# POLYMER MODIFIED ASPHALT CONCRETE

**719.1 DESCRIPTION:**
The work under this section shall consist of furnishing, proportioning and mixing all the ingredients necessary to produce a polymer modified asphalt concrete (PMAC) material.

**719.2 MATERIALS:**

**719.2.1 Binder 76-22 (PMAC):** The binder used in PMAC shall meet the requirements of Table 711-2 as specified by the engineer.

**719.2.2 Aggregate:** Coarse and fine aggregates shall conform to the applicable requirements of Tables 719-1 and 719-2 below. Coarse mineral aggregate shall consist of crushed gravel, crushed rock, or other approved inert material with similar characteristics, or a combination thereof, conforming to the requirements of these specifications.

Coarse aggregate is material retained above the Number 8 sieve and fine aggregate is material passing the Number 8 sieve. Aggregates shall be free of deleterious materials, clay balls, and adhering films or other material that prevent thorough coating with the asphalt cement. Mineral aggregate shall conform to the following requirements when tested in accordance with the applicable test methods.

| TABLE 719-1 | |
|---|---|
| MIX DESIGN GRADATION REQUIREMENTS WITH MINERAL ADMIXTURE | |
| **Sieve Size** | **Percent Passing** |
| 1” (25 mm) | 100 |
| ¾” (19 mm) | 100 |
| ½” (12.5 mm) | 90-100 |
| ⅜” (9.5 mm) | 75-90 |
| No. 8 (2.36 mm) | 40-50 |
| No. 40 (425 µm) | 10-20 |
| No. 200 (75 µm) | 2.0-10.0 |

The combined aggregate properties shall conform to the requirements of Table 719-2.

**719.2.3 Mineral Admixture:** Mineral admixture used in PMAC shall be dry hydrated lime conforming to the requirements of ASTM C1097 or Portland cement conforming to ASTM C150 for Type II, or ASTM C595 for Type IP. The minimum mineral admixture content will be 1.0 percent, by weight of total aggregate. Mineral admixture shall be considered part of the total weight of aggregate and all combined specific gravity and combined water absorption calculations for aggregates and mineral admixture will be done in accordance with the latest edition of the Asphalt Institute’s Manual MS-2 (AI MS-2).

| TABLE 719-2 | | |
|---|---|---|
| COARSE/FINE AGGREGATE REQUIREMENTS | | |
| **Characteristics** | **Test Method** | **Requirements** |
| Fractured Faces, % (Plus No. 8) | ARIZ-212 | 85, 1 fracture<br>80, 2 or more |
| Uncompacted Voids, % | AASHTO T-304, Method A | 45.0 |
| Sand Equivalent (Minus No. 4) | AASHTO T-176 | 50 minimum |
| Plasticity Index | AASHTO T-89 & T-90 | Non Plastic |
| L.A. Abrasion, % Loss | AASHTO T-96 | 9 max. @ 100 Rev.<br>40 max. @ 500 Rev. |
| Combined Bulk Specific Gravity | AI MS-2 | 2.35-2.85 |
| Combined Water Absorption, % | AI MS-2 | 0-2.5 |

**719.3 MIX DESIGN REQUIREMENT:**

**719.3.1 General:** The mix design for PMAC shall be prepared by a laboratory that is accredited through the AASHTO Accreditation Program (AAP) in Hot Mix Asphalt Aggregates and Hot Mix Asphalt. The laboratory shall be under the direct supervision of a Civil Engineer, registered by the State of Arizona, and who is listed by ADOT as a "Qualified Asphaltic Concrete Mix Design Engineer" within ADOT's latest list of approved laboratories. The latest list of approved laboratories is available on ADOT's web page www.azdot.gov. The date of the design shall not be older than one year from the date of submittal, unless supportive documentation is provided and approved by the Engineer.

The mix design report shall include the following elements as a minimum.

(1) The name and address of the testing organization and the person responsible for the mix design report.

(2) The mix plant identification and/or location, as well as the supplier or producer name.

(3) A description of all products that are incorporated in the asphalt concrete along with the sources of all products, including admixtures and asphalt binder, and their method of introduction.

(4) The supplier and grade of asphalt binder, the source and type of mineral aggregate, and the percentage of asphalt binder and mineral admixture used.

(5) The mix design report shall identify this as a Marshall 75-blow mix design

(6) The results of all testing, determinations, etc., such as: specific gravity and gradation of each component, water absorption, sand equivalent, loss on abrasion, fractured coarse aggregate particles, Tensile Strength Ratio (ASTM D4867), Marshall stability and flow, asphalt absorption, percent air voids, voids in mineral aggregate, and bulk density. Historical abrasion values may be supplied on existing sources. The submittal should include a plot of the gradation on the Federal Highway Administration's 0.45 Power Gradation Chart, plots of the compaction curves and the results of moisture sensitivity testing.

(7) The laboratory mixing and compaction temperature ranges for the supplier and grade of asphalt binder used within the mix design, and specific gravity at 77°F.

(8) A specific recommendation for design asphalt binder content and any limiting conditions that may be associated with the use of the design, such as minimum percentages of crushed or washed fine aggregate.

(9) The supplier's product code, the laboratory Engineer's seal (signed and dated), and the date the design was performed.

The mix design shall be submitted to the Agency or Engineer by the Contractor/Supplier for which it was developed as part of his project submittals. Once the mix design has been approved by the agency or Engineer, the Contractor and/or his supplier shall not change plants nor use additional mixing plants without prior approval of the Engineer. A new mix design shall be submitted when any changes occur in the plant operation, the producer's pit, the asphalt binder, including modifiers in the asphalt binder, or any other item that will cause an adjustment in the mix.

**719.3.2 Mix Design Criteria:** The mix design shall be performed by the Marshall Mix Design method. A minimum of 4 points will be used to establish the mix design results. The oven aging period for Marshall mix design samples shall be 2 hours.

**719.3.2.1 Marshall Mix Design:** The Marshall Mix Design shall be performed in accordance with the requirements of the latest edition of the Asphalt Institute's Manual, MS-2 "Mix Design Methods for Asphalt Concrete." The mix shall use the compactive effort of 75 blows per side of specimen, unless specified otherwise by the engineer. The mix shall comply with the criteria in Table 719-3.

The mix design for PMAC shall be prepared by a laboratory that is accredited through the AASHTO Accreditation

Program (AAP) in Hot Mix Asphalt Aggregates and Hot Mix Asphalt. The laboratory shall be under the direct supervision of a Civil Engineer, registered by the State of Arizona, and who is listed by ADOT as a "Qualified Asphalt Concrete Mix Design Engineer" within ADOT's list of approved laboratories.

The date of the design shall not be older than two years from the date of submittal, unless supportive documentation is provided and approved by the Engineer.

Mix designs are subject to approval by the Engineer.

| **TABLE 719-3** | | |
|---|---|---|
| **MARSHALL MIX DESIGN CRITERIA** | | |
| Criteria | Requirements<br>1/2" Mix | Designated Test<br>Method |
| 1. Binder Content, Minimum | 6.1% | --- |
| 2. Voids in Mineral Aggregate: %, min | 14 | AI MS-2 |
| 3. Effective Voids: %, Range | 4.0±0.2 | AI MS-2 |
| 4. Absorbed asphalt: %, Range* | 0-1.0 | AI MS-2 |
| 5. Dust to Eff. Asphalt Ratio, Range ** | 0.6-1.4 | AI MS-2 |
| 6. Tensile Strength Ratio: % Min. | 65 | ASTM D4867 |
| 7. Dry Tensile Strength: psi, Min. | 100 | ASTM D4867 |
| 8. Stability: pounds, Minimum | 2,500 | ASTM D6926 |
| 9. Flow: 0.01-inch, Range, Minimum | 8 | ASTM D6927 |
| 10. Mineral Aggregate Grading | --- | AASHTO T-27 & T11 |

* Unless otherwise approved by the Engineer.

** The ratio of the mix design composite gradation target for the No. 200 sieve, including admixture, to the effective asphalt content shall be within the indicated range

# SECTION 326

## PLACEMENT AND CONSTRUCTION OF POLYMER MODIFIED ASPHALT CONCRETE

### 326.1 DESCRIPTION:

This section is to provide specifications for furnishing all materials, mixing at a plant, hauling and placing a mixture of aggregate materials, mineral admixture and asphalt binder to form a pavement course for placement upon a previously prepared base or sub base.

### 326.2 MATERIALS AND MANUFACTURE:

The materials shall conform to Section 719 for the type specified. The specific required mix type shall be called out in the contract documents or as directed by the Engineer.

### 326.3 WEATHER AND MOISTURE CONDITIONS:

Asphalt concrete shall be placed only when the surface is dry, and when the atmospheric temperature in the shade is 40 degrees F. (50 degrees F for Asphalt Concrete lift less than 2 inch thick) or greater. No asphalt concrete shall be placed when the weather is foggy or rainy, or when the base or sub base on which the material is to be placed is unstable. Asphalt concrete shall be placed only when the Engineer determines that weather conditions are suitable.

### 326.4 APPLICATION OF TACK COAT:

A tack coat shall be applied to all existing and to each new course of asphalt concrete prior to the placing of a succeeding lift of asphalt concrete. If approved by the Engineer, the tack coat may be deleted when a succeeding layer of asphalt concrete is being applied over a freshly laid course that has been subjected to very little traffic.

The application of the tack coat shall comply with Section 329. The grade of emulsified asphalt shall be SS-1h or CSS-1h as specified in Section 713.

