subgrade Layer will be adjusted for the actual percentages of cement and lime required.

**305.04.1.3 Pulverization:** After treatment the pulverized mixture shall conform to the gradation requirements in Table 305-2 when tested in accordance with DOTD TR 431.

**Table 305-2  
Gradation Requirements for Treated Subgrade Layer**

U. S. Sieve, Inches	Percent Passing By Weight
$\frac{3}{4}$	95
No. 4	50

**305.04.2 Aggregate Surface Layer:** Unless otherwise specified, furnish stone or recycled portland cement concrete. Place the aggregate subgrade layer and compact, finish, and protect in accordance with Section 302.

If using an aggregate subgrade layer, furnish and place a Class D geotextile fabric to separate the aggregate subgrade layer from untreated soil.

**305.04.3 Asphalt Concrete Subgrade Layer:** Construct asphalt concrete subgrade layer in accordance with Section 502.

**305.04.4 Blended Calcium Sulfate:** Blend calcium sulfate with an approved aggregate prior to placement. Uniformly mix and sample the blended calcium sulfate material from dedicated stockpiles.

Add water or use other suitable means to prevent dust during the transport and placement of dry blended calcium sulfate.

Place, spread, and compact blended calcium sulfate to produce layers not exceeding 12 inches compacted thickness. Place each layer for the full

width, bring to optimum moisture content, and compact to at least 95 percent of maximum dry density before the next layer is placed. Determine optimum moisture and maximum dry density in accordance with DOTD TR 415 or TR 418 Method G, modified to include a maximum drying temperature of 140°F. Provide a forced draft type oven capable of maintaining the temperature for field moisture content determination for density control.

Do not place blended calcium sulfate within 10 feet of metal pipe.

Protect and cure blended calcium sulfate in accordance with 301.12.2.

**305.05 MEASUREMENT.** The quantities of subgrade layer for payment will be the design areas as specified in the plans and adjustments thereto. Design quantities will be measured in square yards based on the horizontal dimensions of the completed subgrade layer shown on the plans. Design quantities will be adjusted if the engineer makes changes to adjust to field conditions, plan errors are proven, or design changes are necessary.

DOTD TR 602 measurements for width and thickness will not be made, but the width and thickness will be checked by the engineer during construction.

When using aggregate, blended calcium sulfate, asphalt concrete, or central mixing, the removal of existing soil materials from the subgrade will not be measured for payment.

Geotextile fabric used beneath the subgrade layer will not be measured for payment.

**305.06 PAYMENT.** Payment for subgrade layer will be made at the contract unit price per square yard which includes lime, lime treatment, cement, cement treatment, water, stone, recycled portland cement concrete, blended calcium sulfate, asphalt concrete, geotextile fabric, and asphalt curing membrane or prime coat, subject to the payment adjustment provisions of Section 1002 for specification deviations of asphalt materials and 303.11.1 for density deficiencies of cement treated materials. Adjustments in pay for increase or decrease in the percent cement ordered by the engineer will be in accordance with 303.13. Adjustments in pay for increase or decrease in percent lime ordered by the engineer will be based on the price of lime shown on paid invoices (total of all charges). The Materials and Testing Section will provide the payment adjustment percentage for properties of asphalt materials.

Payment will be made under:

<b>Item No.</b>	<b>Pay Item</b>	<b>Pay Unit</b>
305-01	Subgrade Layer ___ in Thick	Square Yard

## **Section 306**

### **Scarifying and Compacting Roadbed**

**306.01 DESCRIPTION.** Scarify, shape, and compact existing roadbed to form a subbase or base course in accordance with these specifications, and in conformity with the lines, grades, depth, and cross-section shown on the plans or established.

Quality assurance requirements shall be as specified in the latest edition of the Department's publication titled *Application for Quality Assurance Specifications for Embankment and Base Course*.

