

SECTION 02630

ASPHALT CONCRETE PAVEMENT

PART 1 - GENERAL

1.1 Summary

A. Description of Work

The work to be performed in accordance with this section includes the furnishing of all materials and the placing of asphalt concrete for roadway pavements.

The work covered shall include furnishing of all labor, equipment, materials and performing all required operations to provide a complete item in accordance with the project plans and these specifications.

B. Related Work Specified Elsewhere

Aggregate Base CourseSection 02610
Bituminous Prime and Tack Coat.....Section 02620

C. Definitions

1. Relative Density

Relative density is determined by the bulk specific gravity of the compacted pavement divided by the 75 blow Marshall specific gravity of the corresponding lot.

2. Lot

For the purposes of compliance testing, a lot shall be 300 tons of asphalt concrete placed or one day's production, as determined by the Engineer.

3. Coarse Aggregate

Portion of the mineral aggregate retained on the No. 4 sieve.

4. Fine Aggregate

Portion of the mineral aggregate retained on the No. 200 sieve and passing the No. 4 sieve.

5. Mineral Filler

Portion of the mineral aggregate passing the No. 200 sieve.

1.2 Quality Assurance

The Contractor shall provide all preliminary materials and mix design testing and the mix design report in accordance with Section 1330, Submittals. Compliance sampling and testing during construction will be provided by the Owner.

A. Reference Test Standards and Specifications

1. American Society for Testing and Materials (ASTM)

ASTM C88, Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate

ASTM C117, Materials Finer than No. 200 Sieve in Mineral Aggregates by Washing

ASTM C131, Resistance to Abrasion of Small Size Coarse Aggregate by Use of the Los Angeles Machine

ASTM C136, Sieve or Screen Analysis of Fine and Coarse Aggregates

ASTM C150, Portland Cement

ASTM C183, Sampling Hydraulic Cement

ASTM C977, Specification for Quicklime and Hydrated Lime for Soil Stabilization

ASTM D75, Practice for Sampling Aggregates

ASTM D140, Practice for Sampling Bituminous Materials

ASTM D242, Mineral Filler for Bituminous Paving Mixtures

ASTM D692, Coarse Aggregate for Bituminous Paving Mixture

ASTM D946, Penetration-Graded Asphalt Cement for Use in Pavement Construction

ASTM D995, Requirements of Mixing Plants for Hot-Mixed Hot-Laid Bituminous Paving Mixtures

ASTM D1073, Fine Aggregate for Bituminous Paving Mixture

ASTM D1075, Effect of Water on Cohesion of Compacted Bituminous Mixtures

ASTM D1188, Bulk Specific Gravity of Compacted Bituminous Mixtures Using Paraffin-Coated Specimens

ASTM D1559, Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus

ASTM D2041, Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures

ASTM D2172, Quantitative Extraction of Bitumen from Bituminous Paving Mixtures

ASTM D2419, and Equivalent Value of Soils and Fine Aggregate

ASTM D2489, Degree of Particle Coating of Bituminous-Aggregate Mixtures

ASTM D2726, Bulk Specific Gravity of Compacted Bituminous Mixtures Using Saturated Surface-Dry Specimens

ASTM D2950, Density of Bituminous Concrete In-Place by Nuclear Methods

ASTM D3381, Viscosity-Graded Asphalt Cement for Use in Pavement Mixtures

ASTM D3515, Specification for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures

ASTM D3549, Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimen

ASTM D3665, Random Sampling of Paving Materials

ASTM D3666, Inspection and Testing Agencies for Bituminous paving Materials

ASTM D4318, Liquid Limit, Plastic Limit, and Plasticity Index of Soils

2. The Asphalt Institute

Mix Design Methods for Asphalt Concrete
Manual No. 2 (MS-2), 1992 or its latest revision.

