

SECTION 02513

BITUMINOUS COURSE (CENTRAL-PLANT HOT MIX)

PART 1 GENERAL

1.1 SUMMARY (Not Applicable)

1.2 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 117	(1990) Materials Finer Than 75-um (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 127	(1988) Specific Gravity and Absorption of Coarse Aggregate
ASTM C 128	(1988) Specific Gravity and Absorption of Fine Aggregate
ASTM C 136	(1984a) Sieve Analysis of Fine and Coarse Aggregates
ASTM D 5	(1986) Penetration of Bituminous Materials
ASTM D 242	(1985; R 1990) Mineral Filler for Bituminous Paving Mixtures
ASTM D 1559	(1989) Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus
ASTM D 2041	(1991) Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
ASTM D 3381	(1983) Viscosity-Graded Asphalt Cement for Use in Pavement Construction
ASTM D 3666	(1993) Minimum Requirement for Agencies Testing and Inspecting Bituminous Paving Materials

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01300 SUBMITTAL DESCRIPTIONS:

SD-09 Reports

Bituminous Pavement; GA.

Copies of test results.

1.4 PLANT, EQUIPMENT, MACHINES, AND TOOLS

1.4.1 Mixing Plants

Mixing plant shall be a weigh-batch, continuous-mix type or dryer drum type and operated so as to produce a mixture within the job-mix formula. The plant shall have a minimum capacity of 1000 kN100 tons per hour.

1.4.2 Other Equipment

1.4.2.1 Spreaders

Bituminous-materials spreaders shall be self-propelled, capable of producing a finished surface conforming to the smoothness requirements specified hereinafter. The use of a spreader that leaves indentations or other objectionable irregularities in the freshly-laid mix is not permitted.

1.4.2.2 Blowers and Brooms

Blowers and brooms shall be of the power type suitable for cleaning the surface to be paved.

1.4.2.3 Saws

Saws shall be of the power type, capable of rapidly cutting pavement and trimming joints and edges of pavement.

1.4.2.4 Small Tools

Small tools available on the work shall consist of the following: rakes, lutes, shovels, tampers, smoothing irons, pavement cutters, portable heater for heating small tools, wood sandles and stilt sandals of standard type, and other small tools as may be required. A sufficient number shall be available at all times. The lutes shall be constructed of metal and shall consist of a plate or sheet 1 meter x 0.1 meter36 x 4 inches attached to a handle properly braced. Hand tampers shall weigh not less than 0.1 kN25 pounds and have a tamping face not larger than 50 square inches.

1.4.2.5 Straightedge

The Contractor shall furnish and maintain at the site, in good condition, one 3.65 meter12-foot straightedge for each bituminous paver. The straightedge shall be made available for Government use. Straightedges shall be constructed of aluminum or other lightweight metal and shall have blades of box-girder cross section with flat bottom reinforced to insure rigidity and accuracy. Straightedges shall have handles to facilitate movement on the pavement.

1.4.3 Rollers

The minimum number of rollers for each spreader shall be one 2-axle tandem roller and one pneumatic-tired roller, with separate operator for each roller. For projects involving less than 2000 kN200 tons of asphalt mixture the requirement for rollers may be reduced to one 2-axle tandem roller and one pneumatic-tired roller at the discretion of the Contracting Officer.

1.4.3.1 Steel Wheeled Rollers

Steel-wheel rollers shall be a self-propelled 2-axle tandem roller weighing not less than 100 kN10 tons. The rollers shall have adjustable wheel scrapers, water tanks, and sprinkling apparatus to keep the wheels sufficiently wet to prevent the bituminous mixture from sticking to the wheels. The rollers shall be capable of reversing without backlash and shall be free from worn parts. The roller wheels shall not have flat or pitted areas or projections that will leave marks in the pavement.

1.4.3.2 Pneumatic-tired Rollers

Pneumatic-tired rollers shall be self-propelled and shall consist of two axles on which are mounted multiple pneumatic-tired wheels in such manner that the rear group of wheels will not follow in the tracks of the forward group but spaced to give essentially uniform coverage with each pass. Axles shall be mounted in a rigid frame provided with a loading platform or body suitable for ballast loading. Tires shall be smooth and capable of being inflated to at least 620 kPa90 pounds per square inch. Construction of roller shall be such that each wheel can be loaded to a minimum of 20 kN 4,500 pounds.