**306.02 CONSTRUCTION REQUIREMENTS.** Scarify existing materials for the full width of roadbed and a minimum depth of 6 inches, shape to the required section, and uniformly compact to at least 95 percent of maximum dry density for subbase, and 98 percent for base, as determined in accordance with DOTD TR 401 and TR 415 or TR 418. Assure that the scarified, shaped, and compacted roadbed has a smooth, uniform, closely-knit surface, free from ridges, waves, depressions, or loose material. Do not scarify the roadbed in excess of one mile in advance of compacting the roadbed. Prime the compacted roadbed in accordance with Section 505.

**306.03 MAINTENANCE OF COMPACTED ROADBED.** Protect the compacted roadbed from damage due to either public traffic or construction operations, and maintain the roadbed in satisfactory condition at all times, including the asphalt prime coat. Repair all damage immediately at no direct pay.

**306.04 MEASUREMENT.** The quantities of scarifying and compacting roadbed for payment will be the design lengths or areas as specified in the plans and adjustments thereto. Design quantities are based on the horizontal dimensions of the roadbed shown on the plans. Design quantities will be adjusted when the engineer makes changes to adjust to field conditions, if plan errors are proven, or when design changes are necessary.

**306.05 PAYMENT.** Payment for scarifying and compacting roadbed will be at the contract unit price, which includes asphalt prime coat.

Payment adjustments will be applied for specification deviations of asphalt prime coat materials in accordance with Sections 505 and 1002. The Materials and Testing Section will provide the payment adjustment percentage for properties of asphalt materials.

Payment will be made under:

<b>Item No.</b>	<b>Pay Item</b>	<b>Pay Unit</b>
306-01	Scarifying and Compacting Roadbed ____ in Thick	Mile
306-02	Scarifying and Compacting Roadbed ____ in Thick	Square Yard

## **Section 307**

### **Permeable Bases**

**307.01 DESCRIPTION.** Construct a permeable asphalt base or permeable concrete base on a prepared subgrade in accordance with these specifications and in conformity with the lines, grades, thicknesses, and typical sections shown on the plans or as directed.

When including a permeable base in the contract, furnish either a permeable asphalt base or a permeable concrete base unless otherwise specified. Use the same type of base throughout the project unless otherwise specified on the plans or approved in writing.

The permeable asphalt base shall consist of a mixture of aggregate, polymer modified asphalt cement, and approved anti-strip additive. The permeable concrete base shall consist of a mixture of aggregate, portland cement, admixtures, and water.

**307.02 MATERIALS.** Materials shall comply with the following requirements.

**307.02.1 Aggregates:** The aggregates for both the permeable asphalt base and the permeable concrete base shall be 100 percent crushed stone conforming to the requirements of 1003.03.4.

**307.02.2 Asphalt:** The asphalt for asphalt treated permeable base shall be an approved polymer modified asphalt cement, or, complying with Section 1002. The percentage of asphalt cement shall be 2.0 percent to 4.0 percent by weight of the total mixture. Asphalt cement content and mixing process shall be such that all aggregates are visibly coated. The mixture shall retain 90 percent coating when tested in accordance with DOTD TR 317.

Submit a job mix formula for approval in accordance with Section 502.

**307.02.3 Anti-Strip Additive:** Use an Approved Materials List anti-strip additive complying with 1002.02.1 for the permeable asphalt base.

Add the anti-strip additive at the minimum rate of 0.5 percent by weight of asphalt and thoroughly mix with the asphalt cement at the plant. Additional anti-strip additive may be up to 1.2 percent by weight.

The proposed job mix formula shall indicate a single anti-strip additive rate, which is 0.1 percent greater than the percentage that will yield a minimum of 90 percent coating when tested in accordance with DOTD TR 317. The approved range shall be 0.2 percent by weight of asphalt, with the lower limit being the quantity determined in accordance with DOTD

TR 317 and the maximum limit not to exceed 1.2 percent by weight of asphalt.

**307.02.4 Permeable Portland Cement Concrete:** Use a Type I portland cement complying with Section 1001 for permeable concrete base.

Provide a minimum cement content of 235 pounds of portland cement per cubic yard of concrete. The water cement ratio of the mixture shall be not more than 0.37. Submit a mix design for approval in accordance with Section 901.

