AGGREGATE BASE AND SURFACE COURSE ITEMS
ITEM P-207 IN-PLACE FULL DEPTH RECLAMATION (FDR)
RECYCLED ASPHALT AGGREGATE BASE COURSE

DESCRIPTION

207-1.1 This item consists of a recycled asphalt aggregate base course resulting from the in-place full depth reclamation (FDR) of the existing pavement section (asphalt wearing surface and aggregate base), plus mechanical stabilization with additional aggregate or chemical stabilization with Portland cement, or asphalt emulsion, when shown on the plans.

MATERIALS

207-2.1 AGGREGATE. The FDR shall consist of materials produced by recycling (pulverizing and mixing) the existing asphalt pavement, aggregate base, subgrade, and any additional aggregate as necessary.

The FDR shall meet the gradation in Table 207-1, below.

TABLE 207-1. FDR GRADATION

<table>
<thead>
<tr>
<th>Sieve</th>
<th>Minimum Percentage by weight passing sieves</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-inch</td>
<td></td>
</tr>
<tr>
<td>1-1/2-inch</td>
<td>100</td>
</tr>
<tr>
<td>1-inch</td>
<td>90-100</td>
</tr>
<tr>
<td>No. 4</td>
<td></td>
</tr>
<tr>
<td>No. 200</td>
<td></td>
</tr>
</tbody>
</table>

a. Deleterious substances. Materials for aggregate base shall be kept free from weeds, sticks, grass, roots and other foreign matter.

b. Uniformity. The materials shall be thoroughly recycled (pulverized and mixed) to ensure a uniform gradation.

207-2.2 STABILIZATION.

a. Mechanical stabilization. Addition of corrective aggregate material to adjust gradation shall be equivalent to P-209 Crushed Aggregate Base Course.

b. Chemical Stabilization. Provide the specific chemical stabilization material designated in the Plans. Portland cement shall meet the requirements of AASHTO M 85. Emulsified asphalt cement shall meet the requirements of AASHTO M 140. Cationic emulsified asphalt shall meet the requirements of AASHTO M 208. Materials shall be handled, stored, and applied in accordance with all federal, state, and local requirements.

207-2.3 WATER. Water used in mixing or curing shall be from potable water sources. Other sources shall be tested in accordance with ASTM C1602 prior to use.

207-2.4 QUALITY CONTROL (QC) SAMPLING AND TESTING. The Contractor shall take at least two FDR samples per day of production in the presence of the Engineer to check the gradation. Sampling shall be per ATM 301. Material shall meet the requirements in paragraph 207-2.1. Samples shall be taken from the in-place, un-compacted material at random sampling locations according to ATM SP 4.

CONSTRUCTION METHODS

207-3.1 MILLING. The existing asphalt pavement shall be milled to the depth below surface grade shown on the plans.
207-3.2 CONTROL STRIP. The control strip shall be 12 feet in width and 300 feet in length. The Engineer will designate the location of control strips. The Contractor shall demonstrate, in the presence of the Engineer, that the materials, equipment, and construction processes meet the requirements of the specification. The sequence and manner of rolling necessary to obtain specified density requirements shall be determined. Control strips that do not meet specification requirements shall be reworked, re-compacted, or removed and replaced at the Contractor’s expense. Full operations shall not begin until the control strip has been accepted by the Engineer. Upon acceptance of the control strip by the Engineer, the Contractor shall use the same equipment, materials, and construction methods for the remainder of construction, unless adjustments made by the Contractor are approved in advance by the Engineer.

207-3.3 RECYCLING (PULVERIZATION AND MIXING). The asphalt pavement and aggregate base shall be recycled (pulverized and mixed) into a uniformly blended mixture to the depth shown on the plans. Add mechanical and chemical stabilization materials of the type(s) and in proportions shown on the plans to the mixture of asphalt pavement and aggregate base. All material over approximately 1-1/2 inches will be removed by the Contractor. The mixture shall be brought to the desired moisture content. The maximum lift thickness of the recycled aggregate base course material to be compacted is shown on the plans.

207-3.4 GRADING AND COMPACTION. Immediately upon completion of recycling (pulverization and mixing), the material shall be shaped and graded in accordance with the project plans. The Engineer will use ATM 412 to determine the density standard from the control strip. The recycled asphalt aggregate base course shall be compacted within the same day to an in-place density of 98 percent as determined by ATM 213. Compact the remainder of the project to not less than 98 percent of the density standard, in accordance with ATM 213. The number, type and weight of rollers shall be sufficient to compact the material to the required density.

