

SECTION 02721

UNTREATED BASE COURSE (UTBC)

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Production, construction, and compaction of untreated base course material.

1.2 RELATED SECTIONS

- A. Section 01572: Dust Control and Watering

1.3 REFERENCES

- A. AASHTO T 11: Materials Finer than 75 μm (no. 200) Sieve in Mineral Aggregates by Washing
- B. AASHTO T 19: Unit Weight and Voids in Aggregate
- C. AASHTO T 27: Sieve Analysis of Fine and Coarse Aggregates
- D. AASHTO T 89: Determining the Liquid Limit of Soils
- E. AASHTO T 90: Determining the Plastic Limit and Plasticity Index of Soils
- F. AASHTO T 96: Resistance to Degradation of Small-Sized Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
- G. AASHTO T 180: Moisture-Density Relations of Soils Using a 4.54 kg (10 lb) Rammer and 457 mm (18 in) Drop
- H. AASHTO T 193: The California Bearing Ratio
- I. AASHTO T 308: Determining the Asphalt Binder Content of Hot Mix Asphalt (HMA) by the Ignition Method
- J. AASHTO T 310: Field Density and Moisture Content by Nuclear Gage

1.4 DEFINITIONS

- A. **Mean of the Deviations:** The sum of the absolute values of the deviations divided by the number of tests in the lot.

1.5 SUBMITTALS

- A. Ten days before placement begins, submit a written report on the following:
 - 1. Aggregate suitability. Refer to this Section, Part 2.
 - 2. Name of supplier and source.
 - 3. Job mix gradation including single values for each sieve size based on the dry weight of the aggregate.
- B. Resubmit all quality documents 24 hours before a day's production starts if a change in source is required.
 - 1. Changes must fall within bands of Table 2 in this Section, and are subject to approval.
 - 2. Retroactive changes are allowed only for the first day's production for each construction season.

1.6 QUALITY ASSURANCE

- A. Remove products found defective after installation and install acceptable products at no additional cost to the Department.

1.7 ACCEPTANCE

- A. Engineer takes random sample from the grade.
- B. Acceptance will be on a lot-by-lot basis where a lot consists of a single layer of not more than 8000 yd² placed to line and grade and compacted. Divide the lot into five sublots of approximately 1600 yd² each. When working with small daily amounts, limit lot to maximum of two weeks worth of production and adjust subplot size accordingly.
 - 1. Conduct one random moisture, gradation and density test within each subplot. AASHTO T 310.
 - a. If the Mean of the Deviations of test results varies from the Combined Aggregate Target more than the minimum shown under the 0.70 pay factors of Table 2, the pay factor for the material allowed to remain in place is 0.50. This applies only if the Engineer does not order correction or removal of any or all of the material represented by the tests.

- b. The results of five density tests must indicate that the average of 97 percent of maximum laboratory density has been met with no test less than 94 percent. AASHTO T 180, Method D.
- C. Do not place additional material on any unaccepted layer.
- D. Rework unacceptable material at no additional cost to the Department.
- E. Price Adjustments - Rap Content (AASHTO T 308)
 - 1. Based upon average asphalt cement content per lot.
 - 2. Apply price adjustment to entire lot quantity.

Table 1

Asphalt Cement Content over Design Content (x) (% by Weight of Mix)	Price Adjustment (Dollars/ton)
$0.2 \leq x < 0.4$	- 0.30
$0.4 \leq x < 1.0$	- 1.50
$x \geq 1.0$	Reject*

* Lots in Reject due to RAP content may stay in place, at the direction of the Engineer, with a 50 percent price adjustment.