The same material that is specified above for the tack coat shall be applied to the vertical surfaces of existing pavements, curbs, and gutters, against which asphalt concrete is to be placed.

The surface to be covered may require repair or patching as directed by the Engineer. This shall be addressed in the project specifications prior to the bidding of the project.

### 326.5 MIX DESIGN:

The mix design shall be submitted to the Engineer at least five working days prior to the start of asphalt concrete production. Mix designs provided by the agency may be utilized on projects at the Engineer's discretion. The Engineer will review and approve the mix design to assure it contains all of the required information as outlined in Section 719.3.1. The target values for gradations, binder contents, and air voids will be established as the accepted Job Mix Formula (JMF) based upon the mix design. Mix designs not containing all of the information will be returned within five working days of receipt of all mix design information, for action and resubmission by the contractor.

Once the mix design has been approved by the agency and the mixing plant selected, the Contractor and/or his supplier shall not change plants nor utilize additional mixing plants without prior approval of the Engineer.

If the contractor elects to change its source of material, the contractor shall furnish the Engineer with a new mix design, which meets the requirements of Section 719, as amended by the Project Specifications.

The contractor may make self-directed target changes to the approved mix design within the limits shown below. Requests for self-directed target changes shall be made in writing and acknowledged by the Engineer prior to the start of production of a lot and will remain in effect until such time as any additional changes are implemented. The self-directed target changes must meet the contract requirements for mix design criteria and gradation limits.

| TABLE 326-1<br>ALLOWABLE SELF-DIRECTED TARGET CHANGES | |
|---|---|
| MEASURED CHARACTERISTICS | ALLOWABLE SELF-DIRECTED TARGET CHANGES |
| Gradation (Sieve Size) | |
| 3/8 inch | ± 4% from mix design target value |
| No 8 | ± 4% from mix design target value |
| No 40 | ± 2% from mix design target value |
| No 200 | +0.5% from mix design target value |
| Binder Content | ± 0.2% from mix design target value |
| Effective Air Voids | None |

The contractor may propose target changes, other than self-directed changes, to the approved mix design for the approval of the Engineer. The Engineer will determine if the proposed target change will result in mix production that meets the contract requirements for mix design criteria and gradation limits. The target changes will not be retroactive for the purpose of acceptance.

**326.6 MIX PRODUCTION:**

All materials shall be proportioned by weight in a hot mix asphalt plant in the proportions required by the mix design to provide a homogeneous and workable mass. Each hot mix asphalt plant shall be inspected in accordance with the provisions contained in the 'Hot Mix Asphalt Production Facilities' by the Arizona Rock Products Association and shall have a current inspection certificate. All measuring devices shall be calibrated at least annually by a technician licensed by the Arizona Bureau of Weights & Measures. Mixing plants shall conform to the requirements of AASHTO M-156, except as modified herein.

In drum mix plants the mineral admixture shall be added and thoroughly mixed with the mineral aggregate by means of a mechanical mixing device prior to the mineral aggregate and mineral admixture entering the dryer. The moisture content of the combined mineral aggregate shall be a minimum of three percent by weight of the aggregate during the mixing process.

For drum-mix plants, the mineral admixture shall be weighed across a weight belt, or other approved alternative weighing system, with a weight totalizer prior to entry into the mechanical mixing device. The mechanical mixing device shall be a pugmill type mixer that is in good working condition. The rate of the aggregate feed shall not exceed the mixing device's capacity in ton per hour. The mixer shall be constructed to minimize the loss of mineral admixture and shall be located in the aggregate delivery system at a location where the mixed material can be readily inspected. The mixing device shall be capable of effective mixing in the full range of the asphalt concrete production rates.

The hot plant and equipment shall be constructed and operated to prevent loss of mineral admixture through the dust collection system of the plant.

A positive signal system shall be provided and used during production whereby the mixing shall automatically be stopped if the mineral admixture is not introduced into the mineral aggregate. The plant will not be permitted to operate unless the signal system is in good working condition.

The introduction of bituminous material shall be controlled by an automated system fully integrated with the controls or the mineral aggregate and mineral admixture. The production of the plant shall be controlled by the rate required to obtain a uniform mixture of all components. Drying and heating shall be accomplished in such a manner as to preclude the mineral admixture from becoming coated with un-spent fuel. The completed asphalt concrete may be held in storage for up to 12 hours in insulated or heated silos, providing the minimum temperature noted herein for placement and compaction is met behind the placement device. If the Engineer determines that there is an excessive amount of heat, heat loss, drain down, segregation and/or oxidation of the mixture due to temporary storage, use of surge bins or storage bins will be discontinued.

The temperature of the asphalt concrete upon discharge from the mixer shall not exceed 335 degrees F. The discharge temperature may be increased to 350 degrees F if the binder supplier affirms that no binder degradation will occur from such an increase, and when approved by the Engineer. If the asphalt concrete is discharged from the mixer into a hopper, the hopper shall be constructed so that segregation of the asphalt concrete will be minimized.

## 326.7 TRANSPORTATION:

Petroleum distillates or other substances that will have a detrimental effect on the asphalt concrete shall not be used as a release agent.

The beds of all transportation units shall be clean and smooth to allow the free flow of material into the paving machine's hopper.

Tarpaulins shall be furnished on all trucks and used when weather condition warrant, or if directed by the Engineer.

## 326.8 PLACEMENT:

Placement of asphalt concrete pavement shall not commence until authorized by the Engineer. The Engineer's authorization to allow commencement of asphalt concrete paving will generally require all newly constructed valley gutters, curbing, and curb and gutters which new pavement is to be placed against to be in-place and in an acceptable condition. While it is preferred to have all newly constructed concrete items against which new pavement is to be placed be in an acceptable condition, the Engineer may allow paving to commence based on weather, the amount of defective concrete, or other considerations.

**326.8.1 Placing:** All courses of asphalt concrete shall be placed and finished by means of a self-propelled paving machine equipped with an automatically actuated control system, except under certain conditions or at locations where the Engineer deems the use of a self-propelled paving machine impracticable.

The control system shall control the elevation of the screed at each end by controlling the elevation of one end directly and the other end indirectly either through controlling the transverse slope or alternatively when directed, by controlling the elevation of each end independently.

The control system shall be capable of working with one of the following devices:

(a) Ski or non-contact device of not less than 30 feet in length, supported throughout its entire length
(b) Taut stringline or wire set to grade
(c) Short ski or sonar sensing units from curb control
(d) Joint matching shoe

Failure of the control system to function properly shall be cause for the suspension of asphalt concrete production. In order to achieve a continuous operation, the speed of the paving machine shall be coordinated with the hot mix plant and transport units.

If the asphalt concrete is dumped from the hauling vehicles directly into the paving machine, care shall be taken to avoid jarring the machine or moving it out of alignment. No vertical load shall be exerted on the paving machine by the truck.

If asphalt concrete is dumped upon the surface being paved and subsequently loaded in the paving machine, the loading equipment shall be self-supporting and shall not exert any vertical load on the paving machine. Substantially all of the asphalt concrete shall be picked up and loaded into the paving machine.

Self-propelled paving machines shall spread the mixture without segregation or tearing, true to line, grade and crown indicated on the project plans. Pavers shall be equipped with hoppers and augers that will distribute the mixture uniformly in front of an adjustable floating screed. The raising of the hopper wings must be minimized and the paving machine will not be operated when in an empty condition.

Screeds shall include any strike-off device operated by tamping or vibrating action which is effective, without tearing, shoving or gouging the mixture and which produces a course with a uniform texture and density for the full width being paved. Screeds shall be adjustable as to height and crown and shall be equipped with a controlled heating device for use when required. In the case of the screed, auger extensions and vibrators shall be installed wherever the screed is extended more than one (1) foot beyond the end of the base auger or auger extension. However, when placing material against an extremely uneven curb or edge over a short distance, the Engineer may waive the auger extensions and vibrators.

At any place not accessible to the roller, the mixture shall be thoroughly compacted with tampers to provide a uniform and smooth layer over the entire area compacted in this manner.

**326.8.2 Joints:** Transverse joints, before a surface course is placed in contact with a cold transverse construction joint, the cold existing asphalt concrete shall be trimmed to a vertical face for its full depth exposing a fresh face. The fresh face shall be tack coated prior to placement of the new asphalt concrete. After placement and finishing the new asphalt concrete, both sides of the joint shall be dense and the joint shall be smooth and tight. The surface in the area of the joint shall not deviate more than 1/4 inch from a 12-foot straightedge, when tested with the straightedge placed across the joint, parallel to the centerline.

Longitudinal joints of each asphalt course shall be staggered a minimum of 6 inches with relation to the longitudinal joint of the immediate underlying course's cold longitudinal construction joint.

Longitudinal joints with existing or cold (more than 32 hours old) asphalt concrete shall require the existing pavement to be trimmed to a vertical face for its full depth exposing a fresh face. The fresh face shall be tacked prior to placement of the adjacent course. Longitudinal joints with an existing asphalt pavement that is less than 32 hours old that has had its edge protected from damage may have adjacent new asphalt concrete placed after applying the required tack coat. After placement and finishing of longitudinal joints, both sides of the joint shall be dense and the joint shall be smooth and tight. The surface in the area of the joint shall not deviate more than 1/4 inch from a 12-foot straightedge, when tested with the straightedge placed across the joint, in any direction.

**326.8.3 Asphalt Leveling Course:** A leveling course shall be used when specified, or as directed in writing by the Engineer, to bring existing pavement to a uniform grade prior to placing an overlay or other course. If a leveling course is being applied on an asphalt surface, a tack coat shall be applied. The compaction requirements contained in Section 326.10 do not apply to leveling courses.