207-3.5 FINISHING. The surface of the aggregate base course shall be finished by blading or with automated equipment designed for this purpose. If the top layer is 1/2 inch or more below grade, the top layer shall be scarified to a depth of at least 3 inches, new material added, and the layer blended and re-compact to bring it to grade. The addition of layers less than 3 inches shall not be allowed.

207-3.6 PROOF ROLLING. Compacted asphalt aggregate base course shall be proof rolled with a tandem axle dual wheel dump truck loaded to the legal limit with tires inflated to 80 psi in the presence of the Engineer. Soft areas that deflect greater than 0.5 inch or show permanent deformation greater than 0.5 inch shall be removed and reworked at the Contractor’s expense.

207-3.7 WEATHER LIMITATIONS. When weather conditions detrimentally affect the construction process and/or quality of the materials, the Contractor shall stop construction. Portland cement shall not be applied when wind conditions affect the distribution of the materials. Do not use any frozen material or compact on a frozen base. Construction shall not be performed unless the atmospheric temperature is above 35°F and rising or approved by the Engineer. When the temperature falls below 35°F, protect all completed areas against detrimental effects of freezing by approved methods. Correct completed areas damaged by freezing, rainfall, or other weather conditions to meet specified requirements.

207-3.8 MAINTENANCE. The asphalt aggregate base course shall be maintained in a satisfactory condition until the work is accepted by the Engineer. Equipment used in the construction of an adjoining section may be routed over completed sections of asphalt aggregate base course, provided that no damage results and equipment is routed over the full width of the completed asphalt aggregate base course. Any damage to the recycled asphalt aggregate base course shall be repaired by the Contractor at the Contractor’s expense.

207-3.9 SURFACE TOLERANCES. The finished surface shall be tested for smoothness and accuracy of grade. Any area failing smoothness or grade shall be scarified to a depth of at least 3 inches, reshaped and re-compacted by the Contractor at the Contractor’s expense.
a. **Smoothness.** The finished surface shall not vary more than 3/8-inch when tested with a 12-foot straightedge applied parallel with and at right angles to the centerline. The straightedge shall be moved continuously forward at half the length of the 12-foot straightedge for the full length of each line on a 50-foot grid.

b. **Grade.** The grade shall be measured on a 50-foot grid and shall be within +0 and -1/2 inch of the specified grade.

**207-3.10 ACCEPTANCE SAMPLING AND TESTING FOR DENSITY.** FDR base course will be accepted for density and thickness on an area basis. One (1) test for density and thickness will be made for each 1200 square yds. Sampling locations will be determined on a random basis in accordance with ATM SP 4.

a. **Density.** The Engineer will perform all density tests.

Each area will be accepted for density when the field density is at least 98 percent of the density standard of the FDR base course in accordance with ATM 412. The in-place field density will be determined in accordance with ATM 213, and ATM 213 will be used to determine the moisture content of the material. The machine will be calibrated in accordance with ATM 213. If the specified density is not attained, the area represented by the failed test must be reworked and/or recompacted and two additional random tests made. This procedure will be followed until the specified density is reached.

b. **Thickness.** The thickness of the base course shall be within +0 and -1/2 inch of the specified thickness as determined by depth tests taken by the Contractor in the presence of the Engineer for each area. Where the thickness is deficient by more than 1/2-inch, the Contractor shall correct such areas at no additional cost by scarifying to a depth of at least 3 inches, adding new material, and recompacted to grade. The Contractor shall replace, at his expense, base material where depth tests have been taken.

**METHOD OF MEASUREMENT**

**207-4.1** See GCP Section 90, and the following:

a. FDR asphalt aggregate base course, by the area of the finished top surface.

b. Emulsified asphalt, by the ton.

c. Portland cement, by the ton.

d. FDR asphalt aggregate base course, by Lump Sum. Chemical stabilization is subsidiary.

**BASIS OF PAYMENT**

**207-5.1** Payment will be made at the contract unit price, per unit of measurement, accepted in place. Corrective aggregate material, if required, will be paid under Item P-209.

Payment will be made under:

- P207.110.0000  FDR Asphalt Aggregate Base Course  per square yard
- P207.120.0000  FDR Asphalt Aggregate Base Course  per lump sum
- P207.130.0000  Emulsified Asphalt  per ton
- P207.140.0000  Portland Cement  per ton

