Section 300
BASES AND SUBBASES

SECTION 301 (VACANT)

SECTION 302 - BITUMINOUS STABILIZED COURSE

302-1 DESCRIPTION. This work shall consist of furnishing and placing a course of bituminous stabilized granular material and stabilized reclaimed asphalt pavement shoulder in conformance with this specification, the payment lines, and typical sections shown on the plans or as specified by the Engineer.

302-2 MATERIALS

302-2.01 General. The Contractor has the following options in furnishing a bituminous stabilized course:

Option A. Furnish a granular material conforming to the requirements of Option A under §302-2.03, mixed with an asphalt emulsion conforming to §702-3201. Requests to use any asphalt emulsion other than that specified must be approved by the Director, Geotechnical Engineering Bureau. The written request must state the type of asphalt emulsion for the proposed use and be accompanied by a sample (one liter minimum) of such. The Geotechnical Engineering Bureau will require at least fourteen (14) days to act upon the request, after receipt of the request and the sample.

Option B. Furnish a 19, 25 or 37.5 mm hot mix asphalt (HMA), mixed and placed in conformance with the Materials and Construction Details specified in Section 402, Hot Mix Asphalt (HMA) Pavements, except as modified herein.

Option C. Furnish a granular material conforming to the requirements of Option C under §302-2.03, mixed with the appropriate P.G. Binder specified in the contract and placed in accordance with the requirements of Section 402 except as modified herein. The amount of P.G. Binder for this option will be as ordered by the Engineer, but shall range between 6 and 8 percent by weight. Unless otherwise indicated by a Special Note in the Proposal, this option will be permitted only in Nassau and Suffolk Counties.

Before any Bituminous Stabilized Course is prepared, the Contractor shall take one of the following two actions:

• Notify the Engineer in writing as to which option is selected to furnish material under. Only this option will then apply for the entire project unless written approval is received from the Engineer.
• Submit to the Engineer for approval, a plan of the project delineating the areas where each option will apply. Exceptions to the approved plan during the course of the work shall be subject to advance written approval by the Engineer.

302-2.02 Tests and Control Methods. Materials tests and quality control methods pertaining to the work of this Section will be performed in conformance with the procedures contained in the appropriate Department publications which are current on the date of advertisement for bids. These publications are available upon request to the Regional Director or the Director, Geotechnical Engineering Bureau.

302-2.03 Granular Material Requirements for Options A and C. All borrow sources of granular materials for Options A and C shall be managed in accordance with the applicable provisions of §203-3.16, Borrow.

A. Gradation Requirements. The material for Options A and C shall conform to Table 302-1.
§302

B. Soundness. Granular materials will be accepted on the basis of a Magnesium Sulfate Soundness Loss after 4 cycles of 20 percent or less, unless other values are specified by a Special Note in the Proposal.

<p>| Table 302-1 Gradation of Options A and C, Percent Passing by Weight |
|---------------------------------|---|---|---|---|---|---|---|</p>
<table>
<thead>
<tr>
<th>Gage Size</th>
<th>Option A</th>
<th>50 mm</th>
<th>25 mm</th>
<th>12.5 mm</th>
<th>6.3 mm</th>
<th>2.0 mm</th>
<th>425 µm</th>
<th>150 µm</th>
<th>75 µm</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>100</td>
<td>30-65</td>
<td>5-40</td>
<td>0-10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>100</td>
<td>85-100</td>
<td>65-85</td>
<td>55-75</td>
<td>20-40</td>
<td>5-18</td>
<td>4-12</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

C. Plasticity Index. The plasticity index shall not exceed 5.0 for the granular material unless otherwise stated in the Proposal by a Special Note.

302-3 CONSTRUCTION DETAILS

302-3.01 Weather Limitations for Option A. This work will not be permitted on a subbase or subgrade containing frost, nor when the temperature of the surface on which the mixture is to be placed is below 7°C. All material placed under this section during any calendar year shall be mixed after March 1 of that year. No material shall be placed from the last Saturday of September to May 15, except with written permission of and under such special limitations and conditions as may be imposed by the Deputy Chief Engineer (Technical Services).

302-3.02 Equipment for Mixing Option A. All equipment for this work shall be subject to approval of the Engineer at all times. No work under this section will be permitted until all equipment and the processing facilities are established, inspected and approved.

Mixing shall be done with a rotating paddle shaft pugmill, providing suitable pressure-kneading action in mixing. Mixing by blading, shoveling and/or scooping will not be permitted.

The materials shall be mixed either at a central twin shaft pugmill mixing plant by the plant mix method, or on the roadbed (or some other area approved by the Engineer) by a traveling twin shaft pugmill, whichever equipment the Contractor elects to use.

The mixer shall be either a continuous or a batch type pugmill, designed to accurately proportion either by volume or by weight, so that when the granular material and bituminous material are incorporated in the mix, a thorough and uniform coating of the granular material will result. The pugmill mixer shall be provided with weighing, volumetric or other gauging equipment which shall be capable of providing accurate control at all times of the amount of granular material entering the mixer per time interval. The mixer shall be equipped to mechanically interlock the bituminous feed with the granular material feed, such that uniformity of the mixture is assured at all times. A water pump with meter shall be available to add water to the granular material, just prior to the addition of the bituminous material.

The mixer shall be equipped with a positive displacement meter for totalizing the quantity of bituminous material applied to the mixing chamber. A by-pass valve shall be placed on the bituminous line between the positive displacement meter and the spray bar in the pugmill to permit determination of the accuracy of the positive displacement meter. The Contractor shall furnish a clean 208 L drum having one end completely open, and a length of flexible hose to permit filling from the by-pass valve on the bituminous line.

Traveling pugmill mixing equipment shall not be operated at speeds greater than those recommended by the manufacturer for the depth of treatment and quantity of material used.

