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**SECTION 30 – RECYCLED CONCRETE AGGREGATE BASE COURSE  
(FAA P-219)**

**30-1 GENERAL**

The Contractor shall perform all work required by the plans and specifications for construction of recycled concrete base course for asphalt or concrete pavement in accordance with the Standard Specifications, except as specified otherwise in FAA Specification Item P-219, as included and modified hereafter, and as shown on the Plans.

[Add Description of Special Requirements, Conditions]

**ITEM P-219 RECYCLED CONCRETE AGGREGATE BASE COURSE**

**DESCRIPTION**

*219 -1.1 This item consists of a base course composed of recycled concrete aggregate, crushed to meet a particular gradation, 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**

*219-2.1 AGGREGATE. Recycled concrete aggregate shall consist of Portland cement concrete or other concrete containing pozzolanic binder material. The recycled concrete material shall be free of reinforcing steel, expansion material. Asphalt concrete overlays shall be removed from the PCC surface prior to pavement removal and crushing. Also, full-slab asphalt concrete panels (used as a replacement for a removed PCC slab) shall be removed. An incidental amount of recycled asphalt concrete pavement and other foreign material may be present in the recycled concrete aggregate.*

*Recycled concrete aggregate for base course shall consist of at least 90 percent, by weight, Portland cement concrete, with the following materials making up the remaining 10 percent:*

- Wood - 0.1 percent maximum*
- Brick, mica, schist, or other friable materials - 4 percent maximum*
- Asphalt concrete – 10 percent maximum*

*Virgin aggregates may be added to meet the 90 percent minimum concrete requirement*



*The percentage of wood, brick, mica, schist, other friable materials, and asphalt concrete shall be determined by weighing that material retained on the No. 4 sieve, and dividing by the total weight of recycled concrete aggregate material retained on the No. 4 sieve.*

*Fine aggregate passing the No.4 sieve shall consist of fines from the operation of crushing the recycled concrete aggregate. If necessary, fine aggregate may be added to produce the correct gradation. The fine aggregate shall be produced by crushing stone, gravel, slag, or recycled concrete that meet the requirements for wear and soundness specified for coarse aggregate.*

*Recycled concrete aggregate shall not be used in locations with high sulfate content soils (no more than 1 percent).*

*The amount of flat and elongated particles in recycled concrete aggregate shall not exceed 20 percent for the fraction retained on the 0.5 inch sieve nor 20 percent for the fraction passing the 0.5 inch sieve when tested in accordance with ASTM D 4791. A flat particle is one having a ratio of width to thickness greater than 3; an elongated particle is one having a ratio of length to width greater than 3.*

*The percentage of wear shall not be greater than 45 percent when tested in accordance with ASTM C 131. The sodium sulfate soundness test (ASTM C 88) requirement is waived for recycled concrete aggregate.*

*The fraction passing the No. 40 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.** Recycled concrete aggregate samples for preliminary testing shall be furnished by the Contractor prior to the start of base construction. 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.*

*Samples of recycled concrete aggregate shall be furnished by the Contractor at the start of production and at intervals during production. The sampling points and intervals will be designated by the Engineer. The samples will be the basis of approval of specific lots of recycled concrete aggregate for the quality requirements.*

*Samples of recycled concrete aggregate to check gradation shall be taken at least once daily. Sampling shall be in accordance with ASTM D 75, and testing shall 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 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 Recycled Concrete Aggregate.**

Sieve Size	Percentage by Weight Passing Sieves	Job Mix Tolerances Percent
2 in	100	--
1-1/2	95 - 100	+/- 5
1 in	70 - 95	+/- 8
3/4 in	55 - 85	+/- 8
No.4	30 - 60	+/- 8
No. 30	12 - 30	+/- 5
No. 200	0 - 5	+/- 3

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

### **EQUIPMENT**

**219-3.1 GENERAL.** All equipment necessary to mix, transport, place, compact, and finish the recycled concrete aggregate base course shall be furnished by the Contractor. The Contractor shall provide written certification to the Engineer that all equipment meets the requirements for this section. The equipment shall be inspected by the Engineer at the job site prior to the start of construction operations.