**307.02.5 Admixtures:** Admixtures for the permeable concrete base shall be from the Approved Materials List complying with 1011.02. The rate shall be as indicated in the Approved Materials List.

### **307.03 CONSTRUCTION**

**307.03.1 Permeable Asphalt Base:** Place the permeable asphalt base in accordance with Section 502. Compact with a minimum of three passes of a 5- to 10-ton smooth steel-wheel roller conforming to Section 503 until no further displacement is noted.

Place permeable asphalt base at a temperature between 200°F to 260°F when measured in the hopper of the paving machine. Begin compaction when the temperature of the permeable asphalt base has cooled to approximately 160°F and complete before the temperature falls below 100°F.

**307.03.2 Permeable Concrete Base:** Place the permeable concrete base by slip forming in accordance with Section 601 or by an asphalt concrete paver in accordance with Section 503. Compact by using vibrating screeds or plates as directed. No construction joints will be required.

Immediately after concrete placement, cure the permeable concrete base by covering the entire surface and exposed edges with white pigmented curing compound in accordance with 601.03.10.

**307.04 PROTECTION.** Protect the permeable asphalt and permeable concrete bases from severe weather conditions and contamination by dust, dirt, mud, or other fine grained material. Protect by an approved method from the time of placement until placement of the following pavement layer. Do not permit traffic on the permeable asphalt base or permeable concrete base. Equipment required to place the pavement will be allowed, provided that it enters and exits as near as possible to the paving operation. Repair all

damage to the permeable bases caused by the contractor's equipment at no direct pay.

Remove and replace at no direct pay all portions of the permeable bases that become contaminated to the extent that drainage is reduced or inhibited.

Cover the permeable bases with the pavement within 15 working days after placement.

**307.05 TOLERANCES.** The finished surface of permeable asphalt base and permeable concrete base shall be uniform and shall not vary at any point more than 0.05 foot above or below the established grade. The cross-slope shall not vary by more than  $\pm 0.003$  foot/foot.

Permeable asphalt base or permeable concrete base with a surface higher than 0.05 foot above the established grade shall be removed and replaced with permeable base which complies with these specifications or, when permitted, the high spots may be removed to within specified tolerance by any method that does not produce contaminating fines nor damage the base to remain in place. Grinding will not be permitted.

Permeable base with a surface lower than 0.05 foot below the established grade shall be removed and replaced with permeable base which complies with these specifications. When permitted, low areas not exceeding 1 inch shall be filled with subsequent roadway pavement at the time and in the same operation in which the pavement is placed at no direct pay.

**307.06 TESTING.** Before placing surfacing, core the permeable bases at the locations determined by the engineer in accordance with DOTD TR 602. All cores shall be taken in the presence of and given to the engineer for verification of base thickness.

**307.07 MEASUREMENT.** Permeable base will be measured by the square yard from the design quantities shown on the plans. Design quantities will be adjusted if the engineer makes changes to adjust to field conditions, plan errors are proven, or design changes are necessary. Determine design areas using the horizontal dimensions shown on the plans, the length being along the centerline of the base.

**307.08 PAYMENT.** Payment for permeable base will be made at the contract unit price per square yard, which shall include all materials, tools, incidentals and the performance of work necessary to complete these items.

Payment will be made under:

<b>Item No.</b>	<b>Pay Item</b>	<b>Pay Unit</b>
307-01	Permeable Base ___ in Thick	Square Yard

**Section 308  
Vacant**

## Section 309 In-Place Cement Treated Subgrade

**309.01 DESCRIPTION.** In-Place cement treated subgrade is primarily used for existing roadway reconstruction, typically for subgrade soils with a Plasticity Index (PI) not exceeding 20, unless otherwise specified. The design compressive strength criteria for in-place cement treated subgrade shall be 100 psi as determined in accordance with DOTD TR 432, Method B or C.