Where the materials are mixed at a central twin shaft pugmill mixing plant, the pugmill mixing chamber shall extend at least 1.2 m beyond the last point where the granular material, binder, and water are fed into the mixer, so that all materials will be completely and thoroughly mixed in the pugmill for a distance of at least 1.2 m. The pugmill paddles shall be of a type adjustable for angular position on the shaft, and shall be reversible to allow retardation of the flow of the mixer, in order to control the mixing time. A dam or baffle, if approved in writing by the Director, Geotechnical Engineering Bureau may be used for the purpose of retarding flow. A mechanically operated discharge hopper of at least 0.75 m³
capacity shall be provided. Sufficient clearance for a ten wheel dump truck shall be provided beneath the discharge hopper to permit calibration.

302-3.03 Stockpiling and Sampling for Option A. Before mixing with the bituminous material, the granular material shall be stockpiled, sampled and tested for approval as stipulated in §302-2.02.

302-3.04 Mixing for Option A. The proportion of bituminous material that shall be mixed with the granular material will range between 80 L/m$^3$ and 95 L/m$^3$ loose (uncompacted) measure. The actual proportion within this range, however, shall not be less than that determined by the Geotechnical Engineering Bureau and specified by the Engineer after the stockpiled granular material is sampled and tested. In computing the rate of application, the loose measure volume shall be determined by level filling a truck, having a minimum capacity of 6 m$^3$, with granular material. No mixing will be allowed until the temperature of the granular material is 7°C or higher.

The moisture content of the granular material, based on the material passing 19.0 mm sieve, just prior to the addition of the bituminous material, shall be in the range of 4 to 8 percent. The acceptable moisture content within this range shall be determined by the Engineer.

All granular material removed from stockpiles for introduction into continuous twin shaft or traveling twin shaft pugmill mixers shall be by side excavation for the full height of the stockpile unless otherwise approved in writing by the Director, Geotechnical Engineering Bureau.

If mixed in a traveling plant, the method of transporting and introducing granular material from approved stockpiles into the mixer shall be as approved by the Engineer.

The application temperature of the bituminous material shall be designated by the Engineer and within the range specified in §702 for the bituminous material used.

After the granular material and bituminous material have been introduced into the pugmill, the mixing shall continue for a length of time necessary to uniformly coat the particles and to obtain a homogeneous mixture.

The discharge gates in a central plant shall not remain open during production of the stabilized mixture and shall only be opened in order to empty the hopper after the hopper becomes full. The discharged mixture may be immediately transported directly to the grade or stockpiles for later use.

The material shall be transported to the stockpile by dump truck haul. If the Contractor wishes to utilize a method other than dump truck haul to construct stockpiles, a request shall be submitted to the Director, Geotechnical Engineering Bureau. The request shall include the proposed method and type of equipment to be used.

Approval, if granted, will be based on the opinion of the Director, Geotechnical Engineering Bureau as to the capabilities of the proposal to provide a stockpile of uniformly mixed, uncontaminated material. If granted, such a waiver will remain in force only so long as all conditions for which the waiver is granted remain unchanged and a satisfactory material results.

302-3.05 Transporting, Spreading, Compacting and Finishing of Option A. If a central mixing plant is used, the mixture shall be transported from the mixing plant or stockpiles to the point of use in pneumatic tired vehicles, having tight bodies previously cleaned of all other materials. Approved mechanical spreading equipment shall be used for placing.

The mixture shall be spread in a thickness sufficient to produce the final compacted thickness shown on the plans. The maximum compacted thickness of any layer shall not exceed 100 mm.

After spreading, the mixture shall not be compacted until properly cured. Adequate curing shall be the responsibility of the Contractor, who shall take into account all factors, including weather and time of the year. Material that cannot be properly and adequately compacted to a stable condition shall be removed and replaced at no expense to the State. Compaction of the course shall be in accordance with the applicable provisions of §402-3.07, Compaction.

Successive layers shall not be placed until the underlying layer has been satisfactorily compacted and approved by the Engineer.

302-3.06 Traffic. The movement of highway traffic and construction equipment over this course may be permitted at locations designated by and in a manner under such restrictions as are ordered by the Engineer. Any damage occurring to the course as a result of traffic shall be repaired at no expense to the State as ordered by the Engineer.
§302

302-3.07 Care of Adjoining Pavement. Where this course constitutes a base course for a shoulder, the Contractor shall organize the work and conduct the various operations so as to keep the surface of the adjacent pavement clean at all times, or shall bear the full expense of cleaning the pavement as ordered by the Engineer.

302-3.08 Tolerance. Where used as a base course supporting other pavement courses, the final surface elevation of this course shall not vary more than 6 mm above or below the design grade elevation at any location.

Where used as a shoulder base course, the surface elevation of this course shall not vary more than 6 mm above or below, true grade at any location.

302-3.09 Maintenance. The Contractor shall be required to maintain the bituminous stabilized course in good condition and in a manner satisfactory to the Engineer from the time work is begun until all work has been completed and accepted. Maintenance by the Contractor shall include immediate repairs of any defects, regardless of cause, that may occur.

302-3.10 Repairs. Repairs to the bituminous stabilized course shall be made in a manner that will assure restoration of a uniform surface and durability of the part repaired. A stabilized course that is either faulty, damaged or with low areas shall be repaired by replacing the stabilized course material to the full depth of treatment. When the extent of damage is essentially at the surface of the course and where the areas are low, the Contractor may elect to repair the course with a surface application of an approved, suitable, top course bituminous concrete mix, in lieu of a full depth material replacement.

302-4 METHOD OF MEASUREMENT. The quantity of Bituminous Stabilized Course to be measured for payment, will be the number of cubic meters of compacted material computed from the payment lines shown on the plans, the specifications, or as ordered by the Engineer.

302-5 BASIS OF PAYMENT. The unit price bid per cubic meter shall include the cost of furnishing all labor, materials and equipment, including bituminous material and water necessary to complete the work.

Any work by the Contractor required for the maintenance or repair of bituminous stabilized course prior to acceptance of the contract, shall be done at the Contractor's expense.

**Payment will be made under:**

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>302.01</td>
<td>Bituminous Stabilized Course</td>
<td>Cubic Meter</td>
</tr>
</tbody>
</table>

SECTION 303 - OPTIONAL FLEXIBLE SHOULDER

303-1 DESCRIPTION. The work shall consist of furnishing and placing flexible shoulders where shown on the plans or where directed by the Engineer. The Contractor shall have the option of selecting from five (5) alternative flexible shoulder systems.