3. Maricopa Association of Governments (MAG), Uniform Standard Specifications for Public Works Construction, 1998 Edition (Includes revisions through 2004)

4. Arizona Department of Transportation (ADOT), Standard Specifications, 2000 Edition

B. Frequency of Testing

The following table indicates the minimum number of tests to be performed for acceptance of each lot.

| Test Description | Test Method | Test Frequency |
|---|-------------------------------|--|
| Maximum Density of Laboratory Compacted Mixture | ASTM D1559 ASTM D2726 | 3 test per lot |
| Asphalt Cement Content of Uncompacted Mixture | ASTM D2726 | 3 test per lot |
| Aggregate Gradation of Uncompacted Mixture | ASTM C136 ASTM C117 | 3 test per lot |
| In-Place Density of Compacted Mixture | Core Samples ASTM D2726 or | 3 to 5 randomly distributed core samples per lot |
| Thickness of Compacted Mixture | ASTM D3549 | 3 to 5 randomly distributed core samples per lot |
| Temperature of Mix at Time of Placement | Field Thermometer | 1 test per hot mix sample |
| Straight Edge | 10 foot straight edge | Continuously |

Sampling and testing frequencies may be reduced at the discretion of the Engineer if test results are repeatedly compliant and consistent.

Locations for sampling and in-place tests shall be in accordance with ASTM D3665. The Contractor shall provide extra tests as required by the Owner to define deficient areas at no additional cost to the Owner.

Acceptance samples shall be taken from behind the paving machine with a sampling plate in accordance with Arizona Department of Transportation test method ARIZ 104b. The acceptance laboratory and quality control laboratory shall utilize the ignition method (ASTM D6307) with the appropriate calibration/corrections applied for both gradation and binder content testing.

Three (3) cores should be used for acceptance testing if the production of the lot is less than 1,000 tons. Four (4) cores should be used for lots containing 1,000 to 1,500 tons, and Five (5) cores for lots exceeding 1,500 tons.

The density of the compacted mixture shall be determined from core samples cut from the pavement. The relative density of the finished product shall be determined by dividing the specific gravity of the core by the average Marshall specific gravity obtained for the corresponding lot.

C. Allowable Tolerances

The following table provides the tolerance for individual test results that will be allowed without adjustment to payment.

| Description | Allowable Tolerance |
|------------------------|----------------------------|
| Relative Density | -1 percent |
| Asphalt Cement Content | ±0.3 percent |

| Aggregate Gradation, Job Mix Tolerances | |
|--|-----------------------------|
| Aggregate Passing No. 4 Sieve or Larger | ± 6 percent |
| Aggregate Passing Nos. 8 and 30 sieves | ± 6 percent |
| Aggregate Passing 200 sieves | ± 2 percent |
| Thickness of Compacted Mixture | -1/4 inch |
| Temperature of Mix at Time of Placement | ± 25 degrees Fahrenheit |
| Straightedge, Finish Course | $\pm 1/4$ inch |

D. Acceptance

In place materials with deviations in excess of the allowable tolerances will be either removed and replaced or paid for at a reduced unit price as dictated herein. The penalties shown in the tables following are not cumulative with-in the same table.

1. Relative Density

Deviations from specifications will be based on the average values of acceptance testing performed for each lot and will be based on 95% of the Marshall Specific Gravity. When the relative density is greater or less than that specified, payment will be reduced as follows:

| Deviation From Density Specifications | Reduction in Payment |
|--|-----------------------------|
| 0 to -1% points | 0% |
| Greater than -1% point | - 2% |
| Greater than -2% points | - 5% |
| Greater than -3% points | - 10% |
| Greater than -5% points | Rejected |

When the relative density deviates from that specified by more than 5 percent, remove and replace that section of asphalt concrete pavement in accordance with specifications at no additional cost to the Owner.

2. Asphalt Cement Content

Deviations from specifications will be based on the average values of acceptance testing performed for each lot. When the asphalt cement content exceeds the allowable tolerance of ± 0.3 percent from the approved mix design target value, the payment will be reduced or the material rejected as follows:

| Deviation From Asphalt Cement Content Target Value | Reduction in Payment |
|--|----------------------|
| 0 to $\pm 0.3\%$ points | 0% |
| Greater than $\pm 0.3\%$ points | -2% |
| Greater than $\pm 0.4\%$ points | -5% |
| Greater than $\pm 0.5\%$ points | Rejected |

3. Aggregate Gradation

When the aggregate gradation exceeds the allowable job mix tolerances, that asphalt concrete pavement will be removed and replaced in accordance with the specifications at no additional cost to the Owner.