**219-3.2 MIXING EQUIPMENT.** Base course shall be thoroughly mixed in a plant suitable for recycled concrete aggregate. The mixer shall be a batch or continuous-flow type and shall be equipped with calibrated metering and feeding device that introduce the aggregate and water into the mixer in specified quantities. If necessary, a screening device shall be installed to remove oversized material greater than 2 in from the recycled concrete aggregate feed.



*Free access to the plant shall be provided to the Engineer at all times for inspection of the plant's equipment and operation and for sampling the mixed recycled concrete aggregate materials.*

**219-3.3 HAULING EQUIPMENT.** *The mixed recycled concrete aggregate base course shall be transported from the plant to the job site in hauling equipment having beds that are smooth, clean, and tight. Truck bed covers shall be provided and used to protect the mixed recycled concrete aggregate base course from rain during transport.*

**219-3.4 PLACING EQUIPMENT.** *Recycled concrete aggregate shall be placed using a mechanical spreader or machine capable of receiving, spreading, and shaping the material without segregation into uniform layer or lift. The placing equipment shall be equipped with a strike off plate that can be adjusted to the layer thickness. The placing equipment shall have two end gates or cut off plates, so that the recycled concrete aggregate may be spread up to a lane width.*

**219-3.5 COMPACTION EQUIPMENT.** *Recycled concrete aggregate base course compaction shall be accomplished using one or a combination of the following pieces of equipment:*

*Steel-wheeled roller,*

*Vibratory roller,*

*Pneumatic-tire roller,*

*Hand-operated power tampers (for areas inaccessible to rollers)*

**219-3.6 FINISHING EQUIPMENT.** *Trimming of the compacted recycled concrete aggregate to meet surface requirements shall be accomplished using a self-propelled grader or trimming machine, with a mold board cutting edge of 12 ft minimum width automatically controlled by sensors in conjunction with an independent grade control from a taut string line. String line will be required on both sides of the sensor controls for all lanes.*

## **CONSTRUCTION METHODS**

**219-4.1 WEATHER LIMITATIONS.** *Construction is allowed only when the atmospheric temperature is at or above 35 °F (2 °C). When the temperature falls below 35°F (2 °C), the contractor shall protect all completed areas against detrimental effects of freezing. Areas damaged by freezing, rainfall, or other weather conditions shall be corrected.*

**219-4.2 PREPARING UNDERLYING COURSE.** *The underlying course shall be checked by the Engineer before placing and spreading operations are started. Any ruts or soft yielding places caused by improper drainage conditions, hauling, or any other cause shall be corrected at the Contractor's expense before the base course is placed thereon. Material shall not be placed on frozen material.*



*To protect the existing layers and to ensure proper drainage, the spreading of the recycled concrete aggregate base course shall begin along the centerline of the pavement on a crowned section or on the greatest contour elevation of a pavement with a variable uniform cross slope.*

**219-4.3 GRADE CONTROL.** *Grade control between the edges of the recycled concrete aggregate base course shall be accomplished by grade stakes, steel pins, or forms placed in lanes parallel to the centerline and at intervals of 50 ft or less on the longitudinal grade and 25 ft or less on the transverse grade.*

**219-4.4 MIXING.** *The recycled concrete shall be uniformly blended during crushing operations and mixed with water in a mixing plant suitable for recycled concrete aggregate. The plant shall blend and mix the materials to meet the specifications and to secure the proper moisture content for compaction.*

**219-4.5 PLACING.** *The recycled concrete aggregate base material shall be placed on the moistened subgrade or base in layers of uniform thickness with an approved mechanical spreader.*