1.5 WEATHER LIMITATIONS

Bituminous course shall be constructed only when base course and existing pavement is dry. Unless otherwise directed, bituminous course shall not be constructed when temperature of the surface of existing pavement or base course is below 5 degrees C40 degrees F.

PART 2 PRODUCTS

2.1 AGGREGATES

Aggregates shall consist of crushed stone, crushed gravel, screenings, sand, and mineral filler. Aggregates shall have a satisfactory service record in bituminous pavement construction, and the source selected shall be approved by the Contracting Officer. Not less than 50 percent by weight of the aggregates retained on the No. 4 sieve shall have at least two fractured faces. Material passing the No. 200 sieve shall be known as mineral filler, and shall conform to ASTM D 242. The combined aggregates and mineral filler shall meet the requirements of subsequent paragraphs AGGREGATE GRADATION and COMPOSITION OF MIXTURE.

2.1.1 Aggregate Gradation

*The aggregate gradation as described by ASTM C 117 and ASTM C 136 shall fall within the limits of the following:

Sieve Designation	Percent by Weight Passing Square-mesh Sieve (a)		
	Limits of Proposed Proposed Gradation	Operating Range	Contract Compliance
19 mm		100	100
12.5 mm		95-100	89-100
9.5 mm		80-95	75-100
4.75 mm	59-66	X+/-5	X+/-8
2.36 mm	43-49	X+/-5	X+/-8
0.60 mm	22-27	X+/-5	X+/-8
0.075 mm		3-8	0-11

Sieve Designation	Percent by Weight Passing Square-mesh Sieve (a)		
	Limits of Proposed Proposed Gradation	Operating Range	Contract Compliance
3/4-inch		100	100
1/2-inch		95-100	89-100
3/8-inch		80-95	75-100
No. 4	59-66	X+/-5	X+/-8
No. 8	43-49	X+/-5	X+/-8
No. 30	22-27	X+/-5	X+/-8
No. 200		3-8	0-11

(a) California Gradation: Gradation is 1/2-inch maximum, medium, per section 39 of the California Department of Transportation *Standard Specifications*. The symbol "X" is the gradation which the Contractor proposes to furnish for the proposed sieve. The proposed gradation shall meet the gradation shown under "limits of Proposed Gradation".

2.2 BITUMINOUS MATERIAL

Bituminous material to be mixed with the mineral aggregates shall be paving asphalt conforming to ASTM D 3381, Viscosity-Graded Asphalt Cement for Use in Pavement Construction as listed in Table of the ASTM D 3381, Requirements for Asphalt Cement Viscosity-Graded at 140 degrees F (60 degrees C). Paving asphalt viscosity grade shall be AR 4000. Certified results of tests conducted in accordance with ASTM D 5 shall be submitted in advance of any paving, showing the penetration at 25 degrees C 77 degrees F for the AR grades of asphalt that will actually be used in the paving mix of this project.

2.3 COMPOSITION OF MIXTURE

2.3.1 Job-Mix Formula

The job-mix formula shall be submitted by the Contractor a minimum of 30 days prior to the commencement of paving operations, and no bituminous mixture shall be manufactured until it has been approved by the Contracting Officer. The formula shall indicate the percentage and specific gravity of each bin fraction of aggregate, percentage absorption and specific gravity of asphalt, temperature of the mixture as discharged from the mixer; and test results which show that the job mix formula will produce a bituminous mixture which meets all requirements of this specification. Previously established test results will be acceptable provided that the tests were performed within the last six months. The asphalt in the job-mix formula shall be between 4.5% and 7.5% of the weight of the total mix. If requested by the Contracting Officer, samples of the aggregates and asphalt shall be submitted for approval of the job-mix formula.

2.3.2 Test Properties of Bituminous Mixtures

2.3.3 Nonabsorptive Aggregate

When the water absorption value of the entire blend of aggregate does not exceed 2.5 percent as determined by ASTM C 127 and ASTM C 128, aggregate is designated as nonabsorptive. The test method outlined in ASTM D 2041 may be utilized for the determination of the theoretical maximum specific

gravity and density of the paving mixture providing that the mixture meets the requirements of Table 1. The apparent specific gravity shall be used in computing the voids total mix and voids filled with bitumen. Stability and flow shall be determined in accordance with ASTM D 1559. The mixture shall meet the requirements of Table 1 herein.