4. Thickness

Deviations from specifications will be based on the average values of acceptance testing performed for each lot. Where the pavement is deficient in thickness by not more than **-1/4** inch, payment will be reduced by 25 percent. Where the pavement is deficient in thickness by more than **1/4** inch, pavement shall be rejected. In the event that an individual core is deficient in thickness by more than **3/8** inch, two additional cores will be taken, one approximately 100 feet ahead of the deficient core and one approximately 100 feet behind the deficient core. These three cores will be used to

evaluate the deficiency of that area and it will be treated as a new sub lot regarding thickness acceptance. If the new sub lot is deficient, additional cores may be needed to determine the extent of the deficiency.

| Deviation From Minimum Thickness Specifications | Reduction in Payment |
|--|-----------------------------|
| Spec. to - 1/8 inch | 0% |
| Spec. minus 1/8 inch to spec minus 1/4 inch | -25% |
| Less than Spec. minus 1/4 inch | Rejected |

5. **Effective % Air Voids**

When the percent laboratory air voids (75 blow Marshall method) exceed the allowable mix design tolerances, the following table shall be used to determine pay reduction or pavement remove and replace. Deviations from specifications will be based on the average values of acceptance testing performed for each lot.

| Deviation From Target Percent Air Voids | Reduction in Payment |
|--|-----------------------------|
| 0 to \pm 2% | Full Payment |
| \pm 2.1% to \pm 2.9% | -5% |
| Greater than \pm 3% | Rejected |

6. **Straightedge**

Where the finish surface deviates from a true plane as determined by using a 10-foot straightedge in excess of 1/4 inch, the surface shall be removed and replaced in accordance with these specifications with a method approved by the Owner and shall be provided at no additional cost to the Owner. The repair shall be accomplished by completely removing and replacing the section or grinding down and replacing with a minimum of 2 inch overlay. The 10-foot straightedge shall be furnished by the Contractor.

1.3 Submittals and Quality Control

A. Certificates of Compliances

1. Mineral Filler
2. Asphalt Cement
3. **ARPA plant certification**
4. **Plant scale and metering device calibration**

B. Materials Test Reports

1. Report on Coarse Aggregate
2. Report on Fine Aggregate
3. Asphalt Concrete Mix Design, include the following items in the report:
 - a. Name and address of laboratory and responsible party
 - b. Location of source of aggregate
 - c. Supplier, refinery and grade of asphalt cement
 - d. **Supplier and source of admixture**
 - e. Individual aggregate gradations
 - f. Combined aggregate gradations
 - g. Job mix formula
 - h. Aggregate and mix design test results and voids analysis
 - i. Recommended asphalt cement content
 - j. Recommended lay down temperature
 - k. Recommended mixing temperature
 - l. Complete set of calculations

B. Quality Control Testing

The Contractor is required to provide a reasonable level of quality control testing to ensure that materials incorporated into the work and plant operations achieve a product that complies with the specifications without significant numbers of failures and asphalt concrete penalties. Acceptance testing provided by the Owner is not sufficient for controlling the plant.

PART 2 - MATERIALS

The following materials shall be used in the asphalt concrete.

2.1 Aggregates

A. Coarse Aggregates

ASTM D692, except as modified herein. Hard, strong durable pieces free of coherent coatings.

1. Percentage of Wear

ASTM C131. maximum percentage of wear of 40% after 500 revolutions. ASTM C88, sodium sulfate soundness loss after 5 cycles, less than 12 percent.

2. Fractured Faces

Minimum 75 percent by weight of aggregate retained by weight on the No. 8 sieve, at least one rough angular surface produced by mechanical crushing.

B. Fine Aggregate

ASTM D1073 except as modified herein. Sand prepared from stone, crushed gravel or combinations thereof shall be used, except that natural sand not exceeding 20% of the total aggregate weight may be used. Material shall consist of hard, tough grains free of injurious amounts of clay, loam, or other deleterious substances.

1. Sand Equivalent

ASTM D2419, Greater than 50.

2. Plasticity

ASTM D4318, non-plastic.

3. Percentage of Wear

ASTM D88, sodium sulfate soundness loss after 5 cycles, less than 12 percent.