*The maximum depth of a compacted layer shall be 6 inches. If the total depth of the compacted material is more than 6 inches, it shall be constructed in two or more layers. In multi-layer construction, the material shall be placed in approximately equal-depth layers.*

*The previously constructed layer shall be cleaned of loose and foreign material prior to placing the next layer. The surface of the compacted material shall be kept moist until covered with the next layer.*

*Adjustments in placing procedures or equipment shall be made to obtain grades, to minimize segregation grading, to adjust the water content, and to ensure an acceptable recycled concrete aggregate base course.*

**219-4.6. EDGES OF BASE COURSE.** *The recycled concrete aggregate shall be placed so that the completed section will wider, on all sides, than the next layer that will be placed above it, as shown on the plans. Approved fill material shall be placed along the free edges of the recycled concrete aggregate in sufficient quantities to compact to the thickness of the course being constructed, or to the thickness of each layer in a .multiple course, allowing in each operation at least a 2-ft width of this material to be rolled and compacted simultaneously with rolling and compacting of each layer of base course. If this base course material is to be placed adjacent to another pavement section, then the layers for both of these sections shall be placed and compacted along the edge at the same time.*



**219-4.7 COMPACTION.** *Immediately upon completion of the spreading operations, the recycled concrete aggregate shall be compacted. The number, type, and weight of rollers shall be sufficient to compact the material to the required density.*

*Each layer of the recycled concrete aggregate base course shall be compacted to the required density using the compaction equipment. 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.*

*The compaction shall continue until each layer has a degree of compaction that is at least 100 percent of the laboratory maximum density through the full depth of the layer. The contractor shall make adjustments in compacting or finishing techniques to obtain true grades, to minimize segregation and degradation, to reduce or increase water content and to ensure a satisfactory base course. Any materials found to be unsatisfactory shall be removed and replaced with satisfactory material or reworked, so that the requirements of this specification are met.*

**219-4.8 ACCEPTANCE SAMPLING AND TESTING FOR DENSITY.** *Recycled concrete aggregate shall be accepted for gradation and 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 per lift. 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 per lift.*

*Each lot shall be divided into two equal sublots. One gradation and density test shall be made for each subplot. Sampling locations will be determined on a random basis in accordance with statistical procedures contained in ASTM D 3665.*

*Each lot will be accepted for gradation when it falls within the limits and tolerances shown in Table 1 when tested in accordance with ASTM C117 and C 131. If the proper gradation is not attained the gradation test will be repeated. The entire lot shall be rejected and replaced by the Contractor at the Contractor's expense.*

*Each lot will be accepted for density when the field density is at least 100 percent of the maximum density of laboratory specimens prepared from samples of the base course material delivered to the job site. The specimens shall be compacted and tested in accordance with ASTM D 1557. The in-place field density shall be determined in accordance with ASTM D 1556 or D 2167. If the specified density is not attained, the entire lot shall be reworked and two additional random tests made. This procedure shall be followed until the specified density is reached.*



*In lieu of ASTM D 1556 or D 2167 method of field density determination, acceptance testing may be accomplished using a nuclear gage in accordance with ASTM D 2922. The gage should be field calibrated in accordance with paragraph 4 of ASTM D 2922. Calibration tests shall be conducted on the first lot of material placed that meets the density requirements.*

*Use of ASTM D 2922 results in a wet unit weight, and when using this method, ASTM D 3017 shall be used to determine the moisture content of the material. The calibration curve furnished with the moisture gages shall be checked as described in paragraph 7 of ASTM D 3017. The calibration checks of both the density and moisture gages shall be made at the beginning of a job and at regular intervals.*

*If a nuclear gage is used for density determination, two random measurements shall be made for each subplot.*

**219-4.9 FINISHING.** *The surface of the recycled concrete aggregate base course shall be finished by equipment designed for this purpose.*