303-2 MATERIALS. Materials which shall be used and individual component course thickness are specified in the table below for the five (5) options:

| Table 303-1 Thickness of Courses (Millimeters) |
|-----------------|----------------|---------|---------|---------|---------|
| Material        | Option 1 | Option 2 | Option 3 | Option 4 | Option 5 |
| Asphalt Concrete Type 6, (Type 7 if Indicated on Plans) §403-2 | 25 | 25 | 25 | 75 | - |
| Bituminous Stabilized Course §302-2 (opt A or C) | 75 | - | - | - | - |
| Asphalt Concrete Type 3, Binder Course, §403-2 | - | - | 50 | - | 75 |
| Asphalt Concrete Type 1, Base Course, §403-2 | - | 75 | - | - | - |
| Subbase Course §304-2 | - | - | 25 | 25 | 25 |
Where the adjacent pavement is asphalt concrete and the new overlay surface course is 40 mm thick, then the thickness of the surface course of the shoulder may be increased to 40 mm and the course of Bituminous Stabilized Course (option 1), Type 1 Base Course (option 2), or Type 3 Binder Course (option 3) may be decreased by 15 mm.

Material requirements and quality control methods pertaining to this work shall be as required under Sections 302, 304, and 403 in conformance with the procedures contained in appropriate Department publications in effect on the date of advertisement for bids.

**303-3 CONSTRUCTION DETAILS.** The construction details shall be the same as those in Subsections 302-3, 304-3 and 403-3. Under options 3, 4 & 5, the Subbase Course material shall be placed at the same time as the underlying Subbase Course. For option 5, vibratory compaction equipment appearing on the current “Approved List - Bituminous Concrete Vibratory Compaction Equipment” shall be required if the entire 75 mm lift of asphalt concrete Type 3 is to be placed as a single lift. For option 4, the asphalt concrete shall be placed in two lifts.

**303-4 METHOD OF MEASUREMENT.** The quantity of Optional Flexible Shoulder shall be the number of square meters of satisfactorily completed shoulder computed from the payment lines on the plan or from revised payment lines established in writing by the Engineer.

**303-5 BASIS OF PAYMENT.** The unit price bid for this work shall include the cost of furnishing all labor, material and equipment necessary to complete the work.

When an asphalt concrete material is placed in one operation in both the shoulder and pavement area, a deduction from the weight delivered shall be made for the asphalt concrete placed in the shoulder. The quantity to be deducted will be determined by multiplying the computed volume of such material placed in the shoulder within the payment lines times a factor of 2.25 metric tons/cubic meter.

Payment will not be made for losses of material resulting from compaction, foundation settlement, erosion, or any other causes. The cost of such losses shall be included in the price bid for this item.

If the Contractor elects to use options 3, 4 or 5, the cost of the additional 25 mm of subbase course material necessary to bring the section to grade shall be included in the price bid for this item.

If there is an asphalt price adjustment provision in the contract, the adjustment to be made shall be computed assuming a conversion factor of one hundredth (0.01) of a metric ton of asphalt per square meter of Optional Flexible Shoulder.

**Payment will be made under:**

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>303.01</td>
<td>Optional Flexible Shoulder</td>
<td>Square Meter</td>
</tr>
</tbody>
</table>

**SECTION 304 - SUBBASE COURSE**

**304-1 DESCRIPTION**

**304-1.01 General.** The work consists of furnishing, placing and compacting a subbase course in conformity with the lines, grades, thicknesses and typical sections shown on the plans, or as determined by field conditions and ordered in writing by the Engineer.

**304-1.02 Optional Type.** Unless otherwise stated in the plans or in the proposal, select any of the four (4) options as follows:

- **Option A.** Subbase construction consisting of two (2) separate layers of Type 4 and Type 3 Subbase Course.

- **Option B.** Subbase construction consisting of a single layer of Type 1 Subbase Course.

- **Option C.** Subbase construction consisting of a single layer of Type 2 Subbase Course.

- **Option D.** Subbase construction consisting of a single layer of Type 4 Subbase Course.
§304

304-1.03 Definitions. Deleterious: Any material that does not consist of concrete, asphalt, glass, brick, stone, sand, gravel or blast furnace slag, when these materials are used in subbase in conformance with the specification requirements, OR any material which, in the opinion of the Director, Geotechnical Engineering Bureau, may adversely affect the performance of the product either during handling, during construction, or in its final application.

304-2 MATERIALS

304-2.01 Test and Control Methods. The Department will perform materials tests and quality control methods pertaining to the work of this section in conformance with the procedures contained in the appropriate Departmental publications which are current on the date of advertisement for bids. These publications are available upon request to the Regional Director or the Director, Geotechnical Engineering Bureau.

304-2.02 Material Requirements. Provide suitable material conforming to the requirements of Section 203 and to the requirements contained herein.

Provide a subbase material which meets the specification material requirements and is within the Contractor’s capabilities to place and fine grade to the required tolerances. Should the subbase course become unstable at any time prior to the placement of the overlying course, correct the unstable condition to the satisfaction of the Engineer at no additional cost to the State. Perform any required modification prior to placing the material on the grade.

If used, glass shall conform to the applicable paragraph of Section 203.

If Recycled Portland Cement Concrete Aggregate (RCA) is used and it comes from other than a Department of Transportation project, provide documentation showing that the material obtained is from a NYSDEC registered or permitted construction and demolition (C&D) debris processing facility as specified in Section 360-16.1 of 6NYCRR Part 360, “Solid Waste Management Facilities”.

If Blast Furnace Slag is to be used, provide documentation showing that it has undergone a NYSDEC beneficial use determination (BUD) prior to its use as specified in 6NYCRR Part 360-1.15, “Solid Waste Management Facilities”.