2.2 Asphalt Cement

Asphalt cement shall be performance grade asphalt conforming to the requirements of MAG Specifications, Section 711 for PG-70-10, unless otherwise specified in the plans or special provisions.

2.3 Asphalt Concrete Mixture Composition

A. Design

Design the bituminous mixture using the procedures outlined the Asphalt Institute's Manual Series No. 2 (MS-2), 1992 edition or its latest revision to the following requirements:

| MARSHALL DESIGN CRITERIA (Latest Edition) | |
|--|---------------|
| Number of Blows | 75 |
| Stability, Pounds, Minimum | 1800 |
| Flow, 0.01 inch | 8 to 16 |
| Effective Percent Air Voids | 4.0 |
| Percent Voids in Mineral Aggregate | 14 minimum |
| Percent Voids Filled With Asphalt | 65 to 75 |
| Asphalt Cement Content, Percent | 5.2 (+/- 0.3) |

B. Quality

The proposed mix shall contain a minimum of 1.0 % mineral admixture. The mineral admixture shall be hydrated lime conforming to the requirements of ASTM C-207 Type N or Portland Cement conforming to MAG section 725. , The proposed mix shall have a minimum dry strength of 250 psi and an index of retained strength of at least 60 percent, when tested in accordance with ASTM D1075.

C. Gradation

Gradation of the combined aggregates shall conform to the following table:

| MINERAL AGGREGATE GRADATION (C-3/4) * | |
|--|-------------------------------------|
| SIEVE SIZE | PERCENTAGE BY WEIGHT PASSING |
| | |
| 3/4" | 100 |
| 1/2" | 90 -100 |
| 3/8" | 65-90 |
| No. 4 | 45-70 |
| No. 8 | 30-55 |
| No. 30 | 15-35 |
| No. 200 | 2-8 |

*** Percentages based on weight of dry aggregate and admixture.**

Provide the mineral aggregate or mineral aggregate and filler gradation specified in the previous table when tested in accordance with ASTM C136 and C117.

Provide a combined aggregate gradation within the bounds of the specified limits when plotted on an aggregate grading chart. The gradation shall not vary from the low limit on one sieve to the high limit on the adjacent sieve, or vice versa, but shall be uniformly graded from coarse to fine.

The ratio of the percentage of aggregate by weight passing the No. 30 sieve to that passing the No. 8 sieve shall not exceed 65 percent.

Sand may be used to obtain the proper gradation of the aggregate blend or to improve the workability of the mix. The amount of sand to be added shall be adjusted to produce mixtures conforming to requirements of this specification.

2.4 Preservative Seal

None required.

2.5 Equipment

A. Bituminous Mixing Plant

ASTM D995, Central mixing plant, with the following changes and/or additions.

1. Inspection of Plant

Provide the Owner or his/her authorized representative access, at all times, to all parts of the plant for checking adequacy of equipment; inspecting the operation of the plant; verifying weights, proportions, and character of materials; and checking the temperatures maintained in the preparation of the mixture.

2. Calibration

The plant shall have a current certification of Hot Mix Asphalt Production Facilities by Arizona Rock Products Association. The accuracy of all scales shall be certified through a representative of the State Division of Weights and Measures at least annually. Calibrate the plant as often as required to produce the specified mixture. A copy of all certifications for weighing and metering devices shall be kept in the plant.

3. Air Quality

Provide evidence of applicable permits and/or approval from the Air Quality Section, State Division of Environmental Protection prior to beginning operations.

B. Hauling Equipment

Discharge the bituminous mixture from the surge bin directly into the hauling vehicle and transport directly to the jobsite. Stockpiling outside the surge bins and ultimately loading into the vehicle is strictly prohibited. Provide trucks for hauling bituminous mixtures with tight, clean, and smooth metal beds. To prevent the mixture from adhering, lightly coat the truck beds with a small amount of light film

of distillate or light oil. Provide a suitable cover to protect the mixture from adverse weather. When necessary to ensure that the mixture will be delivered to the site at the specified temperature, insulate truck beds and provide securely fastened covers. Trucks with belly dumps shall not be used.

When required, provide legible weigh masters certificates at the time of material delivery. The ticket shall include the following information;

Date, Supplier, Plant, Ticket Number, Truck Number, Contractor, Project, Product Code and Description, Temperature of batch, Time of batch, Material Weight.

