SPECIFICATION P–208. AGGREGATE BASE COURSE

DESCRIPTION

208–1.1 This Work consists of a base course composed of hard, durable particles or fragments of crushed coarse aggregate blended with either binder and fine aggregate or filler. Construct it on a prepared underlying course in accordance with these Specifications and in conformance with the dimensions and typical cross section shown on the Plans.

MATERIALS

208–2.1 AGGREGATE. Aggregates consist of both fine and coarse fragments of crushed stone, or crushed gravel mixed or blended with sand, screenings, or other similar approved materials. Crushed stone consists of hard, durable particles or fragments of stone.

The crushed gravel consists of hard, durable stones, rock, and boulders crushed to specified size. Produce aggregate free from excess flat, elongated, soft or disintegrated pieces, dirt, or other objectionable matter. The method used in production of crushed gravel shall be such that the fractured particles occurring in the finished product shall be constant and uniform and shall result in at least 45 percent of material retained on a No. 4 mesh (4.75 mm) sieve having one or more fractured faces. If necessary to meet this requirement or to eliminate an excess of fine, uncrushed particles, screen the gravel before crushing. Stones, rocks, and boulders of inferior quality in the pit shall be wasted.

Crushed coarse aggregate shall not have more than 50 percent wear at 500 revolutions as determined by ASTM C 131. When the fraction of the aggregates retained on the No. 4 mesh (4.75 mm) sieve is subjected to five cycles of the sodium sulfate soundness test (ASTM C 88), the weighted loss shall not exceed 18 percent by weight, unless otherwise provided in the Contract.

Incorporate material passing the No. 4 mesh (4.75 mm) sieve produced in the crushing operation of either stone or gravel in the base material to the extent permitted by the gradation requirements. Oversized stones, rocks and boulders occurring in the pit or quarry material shall be wasted; those of acceptable quality may be crushed and become a part of the base material, provided the blend meets the specified gradations. The aggregate shall be free from vegetation, lumps, or excessive amounts of clay and other objectionable substances.

208–2.2 SAMPLING AND TESTING. Furnish aggregates for preliminary testing prior to the start of production. The Engineer will test for initial aggregate submittals necessary to determine compliance with the Specification requirements at no expense to the Contractor.

Furnish samples of aggregates at the start of production and at intervals during production. The Engineer will designate sampling points and intervals. The samples will be the basis of approval of specific lots of aggregates from the standpoint of the quality requirements of this Specification.

Instead of testing, the Engineer may accept certified State of Wisconsin Department of Transportation test results indicating that the aggregate meets specification requirements.

The Engineer may take samples of aggregates to check gradation periodically during construction. Sampling will be in accordance with ASTM D 75, and testing will be in accordance with ASTM C 136 and C 117.

NOTE TO SPECIFIER:
The intent of this specification is to provide an airport specification for base course with requirements similar to Highways Section 304. The resulting material should be superior to the original P–208 material. Use this specification on pavements with gross weights less than 60,000 pounds. When designing pavement thickness, consider using an equivalency factor to increase the thickness of P–208 required.

208–2.3 GRADATION. The gradation shall meet the requirements of one of the gradations given in Table 1 when tested in accordance with ASTM C 117 and C 136.

TABLE 1. REQUIREMENTS FOR GRADATION OF AGGREGATE

Sieve Size	*Percentage by Weight Passing*					
	Gradation No. 1		*Gradation No. 2*		*Gradation No. 3*	
	Crushed Gravel	*Crushed Stone*	*Crushed Gravel*	*Crushed Stone*	*Crushed Gravel*	*Crushed Stone*
1 1/2 Inch (37.0 mm)	100	100	¾	¾	¾	¾
1 Inch (25.0 mm)	75–100	¾	100	100	100	100
3/4 Inch (19.0 mm)	¾	¾	¾	¾	95–100	95–100
3/8 Inch (9.5 mm)	40–75	30–65	50–85	40–75	50–90	50–90
No. 4 (4.75 mm)	30–60	25–55	35–65	25–60	35–70	35–70
No. 10 (2.00 mm)	20–45	15–40	25–50	15–45	20–55	15–55
No. 40 (0.45 mm)	10–30	¾	10–30	¾	10–35	¾
No. 200 (0.075 mm)	3–10	2–12	3–10	3–12	8–15	5–15

The gradations in the table represent the limits that shall determine suitability of aggregate for use from the sources of supply. The final gradations decided within the limits designated in the table 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 amount of the fraction of material passing the No. 200 mesh (0.075 mm) sieve shall not exceed one–half the fraction passing the No. 40 mesh (0.45 mm) sieve.

