

# **Item 245: Heavy-Duty Aggregate Base**

**Product 5-4358-01-P2**

**Cooperative Research Program**

in cooperation with the  
Federal Highway Administration and the  
Texas Department of Transportation  
<http://tti.tamu.edu/documents/5-4358-01-P2.pdf>



**ITEM 245: HEAVY-DUTY AGGREGATE BASE**

by

Tom Scullion, P.E.  
Research Engineer  
Texas Transportation Institute

Product 5-4358-01-P2  
Project Number 5-4358-01  
Project Title: Pilot Implementation of High Performance Flexible Base Specifications

Performed in cooperation with the  
Texas Department of Transportation  
and the  
Federal Highway Administration

November 2006  
Published: July 2007

TEXAS TRANSPORTATION INSTITUTE  
The Texas A&M University System  
College Station, Texas 77843-3135



## **ITEM 245: HEAVY-DUTY AGGREGATE BASE**

**245.1. Description.** Construct foundation courses composed of flexible base in accordance with the typical sections, lines, and grades shown on the plans or as directed.

**245.2. Materials.** Furnish uncontaminated materials of uniform quality that meet the requirements of the plans and specifications. Notify the Engineer of the proposed material sources to be used at least 30 days prior to production. Do not change any material source without written approval from the Engineer. When a source change is approved, the Contractor will verify that the specification requirements are met. The Engineer may sample and test project materials at any time throughout the duration of the project to assure specification compliance. Use Test Method Tex-100-E to define materials.

- A. Aggregate.** Furnish the type and grade shown on the plans and conforming to the requirements specified in Table 1. Do not use additives to modify aggregates to meet the requirements of Table 1, unless shown on the plans.
- 1. Type A.** Crushed stone produced and graded from oversize quarried aggregate that originates from a single, naturally occurring source. Do not use gravel or multiple sources.
  - 2. Type B.** Crushed or uncrushed gravel. (Blending of two or more sources is allowed.)
  - 3. Type C.** Crushed gravel with a minimum of 60 percent of the particles retained on a No. 4 sieve and with two or more crushed faces as determined by Test Method Tex-460-A, Part 1. (Blending of two or more sources is allowed.)

**Table 1. Material Requirements.**

<b>Property</b>	<b>Test Method</b>	<b>Grade 1</b>
Master Gradation (Percent Retained)		
1 ¾ in.	Tex-110-E	0
1 ½ in.		0-15
¾ in.		10-35
⅜ in.		35-55
No. 4		50-75
No. 40		70-90
No. 200		88-98
Liquid Limit <sup>1</sup>		Tex-104-E
Plasticity Index <sup>1</sup>	Tex-106-E	≤ 8
Wet Ball Mill, percent <sup>2,3</sup>	Tex-116-E	≤ 30
Max. Increase Passing No. 40, percent	Tex-116-E	≤ 12
Deleterious Materials, percent	Tex-413-E	≤ 1.5
Confined Compressive Strength (psi)(@15 psi Confining)	Tex-144-E	> 225
Dielectric Value	Tex-144-E	Report
Initial Seismic Modulus (ksi)	Tex-149-E	Report

Notes:

1. Use Tex-107-E when the liquid limit is unattainable as defined in Tex-104-E.
2. Test material in accordance with Test Method Tex-411-A when shown on the plans.
3. The wet ball requirements do not apply when lightweight aggregates are specified. Meet the Los Angeles abrasion, pressure slaking, and freeze-thaw requirements of Item 302, "Aggregate for Surface Treatment (Lightweight)" when shown on the plans.

**B. Material Tolerances.** The Engineer may accept material if no more than 1 of the 5 most recent gradation tests has an individual sieve outside the specified limits of the gradation.

When target grading is required by the plans, no single failing test may exceed the master grading by more than 5 percentage points on sieves No. 4 and larger or 3 percentage points on sieves smaller than No. 4.