**326.8.4 Compaction; Asphalt Base Course and Surface Course:** It is the contractor's responsibility to perform Quality Control monitoring and/or testing during compaction operations to achieve the required density. The temperature of the asphalt concrete immediately behind the laydown machine shall be at least 265 degrees F. A probe type electronic thermometer with a current calibration sticker attached will be used to measure the temperature of the asphalt concrete mixture. When measuring the temperature of the mat, the probe shall be inserted at mid-depth and as horizontal as possible to the mat. The contractor is responsible to achieve the required compaction.

Asphalt compaction equipment shall be of sufficient size and weight to accomplish the required compaction. All compaction equipment shall be operated and maintained in accordance with the manufacturer's recommendations and the project requirements. During the rolling operation, the speed of the roller shall not exceed three miles per hour, unless otherwise approved by the Engineer.

Pneumatic tired compactors shall be equipped with skirt-type devices mounted around the tires so that the temperature of the tires will be maintained during the compaction process.

The Engineer will determine the acceptability of the pavement compaction in accordance with Section 326.10.

**326.8.5 Smoothness:** The completed surfacing shall be thoroughly compacted, smooth and true to grade and cross-section and free from ruts, humps, depressions or irregularities. An acceptable surface shall not vary more than 1/4 inch from the lower edge of a 12-foot straightedge when the straightedge is placed parallel to the centerline of the roadway.

**326.8.6 Asphalt Concrete Overlay:** Asphalt concrete overlay consists of the placing and compacting plant mix asphalt concrete over existing pavement. The mix design and thickness of the overlay shall be as shown on the plans or as specified in the special provisions.

Except when the existing asphalt surface is to be preheated and remixed, pavement surfaces shall be prepared as follows:

(a) Areas designated for pavement repair by the contract documents (which may include severely raveled areas, severely cracked areas, over-asphalted areas, and other defects) shall be cut out and replaced. Pavement repairs shall be completed and approved before placing asphalt concrete overlay.

(b) Before placing asphalt concrete overlay, raised pavement markers shall be removed, and milling shall be completed. Milling shall be as shown on the plans or specified in the special provisions and shall be in accordance with Section 317.

(c) After pavement repairs and milling have been completed the entire surface shall be cleaned with a power broom.

(d) After surfaces have been prepared to the satisfaction of the Engineer, they shall receive a tack coat per Section 326.4. Traffic will not be permitted to travel over surfaces which have received a tack coat, except when tack coat is applied to milled surfaces in compliance with Section 317.2 for dust control purposes. When the overlay is to extend onto a concrete surface, the concrete surface shall be thoroughly cleaned of loose dust and cement particles and shall be tack coated.

Asphalt concrete overlay shall be placed as specified in Section 326.8.1 and compacted as specified in Section 326.8.4. The surface smoothness shall meet the tolerances specified in Section 326.8.5.

Frames and covers of manholes, survey monuments, valve boxes, clean-outs and other existing structures shall be adjusted in accordance with Section 345 to set flush with the finished surface of the new pavement. During adjustment, if pavement or base materials are removed or disturbed, they shall be replaced with approved materials installed in a manner acceptable to the Engineer.

On roads without curb and gutter, the existing unpaved shoulder elevation shall be adjusted by the Contractor to match the elevation at the edge of the new overlay and slope away from the new pavement surface at a rate that the existing quantity of shoulder material will allow. Shoulder material shall be compacted to a minimum of 95% of maximum density, determined in accordance with Section 301.3. Shoulder adjustment to match the new pavement surface elevation shall not be measured. The cost of shoulder adjustment shall be included in the price paid for the asphalt concrete overlay or other related pay items. When the Engineer determines an insufficient amount of material is available for shoulder adjustment, the Engineer may require the Contractor to provide additional material. Acceptable material for shoulders includes the existing shoulder material, millings, untreated base materials, or a granular material approved by the Engineer. Engineer requested imported material for shoulder adjustment is not included in the price paid for the asphalt concrete overlay.

**326.8.7 Pavement Fabric Interlayer:** Pavement fabric interlayer shall be used only when specified on the plans or in the specifications.

Pavement fabric interlayer shall be in accordance with Table 796-1 and be the class designated on the plans or in the specifications.

Asphalt binder coat used to bond the fabric to the pavement shall be paving asphalt PG 70-10 asphalt cement conforming to the requirements of Section 711. The application and distributing equipment for the asphalt binder shall conform to the requirements of Section 330. The asphalt binder coat shall be uniformly spray applied to the prepared pavement surface at the rate of 0.20 gallons per square yard for Class B fabric or at the rate of 0.25 gallons per square yard for Class A fabric. Some underlying surfaces may require a higher or lower application rate. A test strip may be necessary to determine the proper application rate. The width of liquid asphalt cement application shall be the fabric width, plus six inches.

Neither the asphalt binder coat or fabric interlayer shall be placed when weather conditions, in the opinion of the Engineer, are not suitable. The asphalt binder and fabric interlayer shall only be placed when the pavement is dry, the ambient air temperature is 50 degrees F and rising, and pavement temperature is 40 degrees F and rising.

Equipment for placing the fabric shall be mechanized and capable of handling full rolls of fabric. The equipment shall be able to lay the fabric smoothly to maximize pavement contact and remove air bubbles. Stiff bristle brooms shall be used to smooth the fabric. The equipment used to place the fabric shall be in good working order and is subject to approval by the Engineer.

Pavement fabric interlayer shall not be placed if the in-place binder is hotter than 325 degrees F or has cooled to 180 degrees F or below (as determined by non-contact thermometer).

Pavement fabric interlayer shall be placed onto the asphaltic binder with the heat bonded side up with a minimum amount of wrinkling or folding. Remaining wrinkles or folds 1-inch and larger shall be removed or slit and shingle-lapped in the direction of paving. Burning or torching of wrinkles is not allowed. Fabric shall overlap three to six inches to insure full closure of the joint. Transverse joints shall be shingle-lapped in the direction of paving to prevent edge pickup by the paver. A second application of hand-placed asphalt binder may be required at laps and repairs as determined by the Engineer to ensure proper binding of the narrow double fabric layer.

All areas where fabric has been placed shall be paved with asphaltic concrete during the same workshift. Placement of the asphaltic concrete shall closely follow fabric lay down. The temperature of the asphaltic concrete immediately behind the laydown machine shall not exceed 335 degrees F, unless the binder supplier has affirmed a higher tempature range in writing. In the event that the asphalt binder coat bleeds through the fabric causing construction problems before the overlay is placed, the affected areas shall be sanded with a sand blotter in compliance with Section 333. Excess sand shall be removed before beginning the paving operation. In the event of rainfall prior to the placement of the asphaltic concrete, the fabric shall be allowed to dry before the asphalt concrete is placed.

Turning of the paving machine or of other vehicles on the fabric shall be gradual and kept to a minimum to avoid damage to the fabric. Should equipment tires stick to the fabric during pavement operations, small quantities of paving asphalt concrete shall be broadcast on the fabric to prevent pick-up. Decrease of binder rate in order to minimize pick-up on tires is not allowed.

**326.8.8 Thickened Edge:** When the depth of the thickened edge extends four inches or more below the bottom of the asphalt pavement, the portion of the thickened edge extending below the asphalt pavement shall be placed and compacted prior to placement of the asphalt pavement. Placement of tack coat on the surface of the compacted thickened edge asphalt may be omitted when additional asphalt pavement is placed on the same day and the Engineer agrees that the surface of the thickened edge asphalt has remained clean.

When the depth of the thickened edge extends less than four inches below the bottom of the asphalt pavement, the portion below the asphalt pavement may be placed and compacted with the asphalt pavement in a single operation.

**326.8.9 Safety Edge:** The finished safety edge slope shall be planar forming a 30° ± 5° angle with the adjacent roadway surface and extend a minimum of five inches (5”) below the roadway pavement’s finished surface.

The safety edge shall be constructed with the top or final paving lift of a new pavement or overlay using a device that is mounted to or is a part of the screed portion of the laydown machine. The safety edge device shall be capable of constraining the asphalt concrete material to increase density of the extruded profile by reducing the volume. A conventional single strike-off plate is not acceptable. Compaction obtained from the extruded safety edge shall be acceptable when the extruded shape conforms to the specified shape.

During laydown operations if the extruded safety edge does not conform to the specified shape, the Contractor shall take immediate actions to correct the deficiency and to repair all non-compliant sections of safety edge. The Contractor shall stop paving operations until corrections to the laydown operation have been made and resumption of paving is approved by the Engineer or his designated representative.

**326.8.10 Protection for Asphalt Base Course:** Arterial roadway traffic shall not be allowed on a new asphalt base course that is less than five inches (5”) in thickness without the written consent of the Engineer.

**326.9 QUALITY CONTROL:**

It is the contractor’s responsibility to perform Quality Control monitoring and/or testing during asphalt concrete production to achieve the required compaction and to perform Quality Control monitoring and/or testing during asphalt concrete production to achieve the required mix properties. The Engineer may obtain samples of any portion of any material at any point of the operations for his own use. Also, the Engineer may order the use of any drying, proportioning and mixing equipment or the handling of any material discontinued which, in his/her opinion, fails to produce a satisfactory mixture.

The asphalt concrete produced shall conform to the requirements of the production tolerances established in Section 326.10. When the asphalt concrete does not conform to the production tolerances, it shall be reported to the Engineer, and corrective

quality control measures shall be implemented, or production shall cease immediately at no additional cost to the contracting Agency.