Treat subgrade soil materials with portland cement, blended hydraulic cement, or as directed. These specifications set forth the minimum requirements for construction of the treated subgrade; however, construct a treated subgrade that will provide adequate support for construction equipment and processes.

Submit a dust control plan to address weather, sight clearance, operational procedures, traffic control, and any other project specific concerns. Failure to maintain sight clearance will result in the engineer stopping contractor operations.

The Department will identify dust sensitive areas in the plans. In these specific areas, the dust control plan must also include environmental requirements.

Quality assurance requirements shall be as specified in the latest edition of the Department's publication titled *Application of Quality Assurance Specifications for Embankment and Base Course*.

**309.02 MATERIALS.** Materials shall comply with the following sections and subsections:

Portland Cement	1001.01
Blended Hydraulic Cement	1001.02
Water	1018.01

### **309.02.1 Determination of Cement Rate**

**309.02.1.1 Predetermined (Plan Specified):** For portland cement, mix the roadbed material with the rate of cement by volume as shown on the plans.

**309.02.1.2 Non-Predetermined:** If the percent cement has not been predetermined, the rate will be provided by the engineer. The District

Laboratory may determine the percent of cement by volume in accordance with DOTD TR 432, Method B or C from materials sampled in-place on the project from isolated random areas selected by the engineer. Depending on the materials to be treated, normal testing time to determine the required cement content may require up to 21 calendar days.

**309.02.1.3 Contractor Selected Cement Type:** When the contractor elects to use blended hydraulic cement the rate of cement shall be determined in accordance with 303.02.1.3 at no expense to the Department.

**309.03 EQUIPMENT.** Furnish and maintain equipment necessary to produce a finished product meeting specification requirements in accordance with 303.03. The equipment will be approved prior to use.

### **309.04 CONSTRUCTION REQUIREMENTS**

**309.04.1 Treatment and Pulverization:** Treat subgrade soils by mixing with portland cement in accordance with Section 303. Compact and finish treated materials in accordance with Section 203.

When traffic conditions warrant, and an adequate rolling pattern has been established that demonstrates density and pulverization as achieved, the engineer may reduce density frequency testing requirements to expedite construction. A change in subgrade materials will require testing at the original frequency until a new rolling pattern is established.

Make reasonable efforts to conform to the compaction requirements above. When field conditions make this impractical or detrimental, such as a yielding subgrade, establish an optimum rolling pattern to the satisfaction of the engineer. The engineer has the option of increasing or decreasing the percentages of cement based on field conditions. Determine optimum moisture of the mixture in accordance with DOTD TR 415 or TR 418. Increase the cement content by one percent by volume for every 3 percent of moisture content above optimum.

After treatment the pulverized mixture shall conform to the gradation requirements in Table 309-1.

**Table 309-1  
Gradation Requirements for In-Place Cement Treated  
Subgrade**

U. S. Sieve, Inches	Percent Passing by Weight
$\frac{3}{4}$	95
No. 4	50

**309.05 MEASUREMENT.** The quantities of in-place cement treated subgrade for payment will be the design areas as specified in the plans and adjustments thereto. Design quantities are based on the horizontal dimensions of the completed in-place cement treated subgrade shown on the plans. Design quantities will be adjusted if the engineer makes changes to adjust to field conditions, plan errors are proven, or design changes are necessary.

DOTD TR 602 measurements for width and thickness will not be made, but the width and thickness will be checked by the engineer during construction.

**309.06 PAYMENT.** Payment for in-place cement treated subgrade will be made at the contract unit price per square yard, which includes cement, cement treatment, and water. If the actual required percent of cement differs from that required by the contract documents, payment will be increased or decreased based on the difference in required quantity of cement at the price of cement shown on paid invoices (total of all charges). The contractor shall provide copies of paid invoices for this determination. If the contract documents do not specify a percent cement, 6 percent will be used for treated subgrades for bid purposes.

Payment will be made under:

<b>Item No.</b>	<b>Pay Item</b>	<b>Pay Unit</b>
309-01	In-Place Cement Treated Subgrade ___in Thick	Square Yard