For Types 1, 3 and 4 furnish materials consisting of approved Blast Furnace Slag, Stone, Sand, and Gravel, or blends of these materials with not more than 30 percent by weight of glass. Alternately, the following materials are also acceptable under these types as a replacement for the materials mentioned above:

**Alternate A.** At least 95 percent, by weight, of Recycled Portland Cement Concrete Aggregate (RCA), and free from organic and other deleterious material. This material may contain up to 5% by weight asphalt and/or brick.

**Alternate B.** A mixture of Recycled Portland Cement Concrete Aggregate (RCA) conforming to Alternate A above mixed with stone, sand, gravel or blast furnace slag. This material may contain up to 5% by weight asphalt and/or brick.

**Alternate C.** Bituminous material that is reclaimed from bituminous pavement and/or shoulders (Reclaimed Asphalt Pavement, or RAP) on a project constructed by the Department of Transportation and is well-graded from coarse to fine and free from organic or other deleterious material, including tar. This material is at least 95 percent, by weight, reclaimed bituminous material and has a maximum top size, at time of placement, of 50 mm. The gradation requirements for the different Types listed below do not apply when the material consists of RAP. No soundness or Plasticity Index testing will be required for this Alternate.

If, in the opinion of the Regional Geotechnical Engineer, this material becomes unstable during construction, it may be necessary to add a mixture of natural suitable material to the RAP. Acceptance of the final product shall be based on an evaluation by the Regional Geotechnical Engineer.

Provide written documentation that the reclaimed bituminous material originated on a Department of Transportation project. Include an identifier, such as State Highway, Construction Contract or Departmental Project Identification Number (PIN).
For Type 2, furnish materials consisting of approved Blast Furnace Slag or of Stone which is the product of crushing or blasting ledge rock, or a blend of Blast Furnace Slag and of Stone.

A. Gradation. Gradation shall conform to Table 304-1.

<table>
<thead>
<tr>
<th>Sieve Size Designation</th>
<th>Type 1</th>
<th>Type 2</th>
<th>Type 3</th>
<th>Type 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 mm</td>
<td>-</td>
<td>-</td>
<td>100</td>
<td>-</td>
</tr>
<tr>
<td>75 mm</td>
<td>100</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>50 mm</td>
<td>90 - 100</td>
<td>100</td>
<td>-</td>
<td>100</td>
</tr>
<tr>
<td>6.3 mm</td>
<td>30 - 65</td>
<td>25 - 60</td>
<td>30 - 75</td>
<td>30 - 65</td>
</tr>
<tr>
<td>425 µm</td>
<td>5 - 40</td>
<td>5 - 40</td>
<td>5 - 40</td>
<td>5 - 40</td>
</tr>
<tr>
<td>75 µm</td>
<td>0 - 10</td>
<td>0 - 10</td>
<td>0 - 10</td>
<td>0 - 10</td>
</tr>
</tbody>
</table>

B. Soundness. Material for Types 1, 2 and 4 will be accepted on the basis of Magnesium Sulfate Soundness Loss after four (4) cycles of 20 percent or less, unless material meeting the requirements of Alternate C (304-2.02) is used. Material for Type 3 will be accepted on the basis of a Magnesium Sulfate Soundness Loss after four (4) cycles of 30 percent or less.

C. Plasticity Index. The required Plasticity Index of the material passing the 425 µm mesh sieve is 5.0 or less.

D. Elongated Particles. A flat or elongated particle is defined herein as one which has its greatest dimension more than three (3) times its least dimension. Provide material consisting of particles where not more than 30 percent, by weight, of the particles retained on a 12.5 mm sieve are flat or elongated. When the State elects to test for this requirement, material with a percentage greater than 30 will be rejected. Acceptance for this requirement will normally be based on a visual inspection by the Engineer.

304-2.03 Stockpiling. Stockpile all material except as noted herein.

A. Material furnished under Type 3 will not be required to be stockpiled unless it contains RCA or glass.
B. Stockpiling of the reclaimed bituminous material for Alternate C is not required.

Stockpile construction requirements, sampling, testing and acceptance/rejection procedures are stipulated in the appropriate Departmental publication.

304-2.04 Material for Temporary Work. Material used as a subbase for the construction of temporary work may be approved by a Departmental Geotechnical Engineer by visual inspection in accordance with the procedure in the current Departmental publication. Do not incorporate material so approved into the final project without following the appropriate acceptance procedure for the item of intended use.

304-3 CONSTRUCTION DETAILS

304-3.01 General. Notify the Engineer in writing of which placement option, material option (if applicable) and/or material type is proposed for use, at least 14 calendar days prior to performing the work. If it is proposed that more than one option or type is to be used, submit a plan to the Engineer describing where each option or type is proposed for use. This plan must be approved by the Engineer prior to incorporating it into the project. The State reserves the right to disapprove the use of more than one option on a project. Use uniform subbase types and materials between the roadbed limits.
§304-3.02 Placement

- Place the upper course material on the grade in a manner to minimize segregation, using equipment and procedures approved by the Engineer. Do not perform uncontrolled spreading from piles dumped on the grade.
- The maximum compacted layer thickness is 380 mm, or as shown on the plans. In confined areas as defined by the Engineer the maximum compacted layer thickness is 150 mm. The minimum loose lift thickness is 1.5 times the maximum particle size.
- Place Type 1 with a minimum compacted layer thickness of 150 mm.
- Do not place Type 3 material within 100 mm of the bottom of a pavement course.
- Do not place materials blended with glass in contact with synthetic liners, geogrids, geotextiles or other geosynthetics. Ensure that glass incorporated into subbase is thoroughly mixed so that glass constitutes no more than 30 percent by weight anywhere in the subbase.
- When placing material under Option A, place and compact each material in a separate lift.

304-3.03 Compaction. When the moisture content is within the limits for proper compaction, compact the material in accordance with the requirements of §203-3.12, Compaction. Density tests are not required for the acceptance of these courses.

If a subbase course is disturbed by frost action prior to paving, re-compact the subbase where directed by the Engineer.