Requests for referee testing as described in Section 326.11 will only be considered based on quality control test results performed by a laboratory accredited by the AASHTO Accreditation Program (AAP) for the tests being performed or a laboratory listed in the current ADOT Directory of Approved Materials Testing Laboratories for the set of tests in question. The laboratory shall use properly certified technicians in accordance with ASTM D3666, Section 7 (Personnel Qualifications).

**326.10 ACCEPTANCE:**

**326.10.1 Acceptance Criteria:** Asphalt concrete will be divided into lots for the purpose of acceptance. A lot shall be one day's production. Each lot shall be divided into sublots of 500 ton or fraction thereof. Tests used to determine acceptance will be performed by a laboratory accredited by the AASHTO Accreditation Program (AAP) for the tests being performed. The contracting agency shall provide an appropriately accredited laboratory or laboratories to perform the acceptance testing. laboratories shall use properly certified technicians in accordance with ASTM D3666, Section 7 (Personnel Qualifications). The acceptance laboratory will take representative samples of the asphalt concrete from each sublot to allow for testing of gradation, binder content, air voids, pavement thickness, and compaction of base and surface courses. Acceptance of each sublot will be based on the test data from the sample(s) from that sublot. All acceptance samples shall be taken using random locations or times designated by the Engineer in accordance with ASTM D3665. For permit work, testing that does not strictly adhere to the sampling and testing methodology and requirements outlined in this Section shall be disregarded and not considered in any acceptance determination. All required retesting shall be at the expense of the permittee.

**326.10.2 Gradation, Binder Content and Air Voids:** The acceptance laboratory will take a sample of the asphalt concrete in accordance with the requirements of Section 2 or 4 of Arizona Test Methods 104 or AASHTO T-168 from each sublot. The minimum weight of the sample shall be 45 pounds. Asphalt binder content and gradation shall be determined in accordance with AASHTO T-308 using the ignition furnace for each sublot. The acceptance laboratory is responsible for obtaining the necessary materials and performing an ignition furnace calibration as outlined in AASHTO T-308 for each asphalt concrete mixture utilized on the project. The correction factor used for each test shall be clearly indicated on the report. The bulk density for Marshall Mix designs shall be tested in accordance with AASHTO T-245. The bulk density for Gyratory mix designs shall be determined in accordance with AASHTO T-312. The maximum theoretical density shall be determined in accordance with the requirements of AASHTO T-209 including fan drying per AASHTO T-209 Section 15. Effective voids of the laboratory compacted specimens will be determined at a minimum of once per lot in accordance with the requirements of AASHTO T-269. Should the testing for effective air voids not meet the "Full Payment" or "No Corrective Action" requirements of Table 326-5, additional testing for laboratory air voids on the remaining sublots will be performed as necessary to determine the extent of the deficiency. Acceptance testing results will be furnished to the contractor and the supplier within five working days of receipt of samples by the acceptance laboratory.

During production, the allowable deviations from the mix design gradation targets are listed in the tables below. The allowable production tolerances may fall outside of the mix design gradation bands.

| TABLE 326-3 | |
|---|---|
| GRADATION ACCEPTANCE LIMITS FOR PMAC | |
| Sieve Size | |
| 1 inch | --- |
| 3/4 inch | --- |
| 1/2 inch | ±7% |
| 3/8 inch | ±6% |
| No. 8 | ±6% |
| No. 40 | ±4% |
| No. 200 | ±2% |

If the results from a single acceptance sample fall outside of the acceptance limits in Table 326-3 as applicable, a second sample shall be taken and if the second acceptance sample is also outside of the acceptance limits the Contractor shall cease

production of asphalt concrete. Production shall not begin again until calibration test results verify that adjustments made to materials or proportions yield a gradation that falls within acceptance limits in Table 326-3 or as applicable.

If the asphalt binder content is within ± 0.50% of the mix design target value, the asphalt concrete will be paid for at the contract unit price. If the asphalt binder content deviates by more than ± 0.50% from the mix design target value, the deficient area will be evaluated within the sublot by coring one additional location at a maximum interval of 100 feet on each side of the deficient sample. The asphalt content of the original deficient sample will be averaged with the asphalt binder content of the two additional cores to determine compliance with the acceptance requirements. If the resulting average of the asphalt binder content deviates by more than ± 0.50% from the mix design target value, then Table 326-4 shall apply to the sublot. If approved by the Engineer, the Contractor may obtain additional cores to assist in formulation of an Engineering Analysis, but the additional cores shall not be used for re-evaluating acceptance.

| TABLE 326-4 | | |
|---|---|---|
| ASPHALT BINDER CONTENT ACCEPTANCE AND PENALTIES | | |
| Deviation from that permitted | When the contracting agency is the owner: Payment Reduction ($ per ton of asphalt concrete) | When the contracting agency is not the owner (i.e. permits): Corrective Action |
| Over 0.2% above that permitted | Removal* or EA | Removal* or EA |
| Over 0.1% to 0.2% above that permitted | $6.00 | EA |
| Over 0.0% to0.1% above that permitted | $2.00 | EA |
| Within permitted range | Full Payment | No Corrective Action |
| Over 0.0% to0.1% below that permitted | $2.00 | EA |
| Over 0.1% to 0.2% below that permitted | $6.00 | EA |
| Over 0.2% below that permitted | Removal* or EA | Removal* or EA |

NOTES: *The Contractor shall remove and replace the entire sublot that is deficient.
EA = Engineering Analysis per Section 326.10.6

If the laboratory air voids fall within a range of -1.5% and +2% of the design target, the asphalt concrete will be paid for at the contract unit price. If the laboratory air voids are outside of this range, the deficient area will be evaluated within the sublot by coring one additional location at a maximum interval of 100 feet on each side of the deficient sample. The laboratory air voids of the original deficient sample will be averaged with the laboratory air voids obtained from each of the two additional cores to determine compliance with the acceptance requirements. If the resulting average of the laboratory air voids is outside the indicated range, then Table 326-5 shall apply to the sublot. If approved by the Engineer, the Contractor may obtain additional cores to assist in formulation of an Engineering Analysis, but the additional cores shall not be used for re-evaluating acceptance.

| TABLE 326-5 | | |
|---|---|---|
| LABORATORY VOIDS ACCEPTANCE AND PENALTIES | | |
| Laboratory Air Voids (Measured at $N_{des}$ or 75 blows as applicable) | When the contracting agency is the owner: Payment Reduction ($ per ton of asphalt concrete) | When the contracting agency is not the owner (i.e. permits): Corrective Action |
| Greater than -2.7% from Target | Removal* or EA | Removal* or EA |
| -2.7% to -2.1% from Target | $5.00 | EA |
| -2.0% to -1.6% from Target | $2.00 | EA |
| -1.5% to +2% from Target | Full Payment | No Corrective Action |
| +2.1 to +2.9% from Target | $2.00 | EA |
| +3.0% to +4.0% from Target | $5.00 | EA |
| Greater than 4.0% from Target | Removal* or EA | Removal* or EA |

NOTES: *The Contractor shall remove and replace the entire sublot that is deficient.
EA = Engineering Analysis per Section 326.10.6

If an agency or Engineer is purchasing asphalt concrete directly from a commercial material supplier, the agency or Engineer will use Section 326.10, and specifically Table 326-3 as applicable, 326-4 and 326-5 from Section 326.10, when determining the acceptance of the asphalt concrete with the material supplier.

**326.10.3 Surface Testing:** If directed by the Engineer surface drainage test shall be performed. The completed surfacing shall be thoroughly compacted, smooth and true to grade and cross-section and free from ruts, humps, depressions or irregularities. An acceptable surface shall not vary more than 1/4 inch from the lower edge of a 12-foot straightedge when the straightedge is placed parallel to the centerline of the roadway. The straightedge shall be furnished by the contractor and shall be acceptable to the Engineer.

All streets shall be water tested for drainage in the presence of the Engineer or designated representative before final acceptance. Any areas not draining properly shall be corrected to the Engineer's satisfaction at the Contractor's expense. Water for this testing shall be provided and paid for by the Contractor.

When deviations in excess of the above tolerance are found, humps or depressions shall be corrected to meet the specified tolerance. The defective pavement shall be cut out along neat straight lines or for multiple course pavements the surface course may be milled out, and the removed pavement replaced with fresh hot mixture and thoroughly compacted to conform with and bond to the surrounding area. Materials and work necessary to correct such deviations shall be at no additional cost to the Contracting Agency.

When pavement is cut out along neat straight lines, full depth longitudinal joints shall not be located within a lane wheel path or within forty-eight inches (48") of an asphalt pavement edge. Longitudinal joints shall comply with the restrictions for Type A Trench Repairs in Section 336.3.

**326.10.4 Asphalt Pavement Thickness:** Asphalt pavement thickness will be determined from cores secured from each lift of each sublot. Such cores will be taken and measured by the Asphalt Concrete Coring Method. This method can be found in Section 326.14. Each core location will be patched by the party responsible for the testing.

Acceptance or assessment of penalties for asphalt pavement thickness will be based on the combined total thickness of all asphalt concrete layers omitting all layers of asphalt-rubber asphalt concrete. If the final total pavement thickness exclusive of all ARAC layers is deficient from the target thickness by 0.25 inches or less, it will be paid for at the contract unit price.

If the thickness deficiency of the pavement core exceeds 0.25 inch, the thickness deficiency shall be evaluated by coring at a maximum interval of 100 feet on each side of the deficient core. The thickness of the original deficient core will be averaged with the thicknesses of the cores taken from each side of it to determine compliance with the acceptance requirements.