Table 2						
Pay Factors for Aggregate Gradation						
Mean of The Deviations of Sieve Gradation Results From The Combined Aggregate Target - Expressed in Percentage Points						
SIEVE SIZES	Pay Factor	1 TEST Max-min	2 TESTS Max-Min	3 TESTS Max-Min	4 TESTS Max-Min	5 TESTS or More Max - Min
½ inch and larger	1.00	0 - 15	0.0 - 12.1	0.0 - 10.8	0.0 - 10.0	0.0 - 9.5
	0.95	16 - 17	12.2 - 13.9	10.9 - 12.4	10.1 - 11.5	9.6 - 11.0
	0.90	18 - 19	14.0 - 15.1	12.5 - 13.5	11.6 - 12.5	11.1 - 11.9
	0.80	20 - 21	15.2 - 17.2	13.6 - 15.3	12.6 - 14.2	12.0 - 13.5
	0.70	22 - 23	17.3 - 18.8	15.4 - 16.7	14.3 - 15.5	13.6 - 14.7
3/8 inch	1.00	0 - 15	0.0 - 11.5	0.0 - 9.8	0.0 - 8.8	0.0 - 8.0
	0.95	16 - 17	11.6 - 13.3	9.9 - 11.3	8.9 - 10.1	8.1 - 9.2
	0.90	18 - 19	13.3 - 14.4	11.4 - 12.3	10.2 - 11.0	9.3 - 10.0
	0.80	20 - 21	14.5 - 16.3	12.4 - 13.9	11.1 - 12.5	10.1 - 11.4
	0.70	22 - 23	16.4 - 17.9	14.0 - 15.2	12.6 - 13.6	11.5 - 12.4
No. 4	1.00	0 - 14	0.0 - 10.5	0.0 - 8.8	0.0 - 7.8	0.0 - 7.0
	0.95	15 - 17	10.6 - 12.1	8.9 - 10.1	7.9 - 9.0	7.1 - 8.0
	0.90	18	12.2 - 13.1	10.2 - 11.0	9.1 - 9.8	8.1 - 8.7
	0.80	19 - 20	13.2 - 14.9	11.1 - 12.5	9.9 - 11.1	8.8 - 10.0
	0.70	21 - 22	15.0 - 16.3	12.6 - 13.6	11.2 - 12.1	10.1 - 10.8
No. 16	1.00	0 - 11	0.0 - 8.2	0.0 - 6.9	0.0 - 6.2	0.0 - 5.6
	0.95	12 - 13	8.3 - 9.4	7.0 - 7.9	6.3 - 7.1	5.7 - 6.4
	0.90	14	9.5 - 10.3	8.0 - 8.6	7.2 - 7.8	6.5 - 7.0
	0.80	15 - 16	10.4 - 11.6	8.7 - 9.8	7.9 - 8.8	7.1 - 8.0
	0.70	17	11.7 - 12.7	9.9 - 10.7	11.7 - 12.7	8.1 - 8.7
No. 50	1.00	0 - 9	0.0 - 7.0	0.0 - 6.1	0.0 - 5.5	0.0 - 5.2
	0.95	10	7.1 - 9.0	6.2 - 7.0	5.6 - 6.3	5.3 - 6.0
	0.90	11	9.1 - 8.8	7.1 - 7.6	6.4 - 6.9	6.1 - 6.5
	0.80	12 - 13	8.9 - 10.0	7.7 - 8.7	7.0 - 7.8	6.6 - 7.4
	0.70	14	10.1 - 10.9	8.8 - 9.5	7.9 - 8.5	7.5 - 8.1
No. 200	1.00	0 - 4.5	0.0 - 3.4	0.0 - 2.9	0.0 - 2.5	0.0 - 2.3
	0.95	4.6 - 5.2	3.5 - 3.9	3.0 - 3.3	2.6 - 2.9	2.4 - 2.6
	0.90	5.3 - 5.6	4.0 - 4.3	3.4 - 3.6	3.0 - 3.1	2.7 - 2.9
	0.80	5.7 - 6.4	4.4 - 4.8	3.7 - 4.1	3.2 - 3.6	3.0 - 3.3
	0.70	6.5 - 7.0	4.9 - 5.3	4.2 - 4.5	3.7 - 3.9	3.5 - 3.6

- F. Price Adjustments - Gradation:
1. Based upon number of samples per lot and the minimum pay factor.
 2. Pay factors for aggregate gradation when tested in accordance with AASHTO T 27 are indicated in Table 2.

PART 2 PRODUCTS

2.1 AGGREGATES

- A. Clean, hard, tough, durable and sound mineral aggregates that consist of crushed stone, crushed gravel or crushed slag; free of detrimental and organic matter; and complies with Table 3 and Table 4.