304-3.04 Traffic and Contamination. The movement of highway traffic over the final surface of the subbase may be permitted at locations designated by, and under such restrictions as ordered by the Engineer, provided such movements take place prior to the final finishing of this course to the specified tolerance. Do not allow highway traffic to move over subbase containing glass. The movement of construction equipment on this course may be permitted at locations designated by and under such restrictions as ordered by the Engineer. At locations where permission is granted for such movement, place and maintain the temporary surface of the course, upon which the construction traffic is running, at least 50 mm above the final surface of the course. Just prior to paving and after all construction traffic not required for the removal has ceased, remove the 50 mm protective layer, and prepare and compact the exposed surface of the course to the specified tolerance.

No payment will be made for furnishing, placing, maintaining, removing and disposing of the 50 mm thick protective layer. Include the cost thereof in the price bid for Subbase Course.

If, in the opinion of the Engineer, the subbase is damaged or mixed with the subgrade or any other material due to the Contractor’s operation, remove such material and replace it with the appropriate subbase material at no additional cost to the State.

304-3.05 Tolerance. Place Types 1, 2 or 4 so that after compaction the top surface of the course does not extend more than six (6) mm above nor more than six (6) mm below true grade for the course at any location. Place Type 3 course so that the finished surface does not extend above the true grade and surface for this course at any location.

304-4 METHOD OF MEASUREMENT

304-4.01 Subbase Course. The quantity is the number of cubic meters of material, computed from payment lines shown on the plans or, where changes have been ordered, from payment lines established by the Engineer.

304-5 BASIS OF PAYMENT

304-5.01 Subbase Course. The unit price bid for this work includes the cost of furnishing all labor, material and equipment necessary to complete the work. Include the cost of adding water in the price bid unless the items for furnishing and applying water are included in the contract. No direct payment will be made for losses of material resulting from compaction, foundation settlement, erosion, or any other cause. Include the cost of such losses in the price bid for this item. No deductions will be made for the volumes occupied by manholes, catch basins and other such objects.

No additional payment will be made for the protective layer, as stated in 304-3.04.
Progress payments will be made after the subbase course has been properly placed and compacted. Payment will be made at the unit price bid for seventy-five (75) percent of the quantity. The balance of the quantity will be paid for after the final finishing to the required tolerance and just prior to the placing of the next course.

**Payment will be made under:**

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>304.11</td>
<td>Subbase Course, Type 1</td>
<td>Cubic Meter</td>
</tr>
<tr>
<td>304.12</td>
<td>Subbase Course, Type 2</td>
<td>Cubic Meter</td>
</tr>
<tr>
<td>304.13</td>
<td>Subbase Course, Type 3</td>
<td>Cubic Meter</td>
</tr>
<tr>
<td>304.14</td>
<td>Subbase Course, Type 4</td>
<td>Cubic Meter</td>
</tr>
<tr>
<td>304.15</td>
<td>Subbase Course, Optional Type</td>
<td>Cubic Meter</td>
</tr>
</tbody>
</table>

SECTIONS 305 AND 306 (VACANT)

SECTION 307 - HYDRATED LIME STABILIZED SUBGRADE

307-1 DESCRIPTION. Hydrated lime stabilized subgrade shall consist of the in-place subgrade soil mixed uniformly with hydrated lime and moistened, compacted and cured in accordance with these specifications, the plans and as specified by the Engineer.

307-2 MATERIALS

307-2.01 Lime Stabilization. Materials for lime stabilization shall meet the requirements of the following:

- Water: 712-01
- Hydrated Lime: 712-04

Hydrated lime which has slaked prior to mixing, for any reason, shall not be incorporated in the work.

307-2.02 Surface Treatment. When a surface treatment is required to protect the completed lime stabilized course as specified in §307-3.11, the materials for surface treatment shall meet the following requirements:

- Asphalt Emulsion - (RS-2): 702-3101
- Coarse Aggregate - 1A size: 703-02

307-3 CONSTRUCTION DETAILS

307-3.01 Equipment. No work will be permitted until all necessary equipment is on hand, inspected and approved by the Engineer.

**A. Scarifiers.** A grader-scarifier, heavy disc harrow, heavy plow or rotary pulverizing mixer shall be used for the initial scarification of the soil. The equipment shall be capable of scarifying the soil to the full depth of stabilized treatment.

**B. Mixers.** A rotary pulverizing mixer or heavy plow shall be used for all mixing of the hydrated lime with the subgrade soil. The use of a heavy plow will be permitted only if the rotary pulverizing mixer is not capable of adequately mixing the lime-soil mixture to the full depth of treatment. Rotary mixers shall be equivalent to the Seaman Duo-Stabilizer Model DS730 or the Brothers Master Mixer Model LSPRM84A.

**C. Lime Spreaders.** Spreading equipment shall be capable of uniformly distributing the lime without excess loss and at a specified rate.
D. **Compactors.** Compaction equipment shall be selected as specified in §203-3.12, Compaction.

E. **Shaping.** Shaping of the stabilized course shall be accomplished with a motor-grader or equivalent equipment capable of shaping the surface to the required tolerances specified.

F. **Finish Rolling.** A smooth steel wheel tandem roller weighing between 7 to 9 metric tons shall be used for the finish rolling.

G. **Water Equipment.** Water shall be added to the soil with a pressure distributor or other suitable equipment capable of uniformly distributing the required amount.

307-3.02 **Weather Limitations.** Lime stabilization of the subgrade shall not be done when the subgrade temperature is below 5°C, nor in the period from October 15 to May 15, except by written permission of and under such special limitations as set forth by the Deputy Chief Engineer (Technical Services). The hydrated lime shall not be mixed with frozen subgrade soil or when the subgrade contains frost. Lime shall not be applied when wind conditions, as determined by the Engineer, are such that blowing lime becomes objectionable or hazardous to traffic, workers, and adjacent property owners.

307-3.03 **Protection and Safety.** Before lime is spread, the Contractor shall take necessary precautions and provide necessary equipment to protect all personnel and adjacent properties from lime dust created by the lime application and mixing operations. Safety goggles and lightweight filter masks shall be provided by the Contractor to all working personnel and shall be worn at all times during these operations.