The Engineer may accept material if no more than 1 of the 5 most recent plasticity index tests is outside the specified limit. No single failing test may exceed the allowable limit by more than 2 points.

- C. Water.** Furnish water free of industrial waste and other objectionable matter.
- D. Asphalt.** Furnish asphalt or emulsion for tack coat that meets the requirements of Item 300, "Asphalts, Oils, and Emulsions," as shown on the plans. When required by the Engineer, verify that emulsified or cut-back asphalt proposed for use meets the minimum residual asphalt percentage listed in Item 300, "Asphalts, Oils, and Emulsions."
- E. Material Sources.** When non-commercial sources are utilized, expose the vertical faces of all strata of material proposed for use. Secure and process the material by successive vertical cuts extending through all exposed strata, unless otherwise directed.

**245.3. Equipment.** Provide approved machinery, tools, and equipment necessary for proper execution of the work. Maintain them in satisfactory working condition.

- A. Pugmill (optional).** Provide a pugmill or mixer that will combine all aggregate sizes at the required moisture into a uniform product to reduce segregation.
- B. Spreaders (optional).** Provide a hot-mix paver or base lay-down machine that will spread the base material in a uniform layer. When shown on the plans, equip spreaders with electronic grade controls.
- C. Compaction Equipment.** Provide rollers in accordance with Item 210, "Rolling."
- D. Weighing and Measuring Equipment.** Provide weighing and measuring equipment that meets the requirements of Item 520, "Weighing and Measuring Equipment."

**245.4. Construction.** Construct a uniform course, free of loose or segregated areas, with required compaction and moisture content producing a smooth surface that conforms to the typical sections, lines, and grades as shown on the plans or as directed.

Stockpile base material temporarily at an approved location before delivery to the roadway. Build stockpiles in layers no greater than 2 ft thick. Stockpiles must have a total height between 10 and 16 ft unless otherwise shown on the plans. After construction and acceptance of the stockpile, loading from the stockpile for delivery is allowed. Load by making successive vertical cuts through the entire depth of the stockpile.

Do not add or remove material from temporary stockpiles that will require additional sampling and testing before use, unless otherwise approved. Charges for additional sampling and testing required as a result of adding or removing material will be deducted at the rate shown on the plans from the Contractor's estimates.

**A. Production (optional).** Prepare the final aggregate base in a pugmill capable of combining all sieve sizes at the same time to produce a uniform, non-segregated product.

**B. Delivery.** Haul approved aggregate base material in clean trucks, as shown on the plans.

**1. Roadway Delivery.** Deliver the required quantity to each 100-ft station.

Process or manipulate the material in accordance with the applicable bid items.

**2. Stockpile Delivery.** Prepare the stockpile site as directed. Provide and deliver the required quantity of approved base material to the designated stockpile site.

Build stockpiles in layers no greater than 2 ft thick. Stockpiles will have a total height no less than 10 ft, unless otherwise shown on the plans.

**C. Preparation of Subgrade or Existing Subbase.** Remove or scarify existing asphalt concrete pavement in accordance with Item 105, "Removing Stabilized Base and Asphalt Pavement," when shown on the plans or as directed. Prior to placing the base, shape the subgrade and existing subbase to conform to the typical sections, as shown on the plans or as directed.

When shown on the plans or when directed, proof-roll the roadbed in accordance with Item 216, "Proof Rolling." Correct soft spots as directed.



Unless otherwise shown on plans, prior to placing the base on top of raw or treated subgrade, apply asphalt material at the rate of 0.10 to 0.20 gal. per yd<sup>2</sup>, as directed. Use the type and grade of asphaltic material shown on the plans.

- D. Placing.** Spread and shape the aggregate base into a uniform layer with an approved spreader, to the depth shown on the plans, the same day as delivered. In the event of inclement weather or circumstances that render this impractical, spread and shape as soon as practical. Control dust by sprinkling, as directed. Correct or replace segregated areas, as directed. Replace these areas with well-graded material at no additional expense to the Department, as directed. Measure layer thickness in accordance with Test Method Tex-140-E, as directed. Correct locations with a thickness deficient of more than ½ in. by scarifying, adding material as required, reshaping, re-compacting, and refinishing.