C. Bituminous Paver

Provide self-propelled mechanical, spreading and finishing equipment with a screed or strike off assembly capable of distributing not less than twelve feet. The equipment shall produce a finished surface of the smoothness and texture required. The screed shall be adjustable to the required template and elevation. The forward speed of operation shall be regulated so that no irregularities will result, but in no case will the forward speed exceed 55 feet per minute.

Equip the paver with a control system capable of automatically maintaining the specified screed elevation. The control system shall be automatically actuated from either a reference line or surface through a system of mechanical sensors or sensor-directed mechanisms or devices which will maintain the paver screed at a predetermined transverse slope and at the proper elevation to obtain the required surface. The transverse slope controller shall be capable of maintaining the screed at the desired slope within plus or minus 0.1 percent.

Equip the controls so that they are capable of working in conjunction with any of the following attachments.

- 1.** Ski-type device of not less than 30 feet in length or as approved by the Owner.
- 2.** Taut stringline set to grade.
- 3.** Short ski.

D. Rollers

Provide the number and type of rollers necessary to compact the mixture to the required density while it is still in a workable condition.

In no case shall there be less than one steel wheel and one pneumatic roller for production of 150 tons per hour or less. Add additional rollers as required for production of more than 150 ton per hour. Provide self propelled, reversible rollers with a minimum weight of 8 tons. Equip rollers with a device to dispense an approved releasing agent on the wheels to prevent the wheels from picking up the asphalt. When required, equip pneumatic tired rollers with skirt devices to maintain temperature during the rolling process.

1. Pneumatic Rollers

Two axle tandem type with a rolling width of at least 5 feet. Tires shall be the same size with a tread satisfactory to the Owner. The operating weight per tire shall not be less than 2000 pounds and designed so that the entire gap between the adjacent tire is covered by the following tire. Inflate each tire to 90 psi \pm 5 psi.

PART 3 - EXECUTION

3.1 Preliminary Investigation of the Work

Verify that all work has been performed in accordance with these specifications prior to placing asphalt concrete pavement.

3.2 Weather Limitations

Do not place bituminous mixture upon a wet surface or when the surface temperature of the underlying course is less than 40 degrees Fahrenheit or when weather conditions otherwise prevent the proper handling and furnishing of the bituminous mixture.

3.3 Tack and Prime Coat

Apply tack and prime coat in accordance with Section 2620, Bituminous Tack and Prime Coat. Tack coat shall be required at all joints between existing and new pavement. Tack coat will not be required over native subgrade.

3.4 Mixing

According to ASTM D3515.

A. Preparation of Bituminous Material

Heat bituminous material in a manner that will avoid local overheating and provide a continuous supply of the bituminous material to the mixer at a uniform temperature. Deliver the bituminous material to the mixer at a temperature sufficient to provide a suitable viscosity for adequate coating of the aggregate particles. Do not exceed 340 degrees Fahrenheit.

B. Preparation of Mineral Aggregate

Dry and heat the aggregate for the mixture to the temperature designated by the job mix formula within the tolerance specified. The maximum temperature and rate of heating shall be such that no permanent damage occurs to the aggregates. The temperature shall not be lower than is required to obtain complete coating and uniform distribution of the bitumen on the aggregate particles and to provide a mixture of satisfactory workability. The aggregate moisture content shall be 1.0 percent or less at the time of mixing.

C. Preparation of Bituminous Mixture

The aggregates and the bituminous material shall be weighed or metered and introduced into the mixer in the amounts specified in the job mix formula.

Commercial mineral filler shall be added to the mixer separately and shall be thoroughly dry. If the materials are mixed in a batching plant, the filler material shall be fed directly into the mixer as near the center as possible.

The combined materials shall be mixed until the aggregate mixture is uniformly coated with bitumen. The mixing time shall be the shortest time that will produce a satisfactory mixture. It shall be established by the Supplier, based on the procedure for determining the percentage of coated particles described in ASTM D2489, and approved by the **OWNER** for each individual plant and for each type of aggregate used. The minimum mixing time shall be 25 seconds. The mixing time will be set to achieve 95 percent coated particles.