307-3.04 **Preparation of Foundation.** Prior to the addition of any lime to the subgrade, the area to be stabilized shall be graded and shaped in close conformity to the typical sections, lines and grades as shown on the plans or as specified by the Engineer. Where the depth of lime stabilization exceeds 150 mm, the subgrade soil in excess of the 150 mm depth shall be removed, placed in windrows and processed as an additional lift.

307-3.05 **Scarifying.** The subgrade soil shall be scarified 150 mm deep to the width required for stabilization. The scarified material shall be partially pulverized by making one pass through the area with a pulverizing rotary mixer. The pulverizing portion of the scarifying operation may be deleted in some areas, where, as determined by the Engineer, the subgrade soils are excessively wet and sticky so that pulverizing with a rotary mixer is impractical.

307-3.06 **Application of Lime.** The hydrated lime shall be applied to the scarified material by an approved method and at the rate stipulated in the plans or as specified by the Engineer. A lime slurry, applied by an approved method and suitable equipment, will be permitted. Spreading equipment shall uniformly distribute the lime without excess loss. No equipment except that used for spreading and mixing shall be permitted to pass over the spread lime until it is mixed. The Engineer may require the spread lime to be sprinkled with water to reduce dusting.

307-3.07 **Primary Mixing.** After the required amount of lime has been uniformly spread, it shall be mixed into the subgrade to the full depth of treatment using a traveling rotary mixing machine or heavy plow. A minimum of three passes will be required to assure uniform incorporation of the hydrated lime. Water shall be added at the rate of up to 2000 L/metric ton of lime as required for the proper consistency.

The primary mixing operation shall be completed within four hours after application of the lime. At this time, all of the lime shall be thoroughly and uniformly incorporated into the subgrade to the full depth of treatment in such a manner that the result is a homogeneous, friable mixture of subgrade soil and lime, free from clods or lumps exceeding 50 mm in size. Where the required depth of stabilization exceeds 150 mm, the windrowed material in excess of the 150 mm depth shall be spread to the required lift thickness and processed, by the addition of lime and primary mixing, as specified for the first layer. Each additional layer, where required, shall be processed similarly.
Immediately after the primary mixing operations are completed for the full depth of treatment, the surface of the subgrade shall be shaped and lightly sealed with a pneumatic tired or smooth steel wheel roller. The surface shall be crowned so as to properly shed water if rain occurs.

307-3.08 Curing. Following primary mixing operations, the stabilized course shall be allowed to cure for at least 24 hours plus any additional time required for the lime to properly react with the subgrade soil. Curing periods in excess of 24 hours shall be as determined and specified by the Engineer. During the curing period, the surface of the material shall be kept moist to prevent drying and cracking, and maintained in a properly sealed and crowned condition as specified by the Engineer.

307-3.09 Secondary Mixing. Immediately after the completion of the curing period, the stabilized course shall again be completely mixed and pulverized to the full depth of stabilization by a rotary pulverizing mixer. Secondary mixing shall continue for at least three passes or until, as determined by the Engineer, the material is properly mixed and blended. Adjustments in water content shall be made during the secondary mixing operation to obtain the proper moisture content required for compaction.

307-3.10 Compaction, Shaping and Finishing. Compaction of the mixture shall begin immediately after completion of the secondary mixing operations and after the proper moisture content for compaction has been obtained. Compaction shall be in accordance with the requirements of §203-3.12, Compaction. After compaction and shaping, the surface of the course shall be finished-rolled by a smooth steel wheel tandem roller weighing between seven and nine metric tons. The secondary mixing, compaction, shaping and finishing operations shall be completed within eight hours after the start of the secondary mixing.

The surface of the finished stabilized subgrade course shall not extend above design grade at any location.

The thickness of the complete hydrated lime stabilized subgrade will be determined from measurements made in test holes located at random intervals not to exceed 150 m. The measured thickness shall not deviate from that shown on the plans or specified by the Engineer, by more than plus 40 mm or minus 25 mm. Areas of hydrated lime stabilized subgrade not meeting the specified thickness requirements shall be reconstructed.

The subbase course material shall be placed and compacted within two days after the lime stabilized subgrade course has been compacted, shaped and finished at that location. The surface of the treated subgrade shall be kept continuously moist up to the time of subbase material placement.

307-3.11 Surface Treatment Option. The Contractor may elect to defer placement of the subbase materials up to two weeks by placing a bituminous membrane, cationic asphalt emulsion, over the treated subgrade. The bituminous membrane must be placed within two days after the stabilized subgrade has been compacted and finished. The stabilized subgrade must be kept continuously moist prior to application of the bituminous membrane. The bituminous material shall be applied at a uniform rate 0.9 L/m² of treated subgrade. Where traffic is to operate on the treated subgrade, the bituminous membrane shall be chipped with a uniform coating of Size 1A aggregate applied at a rate of 8 kg/m² of treated subgrade.

307-4 METHOD OF MEASUREMENT

307-4.01 Hydrated Lime Stabilized Subgrade. The quantity of hydrated lime stabilized subgrade to be paid for will be the number of cubic meters of lime stabilized computed within the payment lines shown on the plans or otherwise specified in writing by the Engineer.

307-4.02 Furnishing and Applying Hydrated Lime. The quantity of hydrated lime to be paid for will be the number of metric tons of hydrated lime furnished and applied. Lime that has slaked prior to application and additional lime applied because of reduced lime content resulting from excessive thickness of the lime stabilized layer will not be measured for payment.
307-5 BASIS OF PAYMENT

307-5.01 Hydrated Lime Stabilized Subgrade. The unit price bid per cubic meter shall include the cost of furnishing all labor, equipment and materials necessary to complete the work, except that furnishing and applying water and hydrated lime will be paid for separately. No payment will be made for the asphalt emulsion or 1A stone chips, nor for any maintenance, repairs or reconstruction of the stabilized subgrade made before acceptance, nor for any losses of material which may result from compaction, erosion or any other causes.