The portion of the filler and binder, including blended material, passing the No. 40 mesh (0.45 mm) sieve shall have a liquid limit not more than 25 and a plasticity index not more than 6 when tested in accordance with ASTM D 4318.

Selection of gradations shown in the table shall be such that the maximum size aggregate used in any course shall be not more than two–thirds the thickness of the layer of the course being constructed.

208–2.4 FILLER FOR BLENDING If filler, in addition to that naturally present in the base course material, is necessary for satisfactory bonding of the material, for changing the soil constants of the material passing the No. 40 mesh (0.45 mm) sieve, or for correcting the gradation to the limitations of the specified gradation, it should be uniformly blended with the base course material at the crushing plant or at the mixing plant. The material for this shall be obtained from Engineer approved sources and shall be of a gradation necessary to accomplish the specified gradation in the finally processed material.

The additional filler may be composed of sand, but the amount of sand shall not exceed 20 percent by weight of the total combined base aggregate. All the sand shall pass a No. 4 mesh (0.45 mm) sieve and not more than 5 percent by weight shall pass a No. 200 mesh (4.75 mm) sieve.

CONSTRUCTION METHODS

208–3.1 OPERATIONS IN PITS AND QUARRIES. Perform Work involved in clearing and stripping pits and quarries, including handling of unsuitable material. Handle material in a manner to construct a uniform and satisfactory base course. Obtain base course material from approved sources.

208–3.2 PREPARING UNDERLYING COURSE. The underlying course will be checked and accepted by the Engineer before placing and spreading operations are started. Correct ruts or soft, yielding places due to improper drainage conditions, hauling, or other causes, and roll the underlying course to the required density before the base course is placed thereon.

To protect the underlying course and to ensure proper drainage, begin spreading the base along the centerline of the pavement on a crowned section or on the high side of the pavement with a one–way slope.

208–3.3 MIXING. Uniformly blend the aggregate during crushing operations or mix in a plant. The plant shall blend and mix the materials to meet the specifications and to secure the proper moisture content for compaction.

208–3.4 PLACING. Place aggregate base material on the prepared underlying course and compact in layers of the thickness shown on the Plans. Deposit and spread the material where designated and progress continuously without breaks. Deposit and spread material in lanes in a uniform layer and without segregation of size to a loose depth that, when compacted, the layer shall have the required thickness. Spread base aggregate on a moistened subgrade, in layers of uniform thickness. Dumping from vehicles in piles that require rehandling shall not be permitted. Hauling over the uncompacted base course is not permitted.

Construct base course in layers not less than 3 inches (75 mm) nor more than 6 inches (150 mm) compacted thickness. Aggregate, in–place, shall meet gradation specifications. Do not spread more than 2,000 square yards (1,700 square meters) in advance of the rolling. Do not place material in snow or on a soft, muddy, or frozen course.

When more than one layer is required, the construction procedure described applies similarly to each layer.

Exercise caution during the mixing and spreading process to prevent the incorporation of subgrade, subbase, or shoulder material in the base course mixture.

208–3.5 COMPACTION. Compact aggregate immediately upon completion of the spreading operations. Use a sufficient number, type, and weight of rollers to compact the material to the required density. Compact the aggregate base course in-place to a field target density of at least 100 percent and a lower specification limit (L) of at least 97.0 percent of the maximum density of laboratory specimens prepared from samples of base course material delivered to the job site.

The moisture content of the material during placing operations shall not be below, nor more than 1–1/2 percentage points above, the optimum moisture content as determined by ASTM D 698, unless it can be demonstrated in the field that the maximum density can be achieved at lower moisture contents.