If the pavement thickness deficiency is greater than 0.25 inches and the contracting agency is not the owner (i.e. permits) the following will apply:

(1) If the pavement thickness deviates from the target thickness by more than 0.25 inch but not more than 0.50 inch, corrective action will be required. This corrective action shall consist of application of a Type II slurry seal coat in accordance to Section 715. The Contractor may present an Engineering Analysis outlining other proposed remedial measures for the consideration by the Engineer. The Engineer will review the engineering analysis and decide within 30 working days whether to accept the proposed remedial measures.

(2) If the pavement thickness deviates from the target thickness by more than 0.50 inch, corrective action will be required. The deficient area shall be overlaid with no less than a 1 inch thick lift, for the full width of the pavement to meet or exceed the designed thickness, with appropriate end and edge milling, with a mixture approved by the Engineer. The Contractor may present an engineering analysis outlining other proposed remedial measures for the Engineer's consideration. The Engineer will review the engineering analysis and decide within ten working days whether to accept the proposed remedial measures. If the Engineer chooses to reject the Engineering Analysis, the indicated overlay shall be constructed by the Contractor at no additional cost to the Owner.

If the contracting agency is the owner and the pavement thickness deficiency is greater than 0.25 inches but less than 0.50 inches, Table 326-6 will apply. If the pavement thickness deficiency is greater than 0.5 inches, the deficient area shall be overlaid with no less than a 1-inch thick lift for the full width of the pavement to meet or exceed the designed thickness using an asphalt mixture approved by the Engineer. The Contractor shall provide appropriate end and edge milling. The overlay and milling shall be accomplished by the Contractor at no additional cost to the contracting agency.

| **TABLE 326-6** | |
|---|---|
| **ASPHALT PAVEMENT THICKNESS PAYMENT REDUCTION**<br>**For Thickness Deficiency of More Than 0.25 inches and less than 0.50 inches** | |
| **Total Specified Asphalt Pavement Thickness exclusive of ARAC (if any)** | **Reduction in Payment Applied to asphalt concrete Except ARAC layers (if any)** |
| Less than 1.5 inches | 50% |
| 1.50 inches to 1.99 inches | 33% |
| 2.00 inches to 2.49 inches | 25% |
| 2.50 inches to 2.99 inches | 20% |
| 3.00 inches and greater | 17% |

**326.10.5 Density:**

**326.10.5.1 Pavement 1-1/2 Inches or Less in Nominal Thickness:**

Compaction shall consist of a "Rolling Method Procedure" using an established sequence of coverage with specified types of compactors. A pass shall be defined as one movement of a compactor in either direction. Coverage shall be the number of passes as are necessary to cover the entire width being paved.

The rolling sequence, the type of compactor to be used, and the number of coverages required shall be as shown in Table 326-7.

| TABLE 326-7 | | | | |
|---|---|---|---|---|
| ROLLING SEQUENCE FOR LIFT THICKNESS 1½" OR LESS | | | | |
| **Rolling Sequence** | **Type of Compactor** | | **No. of Coverages** | |
| | **Option No. 1** | **Option No. 2** | **Option No. 1** | **Option No. 2** |
| Initial | Static Steel | Vibrating Steel | 1 | 1 |
| Intermediate | Pneumatic Tired | Vibrating Steel | 4 | 2- 4* |
| Finish | Static Steel | Static Steel | 1-3 | 1-3 |
| * Based on the roller pattern which exhibits the best performance. | | | | |

The Contractor shall select the option for compaction and, when pneumatic-tired compactors are used will designate the tire pressure. Steel wheel compactors shall not be used in the vibratory mode for courses of one inch or less in thickness nor when the temperature of the asphaltic concrete falls below 180 degrees F. Initial and intermediate compaction shall be accomplished before the temperature of the asphaltic concrete falls below 200 degrees F.

Compaction will be deemed to be acceptable on the condition that the asphaltic concrete is compacted using the type of compactors specified, ballasted and operated as specified, and with the number of coverages of the compactors as specified.

**326.10.5.2 Pavement Greater than 1-1/2 Inches in Nominal Thickness:**

Achieving the required compaction is the responsibility of the contractor. The number and types of rollers is the contractor's responsibility and shall be sufficient to meet these requirements.

In-place air voids shall be determined in accordance with AASHTO T-269 utilizing cores taken from the finished pavement. The maximum theoretical density used in the determination of in-place air voids will be the average value from the acceptance samples determined for the lot as outlined in 326.10.1.

The Engineer will designate one random test location for each sublot and the acceptance laboratory will obtain one core from that location. Regardless of sublot quantities or boundaries, a minimum of one core will be obtained per residential street and a minimum of one core per travel lane for collector and arterial streets. The outside one foot of each pass of the pavement course or any unconfined edge will be excluded from testing. The Engineer may exclude areas from the compaction lot that are not accessible by normal compaction equipment.

The Contractor shall provide the traffic control to facilitate any coring operations necessary for compaction acceptance.

Cores will be taken per the Asphalt Concrete Coring Method. This method can be found in Section 326.14. Acceptance testing results will be furnished to the contractor within five working days of receipt of samples by the acceptance laboratory.

If the pavement density has in-place voids of between 4.0% and 8.0%, the asphalt concrete will be paid for at the contract unit price. If the acceptance core for a sublot indicates that the pavement density has in-place voids of less than 4.0% or greater than 8.0%, the deficient area will be evaluated by coring two additional locations at maximum intervals of 100 feet from the deficient core. The in-place voids of the original deficient core will be averaged with the in-place voids of the cores taken from 100 feet on each side of it to determine compliance with the acceptance requirements. If the resulting average of the in-place voids is outside the indicated range, then Table 326-8 shall apply to the sublot. If approved by the Engineer, the Contractor may obtain additional cores to assist in formulation of an Engineering Analysis, but the additional cores shall not be used for re-evaluating acceptance.

| TABLE 326-8 | | |
|---|---|---|
| PAVEMENT DENSITY PENALTIES | | |
| Limits of In-place Air Voids for design lift thicknesses 1.5 inches and greater | When the contracting agency is the owner<br><br>Payment Reduction<br>($ per ton of asphalt concrete) | When the contracting agency is not the owner i.e. permits<br><br>Corrective Action |
| Below 3.0% | Removal* or EA | Removal* or EA |
| 3.0% to below 4.0% | $10.00 | EA |
| 4.0% to 8.0% | Full Payment | No Corrective Action |
| Greater than 8.0% to 9.0% | $6.00 | EA |
| Greater than 9.0% to 10.0% | $10.00 | EA and Type II Surry Seal |
| Greater than 10.0% | Removal* or EA | Removal* or EA |

NOTES: *The Contractor shall remove and replace the entire sublot that is deficient.
EA = Engineering Analysis per Section 326.10.6

**326.10.6 Engineering Analysis (EA)**: Within 10 working days after receiving notice that a lot or sublot of asphalt concrete is deficient and is found to fall within the "Removal or EA" band per Table(s) 326-4, 326-5, and/or 326-8 the contractor may submit a written proposal (Engineering Analysis) to accept the material in place at the applicable penalties along with possible remediation(s) listed in the "Removal or EA" category. Engineering Analysis can also be proposed for non-removal categories of "Corrective Actions" when the contracting agency is not the owner (i.e. permits).

The Engineering Analysis shall contain an analysis of the anticipated performance of the asphalt concrete if left in place. The Engineering Analysis shall also detail the effect of any proposed corrective action to the material(s) in place as it relates to the in-place material's performance. The Engineering Analysis shall be performed by a professional engineer experienced in asphalt concrete testing and mix designs.

If a lot or sublot is accepted for referee testing and the referee test results still show a deficiency, the contractor shall have ten working days to submit an Engineering Analysis beginning upon notification of referee test results.

When an Engineering Analysis recommends that a specific lot or sublot should not be removed, the Engineering Analysis will recommend that the following penalties (Table 326-9) be paid when the contracting agency is the owner, for the specific criteria being reviewed by the EA.

| TABLE 326-9 | | |
|---|---|---|
| ENGINEERING ANALYSIS PENALTIES for REMOVAL* LOTS/SUBLOTS LEFT IN-PLACE | | |
| **Acceptance Criteria** | **Acceptance Limits** | **Penalty When Contracting Agency is the Owner ($/Ton)** |
| Asphalt Binder Content | Over 0.2% points from that Permitted | $9.00 |
| Laboratory Air Voids (Measured at $N_{des}$ or 75 blows as applicable) | Less than 1.5% or Greater Than 8.0% | $7.50 |
| Limits of In-place Air Voids | Less than 3% or<br>Greater than 10.0% | $15.00 |

Within 15 working days, the Engineer will determine whether or not to accept the contractor's proposed Engineering Analysis.

**326.11 REFEREE:**

If the Contractor has reason to question the validity of any of the acceptance test results, the Contractor may request that the Engineer consider referee test for final acceptance. Any request for referee testing must describe the contractor's reasons for questioning the validity of the original acceptance test results and must clearly describe which set of acceptance tests are in question. The engineer may either accept or reject the request for referee testing. When referee testing is accepted the Contractor (at the Contractors own expense) will engage an independent laboratory accredited by the AAP or a laboratory listed in the current ADOT Directory of Approved Materials Testing Laboratories as appropriate the acceptance tests that are being questioned. The independent referee laboratory shall use properly certified technicians in accordance with ASTM D3666, Section 7 (Personnel Qualifications). For the set of test results in question the referee laboratory shall perform a new set of acceptance tests (as required by Section 326.10 representing the area for the set of tests in question). The referee tests will replace the original acceptance tests that were in question.