307-5.02 Furnishing and Applying Hydrated Lime. The unit price bid for hydrated lime shall include the cost of all material, labor and equipment necessary to furnish, store, handle and apply hydrated lime in accordance with these specifications.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>307.01</td>
<td>Hydrated Lime Stabilized Subgrade</td>
<td>Cubic Meter</td>
</tr>
<tr>
<td>307.02</td>
<td>Furnishing and Applying Hydrated Lime</td>
<td>Metric Ton</td>
</tr>
</tbody>
</table>

SECTION 308 - SOIL CEMENT COURSE

308-1 DESCRIPTION. This work shall consist of furnishing and placing a course of Portland cement stabilized soil in accordance with these specifications and in reasonably close conformance to the lines, grades, and typical sections shown on the plans or as ordered by the Engineer.

308-2 MATERIALS. Materials used for this item shall conform to the following Sections of these Specifications:

- Portland Cement, Type 2 701-01
- Asphalt Emulsion (RS-2) 702-3101
- Coarse Aggregate - 1A size 703-02
- Water 712-01
- Calcium Chloride 712-02

Soil shall be graded from coarse to fine, free of topsoil, organic matter, and substances deleterious to the normal hardening of the soil cement mixture, and shall be subject to the approval of the Engineer at all times. The soil will be sampled by the Engineer prior to use and submitted to the Geotechnical Engineering Bureau to determine both its suitability and the cement content to be used. Frozen soil or soil containing frost shall not be used.

The soil material shall be stockpiled, sampled and tested before mixing in conformance with material tests and quality control methods contained in the appropriate Department publications which are current on the date of advertisement for bids. These publications are available upon request to the Regional Director or the Director, Geotechnical Engineering Bureau.

308-3 CONSTRUCTION DETAILS

308-3.01 Equipment. No work under this item will be permitted until all equipment and facilities involved are established, inspected and approved by the Engineer.

The materials shall be mixed in a central twin-shaft pugmill mixing plant or mixed on the roadbed by a traveling pugmill, whichever equipment the Contractor elects to use. Traveling pugmill mixing equipment shall not be operated at speeds greater than those recommended by the manufacturer for the depth of treatment and quantity of materials to be mixed.

Where the materials are mixed in a central twin-shaft pugmill mixing plant, the mixing area of the pugmill shall extend at least 1.2 m beyond the last point where the soil, cement, or water are fed into the mixer, so that all materials will be completely and thoroughly mixed in the pugmill for a distance of at least 1.2 m. The paddles of the pugmill shall be adjustable for angular position on the shaft, and shall be reversible to retard the flow of mixture in order to control the mixing time. Where the materials are mixed
§308

at a central twin-shaft mixing plant, a hydraulically or mechanically operated discharge hopper of at least 0.75 m³ capacity shall be provided. Sufficient clearance for a ten-wheel dump truck shall be provided underneath the hopper.

The central mixer shall be either a continuous or batch type pugmill, and shall be designed to accurately proportion the mix either by volume or by weight. The pugmill mixer shall be provided with weighing, volumetric or other gauging equipment, which shall be capable of providing accurate control at all times of the amounts of soil and cement entering the mixer per time interval. The mixer shall be equipped with a method of mechanically interlocking the cement feed with the soil feed so that uniformity of the mixture will be assured at all times. A water pump and meter arrangement shall be available for addition of water to the soil and cement. The water supply line shall have a 90° T connection with a valve immediately downstream of the flow meter for calibration purposes. The meter shall be calibrated at least once a year under the direction of Department personnel.

A smooth steel wheel roller and a self-propelled pneumatic tired or self-propelled vibratory compactor shall be used for compaction. The minimum number of passes shall be determined by the Engineer, after field tests, and shall be such as to produce the specified minimum density for the full depth of the course. Cleated or tracked equipment will not be permitted on the soil cement course. In areas inaccessible to pneumatic tired compactors, or where maneuvering space is limited, impact rammers and/or vibratory equipment may be used provided the required density is obtained.

Equipment suitable for storing, handling, weighing, measuring, proportioning, controlling and applying or spreading the cement shall be used.

Equipment suitable for accurately metering, controlling and applying the water shall be used. If a pugmill mixer is used, all necessary water for mixing shall be added in the pugmill. If a rotary mixer is permitted and used, water for mixing shall be added through a spray bar in the mixing chamber.

308-3.02 Weather Limitations. Soil Cement Course shall not be placed between October 15 and May 15 nor when the air temperature in the shade is 5°C or lower. Soil cement course shall not be placed upon a frozen surface.

308-3.03 Preparation of Foundation. Before soil cement operations are begun, the area upon which the soil cement course is to be placed shall be graded, shaped, and compacted as required in conformance with the grades, lines, thicknesses and typical sections shown on the plans or as ordered by the Engineer.

The subgrade and any preceding course shall be compact and suitable to support the construction and compaction equipment without settlement or displacement. Soft or yielding subgrade shall be corrected and made stable before the soil cement course is placed.

308-3.04 Application of Calcium Chloride and Cement. Where required by a Special Note in the Proposal, the specified quantity of calcium chloride ordered by the Engineer in flake form shall be uniformly added to the soil before adding the cement.

Portland cement, in the amount ordered by the Engineer, shall be added uniformly to the soil material. The amount of cement ordered by the Engineer will range generally between 8 percent and 10 percent by weight.

The percentage of moisture in the soil, at the time of cement application, shall not exceed the quantity that will permit a uniform mixture of soil and cement during mixing operations and shall not exceed the optimum moisture content for the soil cement mixture, as determined by the Engineer.

Where a traveling pugmill mixer is used, cement that has been displaced or removed from the windrow regardless of cause, shall be replaced before mixing is started, at the Contractor's expense.

308-3.05 Mixing and Spreading. Immediately prior to mixing, the soil shall have a minimum temperature of 5°C. After the cement has been applied to the soil, it shall be immediately mixed with the soil. Mixing shall continue until the cement has been thoroughly blended with the soil to prevent the formation of cement balls when the water is applied. Immediately after the soil and cement have been thoroughly mixed, the full amount of water shall be applied uniformly and mixing shall be continued until an intimate and homogeneous blend of soil, cement and water has been obtained.