NOTE TO SPECIFIER:
For gross aircraft weights greater than 60,000 pounds, revise the ASTM reference in the preceding paragraph, by Special Provision, to required use of ASTM D 1557.

208–3.6 ACCEPTANCE SAMPLING AND TESTING FOR DENSITY. Aggregate base course will be accepted for density on a lot basis. A lot will consist of one day's production where it is not expected to exceed 2,400 square yards (2,000 square meters) of material per layer. A lot will consist of one–half day's production where a day's production is expected to consist of between 2,400 and 4,800 square yards (2,000 and 4,000 square meters) of material per layer. Over 4,800 square yards (4,000 square meters), each additional 2,400 square yards (2,000 square meters) or a portion thereof will constitute an additional lot.

Each lot shall be divided into 8 equal sublots. One in-place field density test will be made for each sublot. Test locations will be determined by the Engineer on a random basis in accordance with statistical procedures contained in ASTM D 3665.

The percent compaction of each sampling location will be determined by dividing the in-place field density of each sublot by the average laboratory maximum density of the lot. The Engineer will determine in–place field density in accordance with ASTM D 2922, Method B, Direct Transmission. The maximum density will be the maximum density of laboratory specimens prepared from samples of material taken from the site and shall be determined in accordance with ASTM D 698. The nuclear gage will be calibrated in accordance with ASTM D 2922, Annex A1 and be operated by a technician in accordance with the requirements of the manufacturer. The operator of the nuclear gage must show evidence of training and experience in the use of this instrument. The gage will be standardized daily in accordance with ASTM D 2922, paragraph 8. Use of ASTM D 2922 results in a wet unit weight, and when using this method, ASTM D 3017 will be used to determine the moisture content of the material. The moisture gage will be standardized daily in accordance with ASTM D 3017, paragraph 7.

Acceptance of each lot of in–place material for density will be based on the percentage of material within specification limits (PWL), calculated in accordance with the computational procedure, described in Section 110, Method of Estimating Percentage of Material within Specification Limits (PWL)..

If the PWL of the lot equals or exceeds 90 percent, the lot will be considered acceptable. If the PWL is less than 90, rework and recompact the lot. After recompaction, the lot will be resampled and retested in accordance with the procedures above. A new PWL will be computed based on the retest results and the lot reevaluated for acceptance. This procedure will be repeated until the PWL is 90 or greater.

NOTE TO SPECIFIER:
If the Modified Proctor (ASTM D 1557) is required to determine the maximum density, it should be changed by Special Provision.

NOTE TO SPECIFIER:
The Engineer shall specify ASTM D 698 for areas designated for aircraft with gross weights of 60,000 pounds (27 200 kg) or less and ASTM D 1557 for areas designated for aircraft with gross weights greater than 60,000 pounds (27 200 kg). ASTM D 698 is indicated in the WBOA Standard Specifications and will not normally require modification since P–209 will generally be used for pavements designed for loads over 60,000 pounds gross weight. If ASTM D 1557 is desired, it should be specified in the Special Provisions.

208-3.7 VERIFICATION TESTING. The Engineer will verify the maximum laboratory density of material placed in the field for each lot. A minimum of one test will be made for each lot of material at the site. The verification process consists of:

a. Compacting the material and determining the dry density and moisture-density in accordance with ASTM D 1557 for aircraft over 60,000 pounds (27,000 kg) (or ASTM D 698 for aircraft of 60,000 pounds (27,000 kg) or less, if this test is required for initial laboratory density testing), and

b. Comparing the results with the laboratory moisture-density curves, to select the maximum density and moisture content for the material being placed. This verification process is commonly referred to as a "one point Proctor." If the material does not conform to existing moisture-density curves, the Engineer will establish the laboratory maximum density and moisture content for the material in accordance with ASTM D 1557 for aircraft over 60,000 pounds (27,000 kg) (or ASTM D 698 for aircraft of 60,000pounds (27,000 kg) or less, if this test is required for initial laboratory density testing). Additional verification tests will be made, if necessary, to properly classify all materials placed in the lot.