For permit work, the permittee, responsible for hiring the testing laboratory, whose results necessitate referee testing, shall bear all expenses in the additional testing (i.e. secondary and the referee testing) if the original results are not substantiated by the referee testing procedure outlined in this Section. Additionally, any testing performed that does not strictly ahere to the sampling and testing methodology and requirements in Section 321.10 shall be disregarded and not allowed in any acceptance determination. Disregarded tests will be re-performed at the expense of the permittee.

These tests may include asphalt binder content, aggregate gradation, Marshall or Gyratory unit weight, maximum theoretical unit weight, laboratory air voids and in-place air voids (compaction). Samples for referee testing shall come from representative samples obtained from the completed pavement, as directed by the Engineer.

The number of samples taken will be the same as specified in Section 326.10. The independent laboratory shall compile the test results and transmit them to both the Engineer and the contractor. The independent laboratory shall include a report sealed and signed by an Engineer registered in the State of Arizona, who is experienced in asphalt concrete testing and mix design development. The signed report shall give an opinion that the material evaluated does or does not comply with project specifications, shall clearly describe any deficiencies, and the results will be binding between all parties.

**326.12 MEASUREMENT:**

Asphalt concrete pavement will be measured by the ton, or by the square yard, for the mixture actually used as allowed above, which shall include the required quantities of mineral aggregates, asphalt binder, and mineral admixture. Measurement shall include any tonnage used to construct intersections, roadways, streets, or other miscellaneous surfaces indicated on the plans or as directed by the Engineer.

Measurement for safety edge preparation only applies to overlays of existing pavements that require the construction of a safety edge when none exists. Safety edge preparation will be measured by the linear foot. Safety edge preparation will not be measured when a safety edge is part of new pavement construction, pavement widening, or when overlaying an existing pavement that contains a safety edge. The asphalt concrete pavement measurement shall include the tonnage used to construct safety edges or the square yard measurement for asphalt concrete pavement will be increased by the horizontal extension of the safety edge beyond the roadway pavement edge.

**326.13 PAYMENT:**

The asphalt concrete measured as provided above will be paid for at the contract price per ton or square yard, as adjusted per Section 326.10, which price shall be full compensation for the item complete, as herein described and specified.

Payment for tack coat will be by the ton diluted, based on the rate of application, as directed by the Engineer.

No payment will be made for any overrun in quantity of asphalt concrete in excess of 10 percent for newly constructed pavement having a total thickness equal to or greater than 2.5 inches. The overrun quantity is excess tonnage above the tonnage calculated based on actual field measurement of area covered, design thickness, and the mix design unit weight. The

calculations for overrun will be by individual pay item. To compensate or adjust for a thickness deficiency in an underlying asphalt concrete course, the Engineer may authorize a quantity increase in excess of 10 percent for a subsequent asphalt concrete course. In such cases, the quantity in excess of 10 percent will be paid for at the lowest unit price.

Removal of raised pavement markers, pavement repars, and surface pavement replacments required prior to roadway overlay operations will be paid for by other pay items unless otherwise specified. Except as otherwise specified, no separate payment will be made for work necessary to construct thickened edges, safety edges, or other miscellaneous items or surfaces of asphalt concrete.

Payment for safety edge preparation will be at the contract unit price for the quantities measured as described above.

**326.14 ASPHALT CORE METHOD: Core Drilling of Hot Mix Asphalt (HMA) for Specimens of 4" or 6" diameter**

**326.14.1 Scope:** This method is to establish a consistent method of the use of a diamond bit core to recover specimens of 4 or 6 inch diameter for laboratory analysis and testing. The method will require the use of: water, ice (bagged or other suitable type), dry ice, and a water-soap solution to be utilized when coring asphalt rubber concrete. Individuals doing the specimen recovery should be observing all safety regulations from the equipment manufacturer as well as the required job site safety requirements for actions, and required personal protective equipment.

**326.14.2 Core Drilling Device:** The core drilling device will be powered by an electrical motor, or by an acceptable gasoline engine. Either device used shall be capable of applying enough effective rotational velocity to secure a drilled specimen. The specimen shall be cored perpendicularly to the surface of pavement, and that the sides of the core are cut in a manner to minimize sample distortion or damage. The machinery utilized for the procedure shall be on a mounted base, have a geared column and carriage that will permit the application of variable pressure to the core head and carriage throughout the entire drilling operation. The carriage and column apparatus shall be securely attached to the base of the apparatus; and the base will be secured with a mechanical fastener or held in place by the body weight of the operator. The core drilling apparatus shall be equipped with a water spindle to allow water to be introduced inside of the drill stem while operating. The cutting edge of the core drill bit shall be of hardened steel or other suitable material with embedded diamond chips in the cutting surface. The core barrel shall be of sufficient diameter to secure a specimen that is a minimum of four or six inches or whichever is prescribed for necessary testing. The core barrel shall not be missing more than one of the teeth used for cutting; if so it shall be discarded and another barrel shall be used. The core barrel shall also be a minimum of two inches longer than the anticipated depth of pavement in accordance with project paving plans. For permit work, testing of cores obtained in a manner that does not strictly adhere to the methodology outlined in this Section shall be disregarded and not considered in any acceptance determination. Retesting shall be at the expense of the permittee.

**326.14.3 Accessory Equipment:** A sufficient supply of ice and dry ice shall be provided to sufficiently cool the pavement prior to securing the samples from the designated areas in the pavement. The ice should also be used to adjust the temperature of the water used to cool the core bit. A water supply (usually a plastic 35 – 55 gal drum) with sufficient hose to introduce the water into and through the spindle of the coring device by gravity feed. The drum should be white or light in color to minimize excessive thermal heating of the water (*for coring of asphalt rubber cores see Note 1*). At no time shall the water utilized in the coring operation exceed 65 degrees F during the coring operation. Ice shall be utilized to ensure the temperature control of the water being introduced during the cutting operation. An ice chest or other suitably insulated container that can maintain a temperature of less than 70 degrees F shall be used to secure the specimens during transport. The container will be equipped with flat shelving that will support the drilled cores throughout the entire specimen dimension during transport back to the testing facility.

Miscellaneous hand tools to remove the drilled specimen from the drill hole or the core barrel taking great care in not disturbing the specimen more than necessary (refer to fig. 1 in ASTM D5361).

**326.14.4 Process:** The pavement surface at the time of coring shall not exceed a temperature of 90 degrees F; the pavement shall be conditioned with ice or dry ice to ensure that this requirement is met. Immediately after it has been ensured that the pavement has dropped to the required temperature, core drilling shall begin. The operator will then apply an even and continuous pressure (Note 2) to penetrate through the full depth of the pavement. The operator will concurrently ensure that enough water is moving over the core surface as to adequately remove any and all cuttings that could damage the drilled core. After the pavement thickness has been penetrated the core shall be carefully removed from either the drill hole or the core barrel and be immediately transferred to an ice chest or other suitable container. Each individual core shall be placed on a

shelf in the cooler with the exposed side of the specimen facing down, or the "top side" down. If the specimen is a two lift core, the only acceptable means of separating lifts is with a power or other acceptable wet saw type of equipment (conforming to ASTM D5361); however, at no time shall cores be split using a mallet and screwdriver or metal straight edge when being tested for bulk density. Perpendicularity of the specimen shall be checked in the field after the specimen has been extracted from the surface. The core operator shall hold the core up to eye level and place the core top side down in a "speed square" or small carpenters square. The specimen placed in the square shall not depart from perpendicular to the axis more than $0.5^{o}$ (approximately equivalent to 1/16 of an inch in 6 inches). If the specimen is outside of this distance from square it shall be discarded in the field and another sample cored that falls within tolerance. The cores upon arriving at the laboratory for testing shall be carefully cleaned and measured for thickness in accordance with ASTM D3549. A speed square shall be utilized to measure perpendicularity as compared to a 90 degrees angle and shall not depart from perpendicular to the axis more than 0.5 degrees (approximately equivalent to 1/16 of an inch in 6 inches). All remaining testing shall be done within the parameters of the current project and/or agency required specification.

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*Note 1 – It should be noted that when the material to be cored is a rubberized asphalt mixture a wetting agent such as liquid dish soap shall be added to the water barrel to hinder the material from sticking or allowing the binder to spread during coring.

*Note 2 – This refers to pressure exerted on the core barrel and machine during the coring process. Too much pressure can cause damage to the core barrel and the motor; and too little pressure can cause a glazing of the diamonds, reducing cutting efficiency and premature wear of the barrel.

***-End of Section-***

## SECTION ~~321~~326 - CHANGES IN 326

## PLACEMENT AND CONSTRUCTION OF ASPHALT CONCRETE PAVEMENT

### ~~321~~326.1 DESCRIPTION:

This section is to provide specifications for furnishing all materials, mixing at a plant, hauling and placing a mixture of aggregate materials, mineral admixture and asphalt binder to form a pavement course for placement upon a previously prepared base or sub base.

### ~~321~~326.2 MATERIALS AND MANUFACTURE:

The materials shall conform to Section ~~710~~719 for the type specified. ~~Warm Mix Asphalt (WMA) technologies may be used within the mixture provided all requirements of the specifications are met, and the technology is on the ADOT approved product list.~~ The specific required mix type shall be called out in the contract documents or as directed by the Engineer.

### ~~321~~326.3 WEATHER AND MOISTURE CONDITIONS:

Asphalt concrete shall be placed only when the surface is dry, and when the atmospheric temperature in the shade is 40 degrees F. (50 degrees F for Asphalt Concrete lift less than 2 inch thick) or greater. No asphalt concrete shall be placed when the weather is foggy or rainy, or when the base or sub base on which the material is to be placed is unstable. Asphalt concrete shall be placed only when the Engineer determines that weather conditions are suitable.