When water application and mixing have been completed, the percentage of moisture in the mixture based on oven-dry weights, shall not be below, nor more than two percent above, the specified optimum moisture content determined by the Engineer.
In order to minimize segregation of the mix, the discharge gates shall be kept closed until the hopper is filled to at least one-half of its capacity. After the hopper is emptied, the gates shall be closed until the hopper is refilled. The material shall then be discharged into clean trucks and transported directly to the grade.

The soil cement shall be spread on an accepted subgrade or preceding course immediately after mixing. If mixed in a central plant, approved mechanical spreading equipment shall be used and not more than 30 minutes shall elapse between the time of mixing the cement and the start of the compaction operation.

In case of rain between the time of adding cement and final finishing, the Engineer shall be the sole judge of what areas involved are satisfactory and what areas are not acceptable. Areas not acceptable to the Engineer shall be removed to the full depth of the soil cement course and properly replaced at the Contractor's expense for all labor, materials and equipment involved.

308-3.06 Compaction. Prior to the beginning of compaction, the mixture shall be in a loose condition for its full depth on the subbase course. As an immediate continuation of mixing operations, and after an initial breakdown pass with a smooth steel wheel roller, the loose mixture then shall be uniformly compacted, by a self-propelled pneumatic tired or self-propelled vibratory compactor, to the specified density. All areas and portions of this course shall be thoroughly and uniformly compacted for the full thickness of the course to a minimum dry density of 95 percent of the maximum density. During compaction, water shall be applied to the surface as determined and ordered by the Engineer, to maintain the optimum moisture content.

308-3.07 Finishing. During the compaction operations, shaping will be required to obtain the required surface and cross-section. During shaping operations it may be necessary to lightly scarify and broom-drag the surface in order to remove ridges or depressions in excess of the permitted tolerance. The resulting surface shall then be rolled with a smooth steel wheel roller, weighing not less than nine metric tons, or pneumatic tire rollers, or both. The final rolling shall be done by a smooth steel wheel roller.

Several applications of water may be required to keep the surface at the proper moisture content, as ordered by the Engineer, during the finishing operation. Water shall be applied by the pressure spray bar method. Compaction and finishing shall be done in such a manner as to produce, in not longer than two and one-half hours after completion of mixing, a smooth, dense surface, free of surface compaction planes, cracks, ridges or loose material. Immediately after rolling, the surface of the course shall be tested for trueness, transversely and longitudinally. The finished surface of the course shall not extend above, nor be greater than 15 mm below, true grade and surface at any location. Surface finishing shall be completed in daylight hours.

Any portion of this course which has a density less than that specified shall be corrected or removed and replaced to its full depth to meet these specifications, at the Contractor's expense.

308-3.08 Construction Joints. At the end of each day's construction, a straight transverse and/or longitudinal construction joint shall be formed by cutting back into the completed work to form a true vertical face, which shall be properly maintained until the abutting section is completed.

308-3.09 Curing and Surface Treatment. After the soil cement course has been finished as specified herein, it shall be continually protected against drying by the application of water, until the bituminous seal is applied. At least 48 hours shall elapse between the completion of the finishing operations and the application of the bituminous seal.

At the time the bituminous seal is applied, the soil cement surface shall be dense, free of all loose and extraneous material, and shall contain sufficient moisture to prevent penetration of the bituminous material. Water shall be applied in sufficient quantity to fill the surface voids of the soil cement immediately before the bituminous seal is applied. The bituminous seal shall be uniformly applied to the surface of the completed soil cement at the rate of approximately 0.7 L/m² to 1.4 L/m² with approved heating and distributing equipment. The exact rate and temperature of application to give complete coverage without excessive run-off will be as determined and ordered by the Engineer. No traffic, nor placement of an overlying course, will be permitted over the soil cement course within five days from the application of the bituminous seal. Where this course is utilized for maintaining traffic, the application of the bituminous material shall be immediately followed by the application of approved cover aggregate of
1A size at the rate of 10 kg/m² to 16 kg/m². The aggregate will be broomed and rolled as ordered by the Engineer.

When the air temperature may be expected to reach the freezing point, sufficient protection from freezing shall be given the soil cement for seven days after its construction and until it has hardened to the satisfaction of the Engineer.

308-3.10 Traffic. No traffic or hauling equipment other than that necessary for sealing, chipping or for placing the next course will be permitted over this course, unless specifically permitted by a Special Note in the Proposal.

308-3.11 Maintenance. The Contractor shall be required, within the limits of the contract, to maintain the soil cement in good condition and in a manner satisfactory to the Engineer from the time he first starts work until all work has been completed and accepted. Maintenance by the Contractor shall include immediate repairs of any defects, regardless of cause, that may occur. This work shall be done by the Contractor at its own expense, and repeated as often as may be necessary to keep the course continuously intact. Repairs are to be made in a manner to insure restoration of a uniform surface and durability of the part repaired. Faulty and damaged work, regardless of cause, shall be replaced for the full depth of the course by the Contractor at its own expense. Any low areas, regardless of cause, shall be remedied by replacing the material for the full depth of the course and not by adding a thin layer of soil cement to the completed work.

308-4 Method of Measurement. The quantity to be paid for under this item will be the number of cubic meters of material computed within the payment lines shown on the plans or otherwise ordered in writing by the Engineer, and completed in accordance with the plans and specifications. The thickness of the surface treatment will not be included in the volume measured for payment.

308-5 Basis of Payment. The unit bid price per cubic meter for this item will include the cost of furnishing all labor, equipment and materials necessary to complete the work, except that furnishing Portland cement, calcium chloride (where required), bituminous material, water equipment and applying water, will be paid for separately under their respective items.

No direct payment will be made for any maintenance, repairs and replacements made before acceptance, nor for any losses of material which may result from shrinkage, compaction, foundation settlement, waste, overflow, erosion, leakage or any other causes: the cost of such will be included in the price bid for this item.

Payment will be made under:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>308.01</td>
<td>Soil Cement Course</td>
<td>Cubic Meter</td>
</tr>
</tbody>
</table>