*In no case will thin layers of material be added to the top of base course to meet grade. If the elevation of the layer is 1/2 inch or more below grade, the layer shall be scarified to a depth of at least 3 inches, new material added, and the layer shall be recompact. If the finished surface is above plan grade, it shall be cut back to grade and rerolled.*

*Should the surface become rough, corrugated, uneven in texture, or traffic marked prior to completion, the unsatisfactory portion shall be scarified, and recompact or replaced at Contractor's expense.*

**219-4.10 SURFACE TOLERANCES.** *The finished surface shall not vary more than 3/8 inch when tested with a 16-ft straightedge applied parallel with or at right angles to the centerline. The Contractor shall correct any deviation in excess of this amount, at the Contractor's expense.*

**219-4.11 THICKNESS CONTROL.** *The completed thickness of the base course shall be within 0.5 inch of the design thickness. Four determinations of thickness shall be made for each lot of material placed. Each lot shall be divided into four equal sublots. One test shall be made for each subplot. Sampling locations will be determined on a random basis in accordance with procedures contained in ASTM D 3665. Where the thickness is deficient by more than 0.5 inch, the Contractor shall correct such areas 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.*



**219-4.12 TRAFFIC.** *Equipment used in construction may be routed over completed portions of the base course, provided no damage results and provided that the equipment is distributed evenly over the full width of the base course to avoid rutting or uneven compaction.*

**219-4.13 MAINTENANCE.** *The base course shall be maintained until the base course is completed and accepted. Maintenance will include immediate repairs to any defects and shall be repeated as often as necessary to keep the completed work intact. Any area of the recycled concrete aggregate base course that is damaged shall be reworked as necessary.*

### **METHOD OF MEASUREMENT**

**219-5.1**      *See Section 30-2.*

### **BASIS OF PAYMENT**

**219-6.1**      *See Section 30-3.*

### **TESTING REQUIREMENTS**

<i>ASTM C 29</i>	<i>Unit Weight of Aggregate</i>
<i>ASTM C 117</i>	<i>Materials Finer than 75µm (No. 200) Sieve in Mineral Aggregates by Washing</i>
<i>ASTM C 131</i>	<i>Resistance to Abrasion of Small Size Coarse Aggregate by Use of the Los Angeles Machine</i>
<i>ASTM C 136</i>	<i>Sieve or Screen Analysis of Fine and Coarse Aggregate ASTM D 75 Sampling Aggregate</i>
<i>ASTM D 693</i>	<i>Crushed Stone, Crushed Slag, and Crushed Gravel for Dry-or Water- Bound Macadam Base Courses and Bituminous Macadam Base and Surface Courses of Pavements</i>
<i>ASTM D 698</i>	<i>Moisture-Density Relations of Soils and Soil - Aggregate Mixtures Using 5.5-lb (2.49-kg) Rammer and 12-in (305-mm) Drop</i>
<i>ASTM D 1556</i>	<i>Density of Soil in Place by the Sand -Cone Method</i>





- ASTM D 1557                      Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.5-kg) Rammer and 18-in (457-mm) Drop*
- ASTM D 2167                      Density of Soil in Place by the Rubber-Balloon Method  
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*

**END OF P-219**

**30-2      METHOD OF MEASUREMENT**

The quantity of recycled concrete aggregate base course to be paid will be determined by measurement of the number of cubic yards of material actually constructed and accepted as complying with the plans and specifications.

**30-3      BASIS OF PAYMENT**

Payment shall be made at the contract unit price per cubic yard for recycled concrete aggregate base course. This price shall be full compensation for furnishing all materials, for preparing and placing these materials, and for all labor, equipment tools, and incidentals necessary to complete the item. Payment will be made under:

No separate payment will be made for constructing the item under construction sequencing restrictions, including limited access or nighttime work areas.

Payment will be made under:

- Item 30.1      Recycled Concrete Aggregate Base Course .....per cubic yard

**END OF SECTION 30**



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