### ~~321~~326.4 APPLICATION OF TACK COAT:

A tack coat shall be applied to all existing and to each new course of asphalt concrete prior to the placing of a succeeding lift of asphalt concrete. If approved by the Engineer, the tack coat may be deleted when a succeeding layer of asphalt concrete is being applied over a freshly laid course that has been subjected to very little traffic.

The application of the tack coat shall comply with Section 329. The grade of emulsified asphalt shall be SS-1h or CSS-1h as specified in Section 713.

The same material that is specified above for the tack coat shall be applied to the vertical surfaces of existing pavements, curbs, and gutters, against which asphalt concrete is to be placed.

The surface to be covered may require repair or patching as directed by the Engineer. This shall be addressed in the project specifications prior to the bidding of the project.

### ~~321~~326.5 MIX DESIGN:

The mix design shall be submitted to the Engineer at least five working days prior to the start of asphalt concrete production. Mix designs provided by the agency may be utilized on projects at the Engineer's discretion. The Engineer will review and approve the mix design to assure it contains all of the required information as outlined in Section ~~710~~719.3.1. ~~If WMA technologies are used within the mix design, the type of WMA technology used shall be indicated on the mix design.~~ The target values for gradations, binder contents, and air voids will be established as the accepted Job Mix Formula (JMF) based upon the mix design. Mix designs not containing all of the information will be returned within five working days of receipt of all mix design information, for action and resubmission by the contractor.

Once the mix design has been approved by the agency and the mixing plant selected, the Contractor and/or his supplier shall not change plants nor utilize additional mixing plants without prior approval of the Engineer.

If the contractor elects to change its source of material, the contractor shall furnish the Engineer with a new mix design, which meets the requirements of Section ~~710~~719, as amended by the Project Specifications.

## SECTION ~~321~~326 - CHANGES IN 326

The contractor may make self-directed target changes to the approved mix design within the limits shown below. Requests for self-directed target changes shall be made in writing and acknowledged by the Engineer prior to the start of production of a lot and will remain in effect until such time as any additional changes are implemented. The self-directed target changes must meet the contract requirements for mix design criteria and gradation limits.

**TABLE ~~321~~326-1**
**ALLOWABLE SELF-DIRECTED TARGET CHANGES**

| MEASURED CHARACTERISTICS | ALLOWABLE SELF-DIRECTED TARGET CHANGES |
|---|---|
| Gradation (Sieve Size) | |
| 3/8 inch | ± 4% from mix design target value |
| No 8 | ± 4% from mix design target value |
| No 40 | ± 2% from mix design target value |
| No 200 | +0.5% from mix design target value |
| Binder Content | ± 0.2% from mix design target value |
| Effective Air Voids | None |

The contractor may propose target changes, other than self-directed changes, to the approved mix design for the approval of the Engineer. The Engineer will determine if the proposed target change will result in mix production that meets the contract requirements for mix design criteria and gradation limits. The target changes will not be retroactive for the purpose of acceptance.

### ~~321~~326.6 MIX PRODUCTION:

All materials shall be proportioned by weight in a hot mix asphalt plant in the proportions required by the mix design to provide a homogeneous and workable mass. Each hot mix asphalt plant shall be inspected in accordance with the provisions contained in the 'Hot Mix Asphalt Production Facilities' by the Arizona Rock Products Association and shall have a current inspection certificate. All measuring devices shall be calibrated at least annually by a technician licensed by the Arizona Bureau of Weights & Measures. Mixing plants shall conform to the requirements of AASHTO M-156, except as modified herein. ~~If WMA technology is being used, any equipment associated with the production of hot mix asphalt shall be calibrated and in proper working order according to the WMA equipment specifications. If there are any deviations in the production or compacting temperatures of the hot mix asphalt with WMA technology, the mix design shall state the differences.~~

In drum mix plants the mineral admixture shall be added and thoroughly mixed with the mineral aggregate by means of a mechanical mixing device prior to the mineral aggregate and mineral admixture entering the dryer. The moisture content of the combined mineral aggregate shall be a minimum of three percent by weight of the aggregate during the mixing process.

For drum-mix plants, the mineral admixture shall be weighed across a weight belt, or other approved alternative weighing system, with a weight totalizer prior to entry into the mechanical mixing device. The mechanical mixing device shall be a pugmill type mixer that is in good working condition. The rate of the aggregate feed shall not exceed the mixing device's capacity in ton per hour. The mixer shall be constructed to minimize the loss of mineral admixture and shall be located in the aggregate delivery system at a location where the mixed material can be readily inspected. The mixing device shall be capable of effective mixing in the full range of the asphalt concrete production rates.

The hot plant and equipment shall be constructed and operated to prevent loss of mineral admixture through the dust collection system of the plant.

A positive signal system shall be provided and used during production whereby the mixing shall automatically be stopped if the mineral admixture is not introduced into the mineral aggregate. The plant will not be permitted to operate unless the signal system is in good working condition.

The introduction of bituminous material shall be controlled by an automated system fully integrated with the controls or the mineral aggregate and mineral admixture. The production of the plant shall be controlled by the rate required to obtain a uniform mixture of all components. Drying and heating shall be accomplished in such a manner as to preclude the mineral admixture from becoming coated with un-spent fuel. The completed asphalt concrete may be held in storage for up to 12 hours in insulated or heated silos, providing the minimum temperature noted herein for placement and compaction is met

behind the

placement device. If the Engineer determines that there is an excessive amount of heat, heat loss, drain down, segregation and/or oxidation of the mixture due to temporary storage, use of surge bins or storage bins will be discontinued.

The temperature of the asphalt concrete, with unmodified binders, upon discharge from the mixer shall not exceed 335 degrees F. The discharge temperature may be increased to 350 degrees F if the binder supplier affirms that no binder degradation will occur from such an increase, ~~on the recommendation of the binder supplier,~~and when approved by the Engineer. If the asphalt concrete is discharged from the mixer into a hopper, the hopper shall be constructed so that segregation of the asphalt concrete will be minimized.

**~~321~~326.7 TRANSPORTATION:**

Petroleum distillates or other substances that will have a detrimental effect on the asphalt concrete shall not be used as a release agent.

The beds of all transportation units shall be clean and smooth to allow the free flow of material into the paving machine's hopper.

Tarpaulins shall be furnished on all trucks and used when weather condition warrant, or if directed by the Engineer.

**~~321~~326.8 PLACEMENT:**

Placement of asphalt concrete pavement shall not commence until authorized by the Engineer. The Engineer's authorization to allow commencement of asphalt concrete paving will generally require all newly constructed valley gutters, curbing, and curb and gutters which new pavement is to be placed against to be in-place and in an acceptable condition. While it is preferred to have all newly constructed concrete items against which new pavement is to be placed be in an acceptable condition, the Engineer may allow paving to commence based on weather, the amount of defective concrete, or other considerations.

**~~321~~326.8.1 Placing:** All courses of asphalt concrete shall be placed and finished by means of a self-propelled paving machine equipped with an automatically actuated control system, except under certain conditions or at locations where the Engineer deems the use of a self-propelled paving machine impracticable.

The control system shall control the elevation of the screed at each end by controlling the elevation of one end directly and the other end indirectly either through controlling the transverse slope or alternatively when directed, by controlling the elevation of each end independently.

The control system shall be capable of working with one of the following devices:

(a) Ski or non-contact device of not less than 30 feet in length, supported throughout its entire length
(b) Taut stringline or wire set to grade
(c) Short ski or sonar sensing units from curb control
(d) Joint matching shoe

Failure of the control system to function properly shall be cause for the suspension of asphalt concrete production. In order to achieve a continuous operation, the speed of the paving machine shall be coordinated with the hot mix plant and transport units.

If the asphalt concrete is dumped from the hauling vehicles directly into the paving machine, care shall be taken to avoid jarring the machine or moving it out of alignment. No vertical load shall be exerted on the paving machine by the truck.

If asphalt concrete is dumped upon the surface being paved and subsequently loaded in the paving machine, the loading equipment shall be self-supporting and shall not exert any vertical load on the paving machine. Substantially all of the asphalt concrete shall be picked up and loaded into the paving machine.

Self-propelled paving machines shall spread the mixture without segregation or tearing, true to line, grade and crown indicated on the project plans. Pavers shall be equipped with hoppers and augers that will distribute the mixture ur
front of an adjustable floating screed. The raising of the hopper wings must be minimized and the paving machine ~~will not be~~

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operated when in an empty condition.

Screeds shall include any strike-off device operated by tamping or vibrating action which is effective, without tearing, shoving or gouging the mixture and which produces a course with a uniform texture and density for the full width being paved. Screeds
shall be adjustable as to height and crown and shall be equipped with a controlled heating device for use when required. In the
case of the screed, auger extensions and vibrators shall be installed wherever the screed is extended more than one (1) foot beyond the end of the base auger or auger extension. However, when placing material against an extremely uneven curb or edge over a short distance, the Engineer may waive the auger extensions and vibrators.

At any place not accessible to the roller, the mixture shall be thoroughly compacted with tampers to provide a uniform and smooth layer over the entire area compacted in this manner.