208–3.8 SURFACE TEST. After the course has been completely compacted, the surface will be tested for smoothness and accuracy of grade and crown. Areas lacking the required smoothness or failing in accuracy of grade or crown shall be scarified, reshaped, recompacted, and otherwise manipulated as the Engineer may direct until the required smoothness and accuracy is obtained. The finished surface shall not vary more than 3/8 inch (9 mm) from a 16–foot (4.8 m) straightedge when applied to the surface parallel width, and at right angles to, the centerline.

208–3.9 THICKNESS. The Engineer will determine the thickness of the base course by depth tests or cores taken at intervals in such a manner that each test will represent no more than 300 square yards (250 square meters). When the base deficiency is more than 1/2 inch (12 mm), correct the areas by scarifying, adding satisfactory base mixture, rolling, sprinkling, reshaping, and finishing in accordance with these specifications. Replace, at Contractor's expense, the base material where borings have been taken for test purposes.

NOTE TO SPECIFIER:
Thickness tests are required on FAA funded projects when aggregate is bid by the cubic yard in-place. When the project is State funded or bid by the ton, the specifier should coordinate with the BOA project manager to determine if thickness tests will be included in the testing program.

208–3.10 PROTECTION. Do not work on the base course when temperatures are freezing nor when the subgrade is wet. Do not construct base course when the aggregates contain frozen materials or when the underlying course is frozen.

Hauling equipment may be routed over completed portions of the base course, provided no damage results and provided that such equipment is routed over the full width of the base course to avoid rutting or uneven compaction. The Engineer may limit hauling over completed or partially completed base course when, such hauling is causing damage. Repair, at Contractor's expense, damage resulting to the base course from routing equipment over the base course

208–3.11 MAINTENANCE. Perform maintenance work on the completed base course to keep the base course in a condition equal to that which existed immediately after the finished surface was tested. Keep the surface clean and free from foreign material. Maintain drainage at all times.

Before preparations begin for the application of a surface treatment or for a surface course, allow the base course to partially dry until the average moisture content of the full depth of base is less than 80 percent of the optimum moisture of the base mixture. The drying shall not continue to the extent that the surface of the base becomes dusty with consequent loss of binder. If during the curing period the surface of the base dries too fast, keep it moist by sprinkling until the prime coat is applied as directed.

METHOD OF MEASUREMENT

208–4.1 The quantity of aggregate base course to be paid for will be the number of cubic yards or tons of base course material placed and accepted in the completed base course. The quantity of base course material, when measured by the cubic yard, will be measured in final (compacted) position based upon depth test. On individual depth measurements, thickness more than 1/2 inch (12 mm) in excess of that shown on the Plans will be considered as specified thickness. The quantity of base course, when measured by the ton, will be determined from recorded truck scale weights.

Base course material, measured by the ton, which contains total moisture in excess of the optimum moisture content, will have the weight of the excess deducted from the measured weight. Determination of the moisture content of the aggregates will be based on percent of the dry weight of the aggregates.

BASIS OF PAYMENT

208–5.1 Payment will be made at the Contract unit price per cubic yard or ton for aggregate base course. This price will be full compensation for furnishing all materials and for all operations, hauling, placing of these materials, compacting, and reworking and recompacting if necessary, and for all labor, equipment, tools, and incidentals necessary to complete the Work.

Should excavation below subgrade (EBS) be required in an area of completed base course construction, restoration of the base course to the Plan grade and cross-section in the area of EBS will be paid for at a unit price determined by multiplying the Contract unit price of the base course by three, unless the total quantity for the project exceeds 50 tons (25 cubic yards when the Pay Item is based on cubic yards). When the total quantity for base course restoration exceeds 50 tons (25 cubic yards when the Pay Item is based on cubic yards), either party to the Contract may request revisions to the unit price. The revisions to the unit price shall be negotiated on the basis of the actual cost of the restoration, plus a negotiated allowance for profit and applicable overhead, and added to the Contract by Change Order.

NOTE TO SPECIFIER:
Normally, Aggregate Base Course on WBOA projects will be bid by the ton.

Gradation will be indicated within the Pay Item description. If more than one gradation is allowable, add a Special Provision allowing a substitution.