TABLE 1. NONABSORPTIVE AGGREGATE MIXTURE

Test Property	50-Blow Compaction
Stability, minimum, pounds	1000
Flow, 1/100-inch units	8 minimum, 20 maximum
Voids total mix, percent	3-5
Voids filled with bitumen, percent	75-85

2.3.4 Absorptive Aggregate

When the water absorption value of the entire blend of aggregate exceeds 2.5 percent as determined in ASTM C 127 and ASTM C 128, the aggregate is designated as absorptive. The test method outlined in ASTM D 2041 may be utilized for the determination of the theoretical maximum specific gravity and density of the paving mixture providing that the mixture meets the requirements of Table 2. Bulk-impregnated specific gravity shall be used in computing the percentages of voids total mix and voids filled with bitumen. Stability and flow shall be determined in accordance with ASTM D 1559. The mixture shall meet the requirements in Table 2, herein.

TABLE 2. ABSORPTIVE AGGREGATE MIXTURE

Test Property	50-Blow Compaction
Stability, minimum, pounds	1000
Flow, 1/100-inch units	8 minimum, 20 maximum
Voids total mix, percent	2-4
Voids filled with bitumen, percent	80-90

2.3.5 Stripping of Aggregates

After 24 hours immersion in water bath controlled at a temperature of 140 degrees F., the retained stability of job-mix formula test specimens shall be at least 75 percent of the stability of companion specimens prepared for the job-mix formula when tested in accordance with ASTM D 1559. If the retained stability is less than the required 75 percent, the aggregates shall be either rejected or treated by one of the following procedures until the retained stability reaches the required 75 percent: (1) Addition of heat-stable additives to bitumen; (2) addition of hydrated lime, or other cementitious material containing free lime, as a portion of the mineral filler.

PART 3 EXECUTION

3.1 SAMPLING AND TESTING

The testing laboratory and all field and laboratory testing personnel shall meet the requirements specified in ASTM D 3666. All samples and control testing for construction of the pavement shall be performed by the Contractor. Four-inch in diameter core samples shall be suitable to

determine conformance with stability, density, thickness and other specified requirements. An approved core drill shall be used for cutting samples. The Contractor shall furnish all tools, labor, and materials for cutting samples, testing, and replacing the pavement where samples were removed, to the satisfaction of the Contracting Officer.

3.1.1 Testing Frequency

A one-quart sample of asphalt, a 100 pound sample of mix aggregate, and a 140 pound sample hot mix shall be provided if requested by the Contracting Officer for testing at Government expense. One core sample shall be taken of the bituminous mat placed under the Contract. Testing shall be in accordance with the Marshall test procedures of ASTM D 1559 and shall meet or surpass the requirements specified hereinbefore. No payment will be made for areas of pavement deficient in composition, density, or thickness until they are removed and replaced by the Contractor as directed by the Contracting Officer.

3.2 TREATMENT OF UNDERLYING SURFACE

Prior to laying a bituminous course, the underlying surface shall be cleaned of loose and foreign matter by sweeping with power sweepers, power brooms, and hand brooms, as directed. The surface to be paved shall receive a prime coat conforming to Section 02559 BITUMINOUS PRIME COAT.

3.3 MIXING

Temperature of asphalt at time of mixing shall not exceed 163 degrees C/325 degrees F when asphalt is added.

3.4 TRANSPORTATION OF BITUMINOUS MIXTURE

The bituminous mixture shall be transported from the mixing plant to the site in trucks having tight, clean, smooth bodies with a minimum coating of concentrated solution of hydrated lime and water to prevent adhesion of the mixture. Each load of mixture shall be covered with canvas or other suitable material to protect the mixture from the weather and to prevent loss of heat. Mixtures having temperatures greater than 163 degrees C/325 degrees F, mixtures having temperatures less than 118 degrees C/245 degrees F, or mixtures which foam or show indications of moisture will be rejected. Hauling over freshly laid material is not permitted.