Table 3

Aggregate Properties		
Dry Rodded Unit Weight	Not less than 75 lb/ft ³	AASHTO T 19
Material Passing No. 40 Sieve	Non plastic	AASHTO T 90/T 89
Aggregate Wear	Not to exceed 50 percent.	AASHTO T 96
Dry Weight Values	Within bands shown in Table 4	
Gradation Limits	Table 4	AASHTO T 11 AASHTO T 27
CBR with a 10 lb. surcharge	70% Minimum	AASHTO T 193

Table 4

Gradation Limits – Single Value Job-Mix Formula			
Sieve Size	Percent Passing of Total Aggregate (Dry Weight)		
	1-1/2 inch	1 inch	3/4 inch
1-1/2 inch	100	--	--
1 inch	--	100	--
3/4 inch	81 -91	--	100
1/2 inch	67 - 77	79 - 91	--
3/8 inch	--	--	78 - 92
No. 4	43 - 53	49 - 61	55 - 67
No. 16	23 - 29	27 - 35	28 - 38
No. 200	6 – 10	7 - 11	7 - 11

Untreated Base Course: Based on fine and coarse aggregate having approximately the same bulk specific gravities.

- B. Recycled Asphalt Pavement (RAP): When the Contractor elects to use RAP in the untreated base course, meet the following:
 - 1. Materials manufactured by rotomilling, crushing, or other means approved by the Engineer.
 - 2. Mechanically blend with the virgin material, resulting in a homogeneous material. Do not use windrows and graders/dozers for blending.
 - 3. Do not exceed target asphalt cement content, as calculated by total weight of mix, for final blend material (virgin and RAP).
 - 4. Meet all requirements of this Section, article 2.1, Aggregates, with the following modifications:
 - a. L.A. Wear requirement applies to virgin aggregate portion only.
 - b. Non-plastic requirement applies to virgin aggregate portion only.
 - c. One fractured face and sand equivalent requirements apply to combined material residue from ignition oven.

PART 3 EXECUTION

3.1 JOB-MIX GRADATION

- A. Submit a written job-mix gradation for approval before production, including single values for each sieve size identified in Table 2, based on the dry mass of the aggregate.
- B. Meet Table 4 bands for dry mass values.
- C. For Blends using RAP:
 - 1. Limit target AC content to two percent by total weight of combined material.
 - 2. Submit two sets (five samples each) of ignition oven calibration samples containing blended material.
 - 3. Submit one set (five samples) of ignition oven calibration samples containing 100 percent virgin material.
 - 4. Modify drying procedures for gradation testing to minimize softening of the RAP asphalt cement. Reduce temperature and lengthen drying time. Recommended oven temperatures are approximately 140 degrees F with a drying time of eight to 12 hours or until sample does not continue to lose mass.
- D. Procedures for Changing the Job-Mix Gradation
 - 1. Meet the requirements of this Section, article 2.1, Aggregates for all changes.
 - 2. Submit changes in writing 24 hours prior to start of production for approval by the Engineer.

3.2 INSTALLATION

- A. Mixing: Provide an optimum moisture content of ± 2 percent at the time of placement. AASHTO T 180, Method D.
- B. Placing: Place layers in equal thickness and compact each layer to a thickness not to exceed 6 inches in depth. Do not place on a frozen subgrade or a frozen layer. Refer to Section 01572.
- C. Compaction: Meet requirements of this Section, article 1.7, Acceptance, paragraph, B1. Maintain optimum moisture content ± 2 percent.
 - 1. Within 2 feet of back walls of structure abutments and approach slabs, use a hand-operated vibratory compactor or a vibratory roller.
 - 2. For blends using RAP where maximum laboratory density (AASHTO T 180, Method D) accurate field density values cannot be determined due to Asphalt Cement content, meet 98 percent of maximum field density, with no test less than 96 percent of maximum field density.
 - a. Maximum Field Density
 - b. Determined by use of a repetitive roller pattern over a two adjacent locations. Maximum Field Density is defined as the average of the maximum value attained on a nuclear density gauge for each location prior to breakdown of the material.
 - c. Re-determine at least once per day.
- D. Finishing: Uniform line and grade with surface deviations no more than 3/8 inch \pm in 10 ft in any direction.
 - 1. Profile Tolerance — Correct any profile deficiency of greater than 3/8 inch.
 - a. Rework minimum of 4 inch lift to achieve homogeneous density
 - b. Determine limits of correction based on extent of deficiency. Extend work until existing deficiency is less than 3/8 inch.
- E. Quality Control Testing — Submit a quality control plan to the Engineer prior to construction. Perform tests as stated in the Quality Control plan.

END OF SECTION