Standard Pay items for work covered by this Specification are as follows:

Pay Item P20801	Aggregate Base Course, Gradation No. 1, per cubic yard
Pay Item P20802	Aggregate Base Course, Gradation No. 1, per ton
Pay Item P20803	Aggregate Base Course, Gradation No. 2, per cubic yard
Pay Item P20804	Aggregate Base Course, Gradation No. 2, per ton
Pay Item P20805	Aggregate Base Course, Gradation No. 3, per cubic yard
Pay Item P20806	Aggregate Base Course, Gradation No. 3, per ton

Measurement and Payment will only be made for Pay Items included in the Schedule of Prices. The cost of all Work required by the Contract Documents will be included in the Pay Items contained in the Schedule of Prices.

TESTING REQUIREMENTS

ASTM C 29	Standard Test Method for Unit Weight and voids in Aggregate
ASTM D 75	Standard Practice for Sampling Aggregate
ASTM C 88	Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C 117	Materials Finer than 75um (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 131	Resistance to Abrasion of Small Size Coarse Aggregate by Use of the Los Angeles Machine
ASTM C 136	Sieve or Screen Analysis of Fine and Coarse Aggregate
ASTM D 698	Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600kN-m/m^3))
ASTM D 1557	Test Method for Laboratory Compaction Characteristics Using Modified Effort (56,000 ft-lbf/ft^3 (2,700kN-m/m^3))
ASTM D 2922	Density of Soil and Soil–Aggregate in-Place by Nuclear Methods
ASTM D 3017	Moisture Content of Soil and Soil–Aggregate in-Place by Nuclear Methods
ASTM D 3665	Random Sampling of Paving Materials
ASTM D 4318	Liquid Limit, Plastic Limit, and Plasticity Index of Soils

SPECIFICATION P–209. CRUSHED AGGREGATE BASE COURSE

DESCRIPTION

209–1.1 This Work consists of a base course composed of crushed aggregates constructed on a prepared course in accordance with these Specifications and in conformity to the dimensions and typical cross sections shown on the Plans.

MATERIALS

209–2.1 AGGREGATE. Aggregates consist of clean, sound, durable particles of crushed stone or crushed slag and shall be free from coatings of clay, silt, vegetable matter, and other objectionable materials and shall contain no clay balls. Fine aggregate passing the No. 4 (4.75 mm) sieve shall consist of fines from the operation of crushing the coarse aggregate. If necessary, fine aggregate may be added to produce the correct gradation. Produce the fine aggregate by crushing stone, gravel, or slag that meet the requirements for wear and soundness specified for coarse aggregate.

The crushed slag shall be an air–cooled, blast furnace slag and shall have a unit weight of not less than 70 pounds per cubic foot (1.12 Mg/cubic meter) when tested in accordance with ASTM C 29.

The crushed aggregate portion that is retained on the No. 4 (4.75 mm) sieve shall contain not more than 15 percent, by weight, of flat or elongated pieces as defined in ASTM D 693 and shall have at least 90 percent by weight of particles with at least two fractured faces and 100 percent with at least one fractured face. The area of each face shall be equal to at least 75 percent of the smallest midsectional area of the piece. When two fractured faces are contiguous, the angle between the planes of fractures shall be at least 30 to count as two fractured faces.

The percentage of wear shall not be greater than 45 percent when tested in accordance with ASTM C 131. The sodium sulfate soundness loss shall not exceed 12 percent, after 5 cycles, when tested in accordance with ASTM C 88.

The fraction passing the No. 40 (0.42 mm) sieve shall have a liquid limit no greater than 25 and a plasticity index of not more than 4 when tested in accordance with ASTM D 4318. The fine aggregate shall have a minimum sand equivalent value of 35 when tested in accordance with ASTM D 2419.

a. Sampling and Testing. Furnish aggregates for preliminary testing prior to the start of production. All tests for initial aggregate submittals necessary to determine compliance with the specification requirements will be made by the Engineer at no expense to the Contractor.

Furnish samples of aggregates at the start of production and at intervals during production. The Engineer will designate sampling points and intervals. The samples will be the basis of approval of specific lots of aggregates from the standpoint of the quality requirements of this Section.

Instead of testing, the Engineer may accept certified State of Wisconsin Department of Transportation test results indicating that the aggregate meets Specification requirements.

The Engineer will take samples of aggregates to check gradation at least once daily. Sampling will be in accordance with ASTM D 75, and testing will be in accordance with ASTM C 136 and C 117.

b. Gradation Requirements. The gradation (job mix) of the final mixture shall fall within the design range indicated in Table 1, when tested in accordance with ASTM C 117 and C 136. The final gradation shall be continuously well graded from coarse to fine and shall not vary from the low limit on one sieve to the high limit on an adjacent sieve or vice versa.

TABLE 1. REQUIREMENTS FOR GRADATION OF AGGREGATE[1]

Sieve Size	*Design Range Percentage by Weight Passing Sieves*	*Job Mix Tolerances Percent*
2 in (37.0 mm)	100	
1–1/2 (37.0 mm)	95–100	±5
1 in (25.0 mm)	70–95	±8
3/4 in (19.0 mm)	55–85	±8
No. 4 (4.75 mm)	30–60	±8
No. 30 (0.60 mm)	12–30	±5
No. 200 (0.075 mm)	0–8	±3

[1] Where environmental conditions (temperature and availability of free moisture) indicate potential damage due to frost action, the maximum percent of material, by weight, of particles smaller than 0.02 mm shall be 3 percent. It also may be necessary to have a lower percentage of material passing the No. 200 (0.075 mm)sieve to help control the percentage of particles smaller than 0.02 mm.

The job mix tolerances in Table 1 shall be applied to the job mix gradation to establish a job control grading band. The full tolerance will still apply if application of the tolerances' results in a job control grading band outside the design range.

The fraction of the final mixture that passes the No. 200 (0.075 mm) sieve shall not exceed 60 percent of the fraction passing the No. 30 (0.60 mm) sieve.

CONSTRUCTION METHODS

209–3.1 PREPARING UNDERLYING COURSE. The underlying course will be checked and accepted by the Engineer before placing and spreading operations are started. Correct soft or yielding places caused by improper drainage conditions, hauling, or other causes at the Contractor's expense before the base course is placed thereon. Do not place material on frozen subgrade.

209–3.2 MIXING. Uniformly blend the aggregate during crushing operations or mix in a plant. The plant shall blend and mix the materials to meet the Specifications and to secure the proper moisture content for compaction.

209–3.3 PLACING. Place the crushed aggregate base material on the moistened subgrade in layers of uniform thickness with a mechanical spreader.

The maximum depth of a compacted layer shall be 6 inches (150 mm). If the total depth of the compacted material is more than 6 inches (150 mm), construct it in two or more layers. In multi–layer construction, place the base course in approximately equal–depth layers.

Clean the previously constructed layer of loose and foreign material prior to placing the next layer. Keep the surface of the compacted material moist until covered with the next layer.

209–3.4 COMPACTION. Thoroughly compact the crushed aggregate immediately upon completion of the spreading operations. The number, type, and weight of rollers shall be sufficient to compact the material to the required density. Compact the aggregate base course in-place to a field target density of at least 100 percent and a lower specification limit (L) of at least 97.0 percent of the maximum density of laboratory specimens prepared from samples of base course material delivered to the job site.

The moisture content of the material during placing operations shall not be below, nor more than 1–1/2 percentage points above, the optimum moisture content as determined by ASTM D 1557.

NOTE TO SPECIFIER:
For gross aircraft weights less than 60,000 pounds, the preceding ASTM reference may be revised by Special Provision to require the use of ASTM D 698.

209–3.5 ACCEPTANCE SAMPLING AND TESTING FOR DENSITY. Aggregate base course will be accepted for density on a lot basis. A lot will consist of one day's production where it is not expected to exceed approximately 2,400 square yards (2,000 square meters). A lot will consist of one–half day's production where a day's production is expected to consist of between approximately 2,400 and 4,800 square yards (2,000 and 4,000 square meters). Over approximately 4,800 square yards (4,000 square meters), each additional 2,400 square yards (2,000 square meters) (approximately) or a portion thereof will constitute an additional lot.