3.5 PLACING

Contact surfaces of previously constructed pavement, curbs, manholes, or other structures shall be sprayed with a thin coat of bituminous tack coat. The mechanical spreader shall be adjusted and its speed regulated so that the course being placed will be smooth and continuous without tears and pulling. The course will be of such depth that after compaction, the cross section, grade, and contour will be as shown on the drawings. In areas where the use of machine spreading is impractical, the mixture shall be spread by hand. Unless otherwise directed, placing shall begin on the high side of areas with a one-way slope or along the centerline of areas with a crowned section and shall be in the direction of the main traffic flow. Placing of the mixture shall be as continuous as possible, and the speed of placing shall be adjusted to permit proper rolling.

3.6 COMPACTION OF ASPHALT MIXTURE

Compaction of asphalt mixture shall be accomplished by the steel wheel rollers and pneumatic-tired roller specified above.

3.6.1 Rolling

Rolling shall begin as soon after placing as the mixture will support the roller without undue displacement. Breakdown rolling shall consist of at least three coverages of a layer of asphalt mixture with a steel wheel roller, immediately followed by at least three coverages with a pneumatic-tired roller. A coverage is defined to be as many passes in either direction as may be necessary to cover the entire width of lane with overlap between passes. Each layer shall be additionally compacted by a final rolling of not less than one coverage with a 2-axle tandem roller. The speed of the rollers shall not exceed 3 miles per hour and rolling shall be performed in such a manner to avoid cracking, shoving, or displacement of the hot mixture.

3.6.1.1 Vibratory Steel Wheeled Rollers

Use of vibratory steel wheel roller for breakdown and finish rolling is subject to prior approval. Vibratory roller shall be operated with the vibratory units off for finish rolling. The maximum weight of the vibratory roller shall not exceed 5 tons.

3.6.1.2 Mixture Density

The bituminous mixture shall be compacted to at least 95 percent of the density of the laboratory specimen of the same mixture subjected to 50 blows of a standard Marshall hammer on each side of the specimen. In areas not accessible to the roller the mixture shall be compacted with hot hand tampers. The compacted surface shall be smooth and free from roller marks, ruts, humps, depressions, or irregularities.

3.6.1.3 Compacted Thickness

Maximum compacted thickness per lift shall be not more than 60 mm 2.5 inches.

3.7 JOINTS AND EDGES

Joints between old and new pavements or between successive day's work, or joints that have become cold because of delay, shall be made to insure continuous bond between old and new sections of course. All joints shall have the same texture, density, and smoothness as other sections of course.

Contact surfaces of previously constructed pavements that have become coated with dust, sand or other objectionable material shall be cleaned by brushing or cut back with approved power saw, as directed. The surface against which new material is placed shall be sprayed with a thin, uniform coat of bituminous tack coat.

3.7.1 Transverse Joints

The roller shall pass over the unprotected end of freshly placed mixture only when placing of course is discontinued or when delivery of mixture is interrupted to the extent that unrolled material may become cold. In all cases, edge of the previously placed course shall be sawn back to expose an even, vertical surface the full thickness of the course.

3.7.2 Longitudinal Joints

Edges of previously placed strip that have cooled or are irregular, honeycombed, poorly compacted, damaged, or otherwise defective, and unsatisfactory sections of the joint shall be sawn back to expose clean, sound surface for full thickness of the course as directed.

3.7.3 Pavement Edges

Edges of pavement adjacent to shoulders shall be trimmed neatly to line. An earth berm of selected material not less than one foot wide shall be placed against and to the full height of the pavement surface as soon as practicable after final rolling has been completed and pavement has sufficiently hardened.

3.8 PROTECTION OF PAVEMENT

No vehicular traffic shall be permitted on the pavement for at least 6 hours after final rolling.

3.9 SURFACE REQUIREMENTS

The finished surface shall not vary more than 6 mm1/4-inch from a 3.6 meter (12-foot)12-foot straightedge. The straightedge shall be furnished by the Contractor. Defective areas shall be corrected by and at the expense of the Contractor. Straightedge testing shall be performed as a Contractor Quality Control requirement to demonstrate compliance.

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