**References**

ASTM C1602  Mixing Water Used in the Production of Hydraulic Cement Concrete
<table>
<thead>
<tr>
<th>Standard</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AASHTO M 85</td>
<td>Portland Cement</td>
</tr>
<tr>
<td>AASHTO M 140</td>
<td>Emulsified Asphalt</td>
</tr>
<tr>
<td>AASHTO M 208</td>
<td>Cationic Emulsified Asphalt</td>
</tr>
<tr>
<td>ATM 213</td>
<td>In-Place Density and Moisture Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth), FOP for AASHTO T 310</td>
</tr>
<tr>
<td>ATM 301</td>
<td>Sampling of Aggregates FOP for AASHTO T 2</td>
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<tr>
<td>ATM 412</td>
<td>Relative Standard Density of Treated Mixtures by the Control Strip Method</td>
</tr>
<tr>
<td>ATM SP 4</td>
<td>Random Sampling</td>
</tr>
</tbody>
</table>
ITEM P-209 CRUSHED AGGREGATE BASE COURSE [Reserved]
ITEM P-299 AGGREGATE SURFACE COURSE

DESCRIPTION

299-1.1 This item consists of an aggregate surface course composed of crushed or uncrushed coarse aggregate bonded with either soil or fine aggregate or both. It shall be constructed on a prepared course according to these Specifications and to the dimensions and typical cross section shown on the Plans.

MATERIALS

299-2.1 GENERAL. Aggregates shall consist of hard, durable particles or fragments of stone or gravel mixed or blended with sand, stone dust, or other similar binding or filler materials produced from approved sources. The aggregate shall be free from vegetation, lumps, or excessive amounts of clay and other objectionable substances. The coarse aggregate shall have a minimum degradation value of 45 when tested according to ATM 313. The aggregate shall have a percent of wear not more than 50 at 500 revolutions as determined by AASHTO T 96 and shall not show evidence of disintegration nor show loss greater than 12% when subjected to 5 cycles of sodium sulfate accelerated soundness test using AASHTO T 104.

a. Crushed Aggregate Surface Course. The aggregates shall consist of both fine and coarse fragments of crushed stone or crushed gravel mixed or blended with sand, screenings, or other similar approved materials. The material shall consist of hard, durable particles or fragments of stone and shall be free from excess soft or disintegrated pieces, dirt, or other objectionable matter.

The fractured particles in the finished product shall be as uniform as practicable. At least 75% by weight of material retained on the No. 4 sieve shall have one or more fractured faces, when tested according to ATM 305.

If necessary to meet this requirement, or to eliminate an excess of fine, uncrushed particles, the gravel shall be screened before crushing.

The fine, aggregate portion, defined as the portion passing the No. 4 sieve, produced in crushing operations, shall be incorporated in the base material to the extent permitted by the gradation requirements.

b. Uncrushed Aggregate Surface Course. This material may consist of natural pit-run aggregate. However, screening, blending, ripping, washing, and/or necessary mixing of the material or other processing may be necessary to meet the gradation and performance requirements of this specification.

299-2.2 GRADATION. The gradation of the uncrushed or crushed material shall meet the requirements of the gradations indicated in Table 1, when tested according to ATM 304.

<table>
<thead>
<tr>
<th>Sieve Designation (Square Openings)</th>
<th>Percentage by weight passing sieves For E-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0 in.</td>
<td>100</td>
</tr>
<tr>
<td>3/4 in.</td>
<td>70-100</td>
</tr>
<tr>
<td>3/8 in.</td>
<td>50-85</td>
</tr>
<tr>
<td>No. 4</td>
<td>35-65</td>
</tr>
<tr>
<td>No. 8</td>
<td>20-50</td>
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<tr>
<td>No. 50</td>
<td>15-30</td>
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<tr>
<td>No. 200</td>
<td>8-15</td>
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</tbody>
</table>
The specified gradations represent the limits of suitability of aggregate for use from the sources of supply. The final gradations decided on, within the specified limits, shall be well graded from coarse to fine and shall not vary from the low limit on one sieve to the high limit on the adjacent sieves, or vice versa.

The portion of the material passing the No. 40 sieve shall have a liquid limit not more than 35 and a plasticity index not more than 10, when tested according to ATM 204 and ATM 205.

**299-2.3 FINES FOR BLENDING.** If additional fine material is necessary, it shall be obtained from approved sources and uniformly blended with the aggregate at the crushing plant, the mixing plant, or as approved by the Engineer. Silt, stone dust, or other similar fine material may be used as binder.

**CONSTRUCTION METHODS**

**299-3.1 (RESERVED).**

**299-3.2 PREPARING UNDERLYING COURSE.** The underlying course will be checked and accepted by the Engineer before placing and spreading operations are started. Any ruts or soft areas shall be corrected and compacted to the required density before placing aggregate surface course.

To protect the underlying course and to ensure proper drainage, the spreading of the aggregate surface course shall begin along the centerline on a crowned section or on the high side of sections with a one-way slope.

**299-3.3 METHODS OF PRODUCTION.** The aggregate shall be uniformly blended and when at the satisfactory moisture content per paragraph 299-3.5, the approved material may be transported directly to the spreading equipment.

**299-3.4 PLACING.** The surface course shall be constructed without segregation of the aggregate. The material shall be placed in uniform, equal-depth layers, each not exceeding 6 inches of compacted depth. No material shall be placed in snow or on a soft uncompacted, muddy, or frozen course.

During the mixing and spreading process, sufficient caution shall be exercised to prevent the incorporation of subgrade, subbase, or shoulder material in the surface course mixture.

**299-3.5 COMPACTION.** Immediately upon completion of the spreading operations, the aggregate shall be thoroughly compacted to the required density. The moisture content of the material shall be ± 2 percentage points of the optimum moisture content.

**299-3.6 ACCEPTANCE SAMPLING AND TESTING FOR DENSITY.** The surface course will be accepted for density when the field density is not less than 95% of the maximum density, as determined according to ATM 207, ATM 212, or ATM 309. The control strip for ATM 309 shall be compacted by a vibratory compactor with a minimum operating weight of 22,000 pounds. The in-place field density and moisture content will be determined according to ATM 213. If the specified density is not attained, the material shall be reworked and/or recompacted until the specified density is reached.

**299-3.7 FINISHING.** The surface of the aggregate surface course shall be finished by blading or with automated equipment specifically designed for this purpose.

In no case shall thin layers of material be added to the top of surface course to meet grade. If the compacted elevation of the top layer is 0.05 foot or more below grade, it shall be scarified to a depth of at least 3 inches, new material added, and the layer shall be blended and compacted to bring it to grade. If the finished surface is above plan grade, it shall be cut back to grade and recompacted.

**299-3.8 SURFACE TEST.** After the course has been completely compacted, the surface will be tested by the Engineer for smoothness and accuracy of grade and crown. The finished grade elevation shall not vary more than 0.05 foot from the design elevation. The finished surface shall not vary more than 3/8 inch from a 12-foot straightedge when applied to the surface parallel with, and at right angles to, the
centerline. Any portion lacking the required smoothness or failing in accuracy of grade or crown shall be corrected to within the specified tolerances and approved by the Engineer.

**299-3.9 PROTECTION.** Work on the surface course shall not be accomplished during freezing temperatures or when the subgrade is wet. When the aggregates contain frozen materials or when the underlying course is frozen, the construction shall be stopped.

Hauling equipment may be routed over completed portions of the surface course, provided no damage results and provided that such equipment is routed over the full width of the surface course to avoid rutting or uneven compaction. However, the Engineer in charge will have full and specific authority to stop all hauling over completed or partially completed surface course when, in their opinion, such hauling is causing damage. Any damage resulting to the surface course from routing equipment over the surface course shall be repaired by the Contractor at their own expense.

**299-3.10 MAINTENANCE.** Following the completion of the aggregate surface course, the Contractor shall satisfactorily remove all blue tops, fill and compact the voids, and perform all maintenance work on this surface until final acceptance unless otherwise stated in the Specifications. The surface course shall be properly drained at all times.

**METHOD OF MEASUREMENT**

299-4.1 Aggregate Surface Course will be weighed by the ton or measured by the cubic yard in final position according to GCP Subsection 90-02.

**BASIS OF PAYMENT**

299-5.1 Aggregate Surface Course will be paid for at the contract price, per unit of measurement, accepted in place.

Payment will be made under:

- Item P299.010.0000 Crushed Aggregate Surface Course – per cubic yard
- Item P299.020.0000 Crushed Aggregate Surface Course – per ton
- Item P299.030.0000 Crushed Aggregate Surface Course – per contingent sum
- Item P299.040.0000 Uncrushed Aggregate Surface Course – per cubic yard

**TESTING REQUIREMENTS**

AASHTO T 96 Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

AASHTO T 104 Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate

ATM 212 WAQTC FOP for AASHTO T 27/T 11 Sieve Analysis of Fine and Coarse Aggregates *

ATM 313 Degradation Value of Aggregates

ATM 304 WAQTC FOP for AASHTO T 27/T 11 Sieve Analysis of Fine and Coarse Aggregates *

ATM 204 WAQTC FOP for AASHTO T 89 Determining the Liquid Limit of Soils

ATM 205 WAQTC FOP for AASHTO T 90 Determining the Plastic Limit and Plasticity Index of Soils

ATM 207 WAQTC FOP for AASHTO T 99/ T 180 Moisture-Density Relations of Soils*
| ATM 213 | WAQTC FOP for AASHTO T 310 In-Place Density and Moisture Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)* |
| ATM 305 | WAQTC FOP for AASHTO T 335 Determining the Percentage of Fracture in Coarse Aggregate* |