Each lot shall be divided into 8 equal sublots One in-place field density test will be made for each sublot. Test locations will be determined by the Engineer on a random basis in accordance with statistical procedures contained in ASTM D 3665.

The percent compaction of each sampling location will be determined by dividing the in-place field density of each sublot by the average laboratory maximum density of the lot. The in–place field density will be determined by the Engineer in accordance with ASTM D 2922, Method B, Direct Transmission. The maximum density will be the maximum density of laboratory specimens prepared from samples of material taken from the site and will be determined in accordance with ASTM D 1557. The nuclear gage will be calibrated in accordance with ASTM D 2922, Annex A1 and will be operated by a technician in accordance with the requirements of the manufacturer. The operator of the nuclear gage must show evidence of training and experience in the use of this instrument. The gage will be standardized daily in accordance with ASTM D 2922, paragraph 8. Use of ASTM D 2922 results in a wet unit weight, and when using this method, ASTM D 3017 will be used to determine the moisture content of the material. The moisture gage will be standardized daily in accordance with ASTM D 3017, paragraph 7.

Acceptance of each lot of in–place material for density will be based on the percentage of material within specification limits (PWL), calculated in accordance with the computational procedure, described in Section 110, Method of Estimating Percentage of Material within Specification Limits (PWL).

If the PWL of the lot equals or exceeds 90 percent, the lot will be considered acceptable. If the PWL is less than 90, rework and recompact the lot.

After recompaction, the lot will be resampled and retested in accordance with the procedures above. A new PWL will be computed based on the retest results and the lot reevaluated for acceptance. Repeat this procedure until the PWL is 90 or greater.

NOTE TO SPECIFIER:
The Engineer shall specify ASTM D 698 for areas designated for aircraft with gross weights of 60,000 pounds (27 200 kg) or less and ASTM D 1557 for areas designated for aircraft with gross weights greater than 60,000 pounds (27 200 kg). The Standard Specifications contain the requirements for over 60,000 pounds gross weight. If the other ASTM specification is appropriate, the specification should be modified in the Special Provisions. Normally use P–208 for aircraft gross weights under 60,000 pounds.

209-3.6 VERIFICATION TESTING. The Engineer will verify the maximum laboratory density of material placed in the field for each lot. A minimum of one test will be made for each lot of material at the site. The verification process consists of:

a. Compacting the material and determining the dry density and moisture-density in accordance with ASTM D 1557 for aircraft over 60,000 pounds (27,000 kg) (or ASTM D 698 for aircraft of 60,000 pounds (27,000 kg) or less if this test is required for initial laboratory density testing); and

b. Comparing the results with the laboratory moisture-density curves, to select the maximum density and moisture content for the material being placed. This verification process is commonly referred to as a “one point Proctor.” If the material does not conform to existing moisture-density curves, the Engineer will establish the laboratory maximum density and moisture content of the material in accordance with ASTM D 1557 for aircraft over 60,000 pounds (27,000 kg) (or ASTM D 698 for aircraft of 60,000 pounds (27,000 kg)or less if this test is required to initial laboratory density testing). Additional verification tests will be made, if necessary, to properly classify all materials placed in the lot.

209–3.7 FINISHING. Finish the surface of the aggregate base course by blading or with automated equipment specially designed for this purpose.

In no case will the addition of thin layers of material be added to the top layer of base course to meet grade. If the elevation of the top layer is 1/2 inch (12 mm) or more below grade, scarify the top layer of base to a depth of at least 3 inches (75 mm), new material added, and blend and recompact the layer to bring it to grade. If the finished surface is above Plan grade, cut it back to grade and reroll it.

209–3.8 SURFACE TOLERANCES. The finished surface shall not vary more than 3/8 inch (9 mm) when tested by the Engineer with a 16–foot (4.9 m) straightedge applied parallel with or at right angles to the centerline. Correct deviations in excess of this amount at the Contractor's expense.