**~~321~~326.8.2 Joints:** Transverse joints, before a surface course is placed in contact with a cold transverse construction joint, the cold existing asphalt concrete shall be trimmed to a vertical face for its full depth exposing a fresh face. The fresh face shall be tack coated prior to placement of the new asphalt concrete. After placement and finishing the new asphalt concrete, both sides of the joint shall be dense and the joint shall be smooth and tight. The surface in the area of the joint shall not deviate more than 1/4 inch from a 12-foot straightedge, when tested with the straightedge placed across the joint, parallel to the centerline.

Longitudinal joints of each asphalt course shall be staggered a minimum of 6 inches with relation to the longitudinal joint of the immediate underlying course's cold longitudinal construction joint.

Longitudinal joints with existing or cold (more than 32 hours old) asphalt concrete shall require the existing pavement to be trimmed to a vertical face for its full depth exposing a fresh face. The fresh face shall be tacked prior to placement of the adjacent course. Longitudinal joints with an existing asphalt pavement that is less than 32 hours old that has had its edge protected from damage may have adjacent new asphalt concrete placed after applying the required tack coat. After placement and finishing of longitudinal joints, both sides of the joint shall be dense and the joint shall be smooth and tight. The surface in the area of the joint shall not deviate more than 1/4 inch from a 12-foot straightedge, when tested with the straightedge placed across the joint, in any direction.

**~~321~~326.8.3 Asphalt Leveling Course:** A leveling course shall be used when specified, or as directed in writing by the Engineer, to bring existing pavement to a uniform grade prior to placing an overlay or other course. If a leveling course is being applied on an asphalt surface, a tack coat shall be applied. The compaction requirements contained in Section ~~321~~326.10 do not apply to leveling courses.

**~~321~~326.8.4 Compaction; Asphalt Base Course and Surface Course:** It is the contractor's responsibility to perform Quality Control monitoring and/or testing during compaction operations to achieve the required compaction. The temperature of the asphalt concrete immediately behind the laydown machine shall be at least 265 degrees F. ~~, unless WMA technology is being used. If WMA technology is being used then the minimum requirements will be stated within the mix design recommended by the WMA manufacturer.~~ A probe type electronic thermometer with a current calibration sticker attached will be used to measure the temperature of the asphalt concrete mixture. When measuring the temperature of the mat, the probe shall be inserted at mid-depth and as horizontal as possible to the mat. The contractor is responsible to achieve the required compaction.

Asphalt compaction equipment shall be of sufficient size and weight to accomplish the required compaction. All compaction equipment shall be operated and maintained in accordance with the manufacturer's recommendations and the project requirements. During the rolling operation, the speed of the roller shall not exceed three miles per hour, unless otherwise approved by the Engineer.

Pneumatic tired compactors shall be equipped with skirt-type devices mounted around the tires so that the temperature of the tires will be maintained during the compaction process.

The Engineer will determine the acceptability of the pavement compaction in accordance with Section ~~321~~326.10.

**~~321~~326.8.5 Smoothness:** The completed surfacing shall be thoroughly compacted, smooth and true to grade and cross-section and free from ruts, humps, depressions or irregularities. An acceptable surface shall not vary more than 1/4 inch from the lower edge of a 12-foot straightedge when the straightedge is placed parallel to the centerline of the roadway.

**~~321~~326.8.6 Asphalt Concrete Overlay:** Asphalt concrete overlay consists of the placing and compacting plant mix asphalt concrete over existing pavement. The mix design and thickness of the overlay shall be as shown on the plans or as specified in the special provisions.

Except when the existing asphalt surface is to be preheated and remixed, pavement surfaces shall be prepared as follows:

(a) Areas designated for pavement repair by the contract documents (which may include severely raveled areas, severely cracked areas, over-asphalted areas, and other defects) shall be cut out and replaced. Pavement repairs shall be completed and approved before placing asphalt concrete overlay.

(b) Before placing asphalt concrete overlay, raised pavement markers shall be removed, and milling shall be completed. Milling shall be as shown on the plans or specified in the special provisions and shall be in accordance with Section 317.

(c) After pavement repairs and milling have been completed the entire surface shall be cleaned with a power broom.

(d) After surfaces have been prepared to the satisfaction of the Engineer, they shall receive a tack coat per Section ~~321~~326.4. Traffic will not be permitted to travel over surfaces which have received a tack coat, except when tack coat is applied to milled surfaces in compliance with Section 317.2 for dust control purposes. When the overlay is to extend onto a concrete surface, the concrete surface shall be thoroughly cleaned of loose dust and cement particles and shall be tack coated.

Asphalt concrete overlay shall be placed as specified in Section ~~321~~326.8.1 and compacted as specified in Section ~~321~~326.8.4. The surface smoothness shall meet the tolerances specified in Section ~~321~~326.8.5.

Frames and covers of manholes, survey monuments, valve boxes, clean-outs and other existing structures shall be adjusted in accordance with Section 345 to set flush with the finished surface of the new pavement. During adjustment, if pavement or base materials are removed or disturbed, they shall be replaced with approved materials installed in a manner acceptable to the Engineer.

On roads without curb and gutter, the existing unpaved shoulder elevation shall be adjusted by the Contractor to match the elevation at the edge of the new overlay and slope away from the new pavement surface at a rate that the existing quantity of shoulder material will allow. Shoulder material shall be compacted to a minimum of 95% of maximum density, determined in accordance with Section 301.3. Shoulder adjustment to match the new pavement surface elevation shall not be measured. The cost of shoulder adjustment shall be included in the price paid for the asphalt concrete overlay or other related pay items. When the Engineer determines an insufficient amount of material is available for shoulder adjustment, the Engineer may require the Contractor to provide additional material. Acceptable material for shoulders includes the existing shoulder material, millings, untreated base materials, or a granular material approved by the Engineer. Engineer requested imported material for shoulder adjustment is not included in the price paid for the asphalt concrete overlay.

**~~321~~326.8.7 Pavement Fabric Interlayer:** Pavement fabric interlayer shall be used only when specified on the plans or in the specifications.

Pavement fabric interlayer shall be in accordance with Table 796-1 and be the class designated on the plans or in the specifications.

Asphalt binder coat used to bond the fabric to the pavement shall be paving asphalt PG 70-10 asphalt cement conforming to the requirements of Section 711. The application and distributing equipment for the asphalt binder shall conform to the requirements of Section 330. The asphalt binder coat shall be uniformly spray applied to the prepared pavement surface at the rate of 0.20 gallons per square yard for Class B fabric or at the rate of 0.25 gallons per square yard for Class A fabric. Some underlying surfaces may require a higher or lower application rate. A test strip may be necessary to determine the proper application rate. The width of liquid asphalt cement application shall be the fabric width, plus six inches.

Neither the asphalt binder coat or fabric interlayer shall be placed when weather conditions, in the opinion of the Engineer, are not suitable. The asphalt binder and fabric interlayer shall only be placed when the pavement is dry, the ambient air temperature is 50 degrees F and rising, and pavement temperature is 40 degrees F and rising.

Equipment for placing the fabric shall be mechanized and capable of handling full rolls of fabric. The equipment shall be able to lay the fabric smoothly to maximize pavement contact and remove air bubbles. Stiff bristle brooms shall be used to smooth the fabric. The equipment used to place the fabric shall be in good working order and is subject to approval by the Engineer.

Pavement fabric interlayer shall not be placed if the in-place binder is hotter than 325 degrees F or has cooled to 180 degrees F or below (as determined by non-contact thermometer).

Pavement fabric interlayer shall be placed onto the asphaltic binder with the heat bonded side up with a minimum amount of wrinkling or folding. Remaining wrinkles or folds 1-inch and larger shall be removed or slit and shingle-lapped in the direction of paving. Burning or torching of wrinkles is not allowed. Fabric shall overlap three to six inches to insure full closure of the joint. Transverse joints shall be shingle-lapped in the direction of paving to prevent edge pickup by the paver. A second application of hand-placed asphalt binder may be required at laps and repairs as determined by the Engineer to ensure proper binding of the narrow double fabric layer.

All areas where fabric has been placed shall be paved with asphaltic concrete during the same workshift. Placement of the asphaltic concrete shall closely follow fabric lay down. The temperature of the asphaltic concrete immediately behind the laydown machine shall not exceed 325 degrees F, unless modified by the WMA technology being used. If WMA technology is being used then the minimum requirements will be stated within the mix design recommended by the WMA manufacturer. In the event that the asphalt binder coat bleeds through the fabric causing construction problems before the overlay is placed, the affected areas shall be sanded with a sand blotter in compliance with Section 333. Excess sand shall be removed before beginning the paving operation. In the event of rainfall prior to the placement of the asphaltic concrete, the fabric shall be allowed to dry before the asphalt concrete is placed.

Turning of the paving machine or of other vehicles on the fabric shall be gradual and kept to a minimum to avoid damage to the fabric. Should equipment tires stick to the fabric during pavement operations, small quantities of paving asphalt concrete shall be broadcast on the fabric to prevent pick-up. Decrease of binder rate in order to minimize pick-up on tires is not allowed.

**~~321~~326.8.8 Thickened Edge:** When the depth of the thickened edge extends four inches or more below the bottom of the asphalt pavement, the portion of the thickened edge extending below the asphalt pavement shall be placed and compacted prior to placement of the asphalt pavement. Placement of tack coat on the surface of the compacted thickened edge asphalt may be omitted when additional asphalt pavement is placed on the same day and the Engineer agrees that the surface of the thickened edge asphalt has remained clean.

When the depth of the thickened edge extends less than four inches below the bottom of the asphalt pavement, the portion below the asphalt pavement may be placed and compacted with the asphalt pavement in a single operation.

**~~321~~326.8.9 Safety Edge:** The finished safety edge slope shall be planar forming a 30° ± