## ITEM P-209 CRUSHED AGGREGATE BASE COURSE

DESCRIPTION

**209-1.1** This item consists of a base course composed of crushed aggregate constructed on a prepared course in accordance with these Specifications and to the dimensions and typical cross-sections shown on the Plans.

MATERIALS

**209-2.1 CRUSHED AGGREGATE BASE.** Crushed aggregate shall consist of clean, sound, durable particles of crushed stone or crushed gravel and shall be free from excess coatings of clay, silt, organic material, clay lumps or balls or other deleterious materials. The method used to produce the crushed gravel shall result in the fractured particles in the finished product as consistent and uniform as practicable. Fine aggregate passing the No. 4 sieve shall consist of fines from the coarse aggregate crushing operation. If necessary, fine aggregate may be added to produce the correct gradation. The fine aggregate shall be produced by crushing stone and gravel that meet the coarse aggregate requirements for wear and soundness. Aggregate base material requirements are listed in Table 209-1.

TABLE 209-1

CRUSHED AGGREGATE BASE MATERIAL REQUIREMENTS

| **Material Test** | **Requirement** | **Standard** |
| --- | --- | --- |
| **Coarse Aggregate** | | |
| Resistance to Degradation | Loss: 45% maximum | AASHTO T 96 |
| Soundness of Aggregates  by Use of Sodium Sulfate | Loss after 5 cycles: 12% maximum using Sodium sulfate | AASHTO T 104 |
| Percentage of Fractured Particles | Minimum 90% by weight of particles with at least two fractured faces and 100% with at least one fractured face1 | ATM 305 |
| Flat Particles, Elongated Particles, or Flat and Elongated Particles | 10% maximum, by weight, of flat, elongated, or flat and elongated particles 2 | ATM 306 |
| Micro-Deval | 25% maximum | AASHTO T 327 |
| **Fine Aggregate** | | |
| Liquid limit | Less than or equal to 25 | ATM 204 |
| Plasticity Index | Not more than six (6) | ATM 205 |

1 The area of each face shall be equal to at least 75% of the smallest mid-sectional area of the piece. When two fractured faces are contiguous, the angle between the planes of fractures shall be at least 30 degrees to count as two fractured faces.

2 A flat particle is one having a ratio of width to thickness greater than five (5); an elongated particle is one having a ratio of length to width greater than five (5).

**209-2.2 GRADATION REQUIREMENTS.** The gradation of the final aggregate base material shall meet the requirements of the gradation given in Table 209-2 when tested per ATM 304. The gradation shall be well graded from coarse to fine and shall not vary from the lower limit on one sieve to the high limit on an adjacent sieve or vice versa. Use Gradation D-1 unless specified otherwise.

TABLE 209-2

REQUIREMENTS FOR GRADATION OF AGGREGATE

| **Sieve Size** | **Design Range**  **Percentage by Weight passing** | | **Contractor’s Final Gradation** | **Job Control Grading Band Tolerances1 (Percent)** |
| --- | --- | --- | --- | --- |
|  | **C-1** | **D-1** |  |  |
| 1-1/2 inch | 100 |  |  | 0 |
| 1 inch | 70-100 | 100 |  | ±5 |
| 3/4 inch | 60-90 | 70-100 |  | ±8 |
| 3/8 inch | 45-75 | 50-80 |  | ±8 |
| No. 4 | 30-60 | 35-65 |  | ±8 |
| No. 8 | 22-52 | 20-50 |  | ±8 |
| No. 502 | 6-30 | 6-30 |  | ±5 |
| No. 2002 | 0-5 | 0-5 |  | ±3 |

1 The “Job Control Grading Band Tolerances for Contractor’s Final Gradation” in the table shall be applied to “Contractor’s Final Gradation” to establish a job control grading band. The full tolerance still applies if application of the tolerances results in a job control grading band outside the design range.

2 The fraction of material passing the No. 200 sieve shall not exceed two-thirds the fraction passing the No. 50 sieve.

**209-2.3 SAMPLING AND TESTING.**

**a. Aggregate base materials.** The Contractor shall take samples of the aggregate base in accordance with ATM 301 to verify initial aggregate base requirements and gradation. Material shall meet the requirements in Subsection 209-2.1. This sampling and testing will be the basis for approval of the aggregate base quality requirements.

**b. Gradation requirements.** The Contractor shall take at least two aggregate base samples per day in the presence of the Engineer to check the final gradation. Sampling shall be per ATM 301. Material shall meet the requirements in Subsection 209-2.2. The samples shall be taken from the in-place, un-compacted material at sampling points and intervals designated by the Engineer.

**209-2.4 SEPARATION GEOTEXTILE.** Not Used.

CONSTRUCTION METHODS

**209-3.1 CONTROL STRIP.** The first half-day of construction shall be considered the control strip. 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 continue until the control strip has been accepted by the Engineer. The Contractor shall use the same equipment, materials, construction methods, and sequence and manner of rolling for the remainder of base course construction, unless adjustments made by the Contractor are approved by the Engineer.

**209-3.2 PREPARING UNDERLYING COURSE**. The underlying subgrade and/or subbase shall be checked and accepted, in writing, by the Engineer before base course placing and spreading operations begin. Any ruts or soft, yielding areas shall be corrected and compacted to the required density before the base course is placed. To ensure proper drainage, the spreading of the base shall begin along the centerline of the pavement on a crowned section or on the high side of the pavement with a one-way slope, or as directed by the Engineer.

**209-3.3 PRODUCTION**. The aggregate shall be uniformly blended and, when at a satisfactory moisture content according to Subsection 209-3.5, the approved material may be transported directly to the spreading equipment. The plant shall blend and mix the materials to meet the Specifications.

**209-3.4 PLACEMENT**.

The crushed aggregate base material shall be placed on the approved subgrade in uniform, equal-depth layers, each not exceeding 6 inches of compacted depth. The aggregate shall meet gradation and moisture requirements prior to compaction. . Crushed aggregate base course shall not be placed on frozen material.

When more than one lift is required to establish the layer thickness shown on the plans, the construction procedure described here shall apply to each lift. No lift shall be covered by subsequent lifts until tests verify that compaction requirements have been met. The Contractor shall rework, re-compact and retest any material placed which does not meet the Specifications at the Contractor’s expense.

**209-3.5 COMPACTION**. Immediately after completion of the spreading operations, and within the same day that the aggregate is placed, compact each layer of the base course to the required density.

The field density of each compacted lift of material shall be at least 98% of the maximum density of laboratory specimens prepared from samples of the crushed aggregate base material delivered to the jobsite. The laboratory specimens shall be compacted and tested in accordance with ATM 207 or ATM 212. The moisture content of the material during placing operations shall be within ±2 percentage points of the optimum moisture content as determined by ATM 207 or ATM 212. Maximum density refers to maximum dry density at optimum moisture content unless otherwise specified.

**209-3.6 WEATHER LIMITATIONS.** Material shall not be placed unless the ambient air temperature is at least 40°F and rising. Work on base course shall not be conducted when the subgrade or subbase is wet or frozen or the base material contains frozen material.

**209-3.7 MAINTENANCE.** The base course shall be maintained in a condition that will meet all Specification requirements until the work is accepted. Equipment may be routed over completed sections of base course, provided that no damage results and the equipment is routed over the full width of the completed base course to avoid rutting or uneven compaction. Any damage resulting to the base course from routing equipment over the base course shall be repaired by the Contractor at the Contractor’s expense.

**209-3.8 SURFACE TOLERANCES.** After the course has been compacted, the surface will be tested by the Engineer for smoothness and accuracy of grade and crown. Any portion lacking the required smoothness or failing in accuracy of grade or crown shall be scarified to a depth of at least 3 inches, reshaped and recompacted to grade until the required smoothness and accuracy are obtained and approved by the Engineer. Any deviation in surface tolerances shall be corrected 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 and crown shall be measured on a 50-foot grid and shall be within +0 and ‑1/2 inch of the specified grade.

**209-3.9 ACCEPTANCE SAMPLING AND TESTING.** Crushed aggregate base course shall be accepted for density and thickness on an area basis. Two tests shall be made for density and thickness for each 1200 square yards. Sampling locations will be determined on a random basis according to ATM SP 4.

1. **Density.** The Engineer will perform all density tests. Base course will be accepted for density when the field density is not less than 98% of the maximum density, as determined according to ATM 207 or ATM 212. 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.

**b. Thickness.** The thickness of the finished base course will be determined by the Engineer by taking before and after elevation measurements, or by depth tests, at random locations. The completed thickness of the base course shall be within 1/2 inch of the design thickness. 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 of proper gradation, and the material shall be blended and recompacted to grade. The Contractor shall replace, at his expense, base material where depth tests have been taken.

**METHOD OF MEASUREMENT**

**209-4.1** The quantity of crushed aggregate base course will be determined by the ton or measured by the cubic yard of material in final position according to Subsection 90-02.

**BASIS OF PAYMENT**

**209-5.1** Payment shall be made at the contract unit price per unit of measurement, accepted in place.

Payment will be made under:

Item P209.010.0000 Crushed Aggregate Base Course - per cubic yard

Item P209.020.0000 Crushed Aggregate Base Course - per ton

Item P209.030.0000 Crushed Aggregate Base Course Stockpile – per ton

Item P209.070.0000 Base Course Reconditioning – per square yard

**REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

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

AASHTO T 327 Resistance of Coarse Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus

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 212 Determining the Standard Density of Coarse Granular Materials Using the Vibratory Compactor

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 301 WAQTC FOP for AASHTO T 2 Sampling of Aggregates

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

ATM 305 WAQTC FOP for AASHTO T 335 Determining the Percentage of Fracture in Coarse Aggregate\*

ATM 306 Determining the Percentage of Flat and Elongated Particles in Coarse Aggregate

ATM SP 4 Random Sampling