209–3.9 THICKNESS CONTROL. The completed thickness of the base course shall be within 1/2 inch (12 mm) of the design thickness. When the quantity of base course is measured by cubic yard, four determinations of thickness will be made for each lot of material placed. The lot size shall be consistent with that specified in Subsection 209-3.5. Each lot shall be divided into 4 equal sublots. One test will be made for each sublot. Sampling locations will be determined by the Engineer on a random basis in accordance with procedures contained in ASTM D 3665. Where the thickness is deficient by more than 1/2 inch (12 mm), correct areas where the thickness is deficient by more than ½ inch (12 mm) at no additional cost by excavating to the required depth and replacing with new material. Additional test holes may be required to identify the limits of deficient areas.

NOTE TO SPECIFIER:
Thickness tests are required on FAA funded projects when aggregate is bid by the cubic yard in place. When the project is State funded or is bid by the ton, the specifier should coordinate with the BOA project manager to determine if thickness tests should be included in the testing program.

209–3.10 MAINTENANCE. Maintain the base course in a condition that will meet all Specification requirements until the Work is accepted. Equipment used in the construction of an adjoining section may be routed over completed portions of the base course, provided no damage results and provided that the equipment is routed over the full width of the base course to avoid rutting or uneven compaction.

METHOD OF MEASUREMENT

209–4.1 The quantity of crushed aggregate base course to be paid for will be determined by measurement of the number of cubic yards or tons of material actually constructed and accepted by the Engineer as complying with the Plans and Specifications.

The quantity of base course, measured by the cubic yard (CY) will be measured in final (compacted) position. Depth measurements for payment will not exceed typical thicknesses shown on Plans.

Base course measured by the ton will be determined from recorded truck scale weights. When base course delivered contains total moisture exceeding the optimal moisture content (determined by lab testing) by greater than ½ percent the quantity measured for payment will be reduced based upon measurements obtained by the Engineer.

BASIS OF PAYMENT

209–5.1 Payment will be made at the Contract unit price per cubic yard or ton for crushed aggregate base course. This price will be full compensation for furnishing all materials, for preparing and placing these materials for reworking and recompacting if necessary, and for all labor, equipment tools, and incidentals necessary to complete the Work.

Should excavation below subgrade (EBS) be required in an area of completed base course construction, restoration of the base course to the plan grade and cross-section in the area of EBS will be paid for at a unit price determined by multiplying the Contract unit price of the base course by three, unless the total quantity of base course to be replaced exceeds 50 tons (25 cubic yards when the Pay Item is based on cubic yards). When the total quantity for base course restoration exceeds 50 tons (25 cubic yards when the Pay Item is based on cubic yards), either party to the Contract may request revisions to the unit price. The revisions to the unit price shall be negotiated on the basis of the actual cost of the restoration, plus a negotiated allowance for profit and applicable overhead, and added to the Contract by Change Order.

Standard Pay Items for Work covered by this Specification are as follows:

Pay Item P20901	Crushed Aggregate Base Course, per ton
Pay Item P20902	Crushed Aggregate Base Course, per cubic yard

Measurement and Payment will only be made for Pay Items included in the Schedule of Prices. Include the cost of all Work required by the Contract Documents in the Pay Items contained in the Schedule of Prices.

TESTING REQUIREMENTS

ASTM C 29	Unit Weight of Aggregate
ASTM C 88	Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C 117	Materials Finer than 75um (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 131	Resistance to Abrasion of Small Size Coarse Aggregate by Use of the Los Angeles Machine
ASTM C 136	Sieve or Screen Analysis of Fine and Coarse Aggregate
ASTM D 75	Sampling Aggregate
ASTM D 693	Crushed Stone, Crushed Slag, and Crushed Gravel for Dry– or Water–Bound Macadam Base Courses and Bituminous Macadam Base and Surface Courses of Pavements
ASTM D 698	Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))
ASTM D 1557	Test Method for Laboratory Compaction Characteristics Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3))
ASTM D 2419	Sand Equivalent Value of Soils and Fine Aggregate
ASTM D 2922	Density of Soil and Soil–Aggregate in-Place by Nuclear Methods
ASTM D 3017	Moisture Content of Soil and Soil–Aggregate in-Place by Nuclear Methods
ASTM D 3665	Random Sampling of Paving Materials
ASTM D 4318	Liquid Limit, Plastic Limit, and Plasticity Index of Soils