Place successive base courses and finish courses using the same construction methods required for the first course.

- E. Establishing Rolling Pattern.** Designate a test section at least 500 ft in length and the width of the pavement for establishing a rolling pattern. Spread and shape the aggregate base in a uniform layer to the depth of the first course. When necessary, sprinkle the material in accordance with Item 204, "Sprinkling." Roll and compact the entire test section in the proposed method and pattern.

Measure the density, in accordance with Tex-115-E, and the in-place seismic modulus, in accordance with Tex-148-E, once the proposed rolling pattern is completed. The target density is 100 percent of Tex-113-E, and the target seismic modulus requirements are as measured in Table 1. If 100 percent of the required density and seismic modulus is achieved, use the amount of compactive effort and sprinkling from this rolling pattern for the rest of the project. If the required density and modulus fail the requirement, increase the compactive effort and adjust the sprinkling as needed, until both requirements are achieved.

- F. Compaction.** Compact using "Density Control," unless otherwise shown on the plans.

Begin rolling longitudinally at the sides and proceed toward the center, overlapping on successive trips by at least one-half the width of the roller unit. On super-elevated

curves, begin rolling at the low side and progress toward the high side. Offset alternate trips of the roller. Operate rollers at a speed between 2 and 6 mph, as directed.

Rework, recompact, and refinish materials that fail to meet compaction requirement. Replace them with a new base that meets specification requirements, as directed. Repeat compaction operations. Continue work until specification requirements are met. Perform the work at no additional expense to the Department.

**1. Density Control.** Compact the base to at least 100 percent of the maximum density determined by Tex-113-E unless otherwise shown on the plans.

Determine the moisture content at the beginning and after compaction in accordance with Tex-103-E. In cases of disputes, the sand cone method may be used as an alternative density measuring test.

The Engineer may accept the section if no more than 1 of the 5 most recent density tests is below the specified density and the failing test is not less than 98 percent of the specified density.

**2. Modulus Control.** Determine the moisture content in the mixture at the beginning and during compaction in accordance with Test Method Tex-103-E.

Modulus control testing shall be conducted no more than 1 hour after the completion of compaction and the moisture content of the base must be no more than  $\pm 2$  percent of optimum moisture content.

Compact to achieve a modulus of at least 100 percent of the initial modulus determined by Test Method Tex-147-E, Part II, unless otherwise shown on the plans. The Engineer will determine the roadway modulus of completed sections in accordance with Test Method Tex-148-E. Measure the modulus at three points in every 100-ft station of the project. Measure at least three points in cross section at each third of the station, and average the modulus as the result of each point. Rework, recompact, and refinish or remove and replace areas that do not meet seismic modulus requirements shown in Table 1 or on the plans.

**G. Finishing.** Brush and sweep the surface of the final base course. Remove loosened material and dispose of it at an approved location. Maintain the shape of the course

and surface in conformity with the typical sections, lines, and grades, as shown on the plans or as directed.

In areas where surfacing is to be placed, correct grade deviations greater than ¼ in. in 16 ft measured longitudinally or greater than ¼ in. over the entire width of the cross section. Correct by loosening, adding, or removing material. Reshape and recompact the material in accordance with Section 247.E, "Compaction."

**H. Curing.** Cure the final section until the moisture content is at least 2 percentage points below optimum moisture or as directed before applying the next successive course or prime coat. After curing, apply asphalt material at the rate of 0.10 to 0.20 gal. per yd<sup>2</sup> as directed. Use the type and grade of asphaltic material shown on the plans.

**245.5. Measurement.** Aggregate base will be measured as follows:

- A. Aggregate Base (Complete in Place).** The ton, square yard, or any cubic yard method.
- B. Aggregate Base (Roadway Delivery).** The ton or cubic yard in vehicle method.
- C. Aggregate Base (Stockpile Delivery).** The ton, cubic yard in vehicle, or cubic yard in stockpile method.

Measurement by the cubic yard in final position and square yard is a plans quantity measurement. The quantity to be paid for is the quantity shown in the proposal unless modified by Article 9.2, "Plans Quantity Measurement." Additional measurements or calculations will be made if adjustments of quantities are required.

Measurement is further defined for payment as follows:

- 1. Cubic Yard in Vehicle.** By the cubic yard in vehicles of uniform capacity at the point of delivery.
- 2. Cubic Yard in Stockpile.** By the cubic yard in the final stockpile position by the method of average end areas.
- 3. Cubic Yard in Final Position.** By the cubic yard in the completed and accepted final position. The volume of base course is computed in place by the method of

average end areas between the original subgrade or existing base surfaces and the lines, grades, and slopes of the accepted base course, as shown on the plans.

4. **Square Yard.** By the square yard of surface area in the completed and accepted final position. The surface area of the base course is based on the width of flexible base, as shown on the plans.
5. **Ton.** By the ton of dry weight in vehicles as delivered. The dry weight is determined by deducting the weight of the moisture in the material at the time of weighing from the gross weight of the material. The Engineer will determine the moisture content in the material in accordance with Tex-103-E from samples taken at the time of weighing.

When material is measured in trucks, the weight of the material will be determined on certified scales, or the Contractor must provide a set of standard platform truck scales at a location approved by the Engineer. Scales must conform to the requirements of Item 520, "Weighing and Measuring Equipment."

**245.6. Payment.** The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for the types of work shown below. No additional payment will be made for thickness or width exceeding that shown on the typical section or provided on the plans for cubic yard in the final position or square yard measurement.

Sprinkling and rolling, except proof rolling, will not be paid for directly but will be subsidiary to this Item unless otherwise shown on the plans. When proof rolling is shown on the plans or directed, it will be paid for in accordance with Item 216, "Proof Rolling."

Where subgrade is constructed under this project, correction of soft spots in the subgrade will be at the Contractor's expense. Where subgrade is not constructed under this project, correction of soft spots in the subgrade will be paid in accordance with pertinent Items or Article 4.2, "Changes in the Work."

- A. **Aggregate Base (Complete in Place).** Payment will be made for the type and grade specified. For cubic yard measurement, "In Vehicle," "In Stockpile," or "In Final Position" will be specified. For square yard measurement, a depth will be specified.

This price is full compensation for furnishing materials, temporary stockpiling, assistance provided in stockpile sampling and operations to level stockpiles for measurement, loading, hauling, delivery of materials, spreading, blading, mixing, shaping, placing, compacting, reworking, finishing, correcting locations where thickness is deficient, curing, furnishing scales and labor for weighing and measuring, and equipment, labor, tools, and incidentals.

- B. Aggregate Base (Roadway Delivery).** Payment will be made for the type and grade specified. For cubic yard measurement, “In Vehicle” will be specified. The unit price bid will not include processing at the roadway. This price is full compensation for furnishing materials, temporary stockpiling, assistance provided in stockpile sampling, and operations to level stockpiles for measurement, loading, hauling, delivery of materials, furnishing scales and labor for weighing and measuring, and equipment, labor, tools, and incidentals.
- C. Aggregate Base (Stockpile Delivery).** Payment will be made for the type and grade specified. For cubic yard measurement, “In Vehicle” or “In Stockpile” will be specified. The unit price bid will not include processing at the roadway. This price is full compensation for furnishing and disposing of materials, preparing the stockpile area, temporary or permanent stockpiling, assistance provided in stockpile sampling and operations to level stockpiles for measurement, loading, hauling, delivery of materials to the stockpile, furnishing scales and labor for weighing and measuring, and equipment, labor, tools, and incidentals.