For continuous mix plants, the minimum mixing time shall be determined by dividing the weight of its contents at operating level by the weight of the mixture delivered per second by the mixer.

3.5 Transporting, Spreading, and Finishing

Transport the mixture from the mixing plant to the point of use in vehicles conforming to the specified requirements. Schedule deliveries so the spreading and rolling of all mixture prepared for one day's run can be completed during daylight, unless adequate artificial lighting is provided. Do not haul over freshly placed material until the material has been compacted, as specified, and allowed to cool sufficiently to handle traffic loads.

Place the mix at a temperature no higher than necessary for placing, finishing and compacting but not less than 260 degrees Fahrenheit.

Spread the mixture to the full width with an approved bituminous paver. The lay down machine shall be capable of placing a 12-foot wide mat without a screed. Strike off in a uniform layer of such depth that, when the work is completed, it shall have the required thickness and conform to the grade and contour indicated. Regulate the speed of the paver to eliminate pulling and tearing of the bituminous mat. Begin the placement of the mixture along the centerline of a crowned section or on the high side of area with a one-way slope. Place the mixture in consecutive adjacent strips having a minimum width as specified. Offset transverse joints in adjacent lanes a minimum of 10 feet. Belly dumps shall not be used on overlay projects.

On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the mixture may be spread, raked, and luted with hand tools.

Handle the mixture in such a way as to prevent segregation of the aggregate mix. Coarse float rock that develops in the process of raking shall be placed on a surface, which will receive pavement or shall be removed from the site.

Place layers of bituminous material such that the compacted thickness does not exceed 4 inches. Place layers in excess of 4 inches in successive layers of equal thickness not exceeding 4 inches. When required by the Owner, place tack coat between successive layers as specified in Section 2620, Bituminous Prime and Tack Coat.

3.6 Compaction of Mixture

The completed surfacing shall be thoroughly compacted, smooth and true to grade and cross section as indicated and be free from ruts, humps, depressions or irregularities. After spreading, thoroughly and uniformly compact the mixture by rolling. Roll the surface when the mixture has attained sufficient stability so that the rolling does not cause undue displacement, cracking or shoving. The sequence of rolling operations and the type of rollers used shall be at the discretion of the Contractor and as specified herein.

Compact the mixture to 96 percent of the maximum Marshall density determined in accordance with ASTM D1559 (75 blows).

Operate the roller at a sufficiently slow speed to avoid displacement of the hot mixture. Immediately correct any displacement that occurs as a result of reversing the direction of the hot roller, or from any other cause.

Furnish sufficient rollers to handle the output of the plant. Continue rolling until all rolling marks are eliminated, the surface is of uniform texture and true to grade and cross section, and the required density is obtained.

To prevent adhesion of the mixture to the roller, keep the wheel properly moistened, but excessive water will not be permitted.

In areas not accessible to the roller, thoroughly compact the mixture with hand tampers or mechanical compactors.

Remove and replace any mixture that becomes loose and broken, mixed with dirt, or is in any way defective, with fresh hot mixture and immediately compact to conform to the surrounding area. Skin patching will not be allowed.

3.7 Joints

Form all joints in such a manner as to ensure a continuous bond between old and new sections of the course. The Contractor shall make every attempt to provide joints with the same texture, density, and smoothness as adjacent sections of the course.

Longitudinal joints which are irregular, damaged, or defective shall be cut back to expose a clean, sound surface for the full depth of the course. All contact surfaces shall be given a tack coat of bituminous material prior to placing any fresh mixture against the joint.

Stagger longitudinal joints at least 6 inches in relation to the joints of the underlying course and provide a sloped joint for each course.

Do not pass over the unprotected end of the freshly laid mixture except when necessary to form a transverse joint. Construct transverse joints by placing a bulkhead or by tapering the course, in which case the edge shall be cut back to its full depth and width on a straight line to expose a vertical face. Tack coat all contact surfaces before placing any fresh mixture against the joint.

3.8 Preservative Seal

None required.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Measurement & Payment

Measurement and payment will be made for asphalt concrete pavement as specified in Section 01210 Measurement and Payment for Asphalt Pavement Replacement.

**** END OF SECTION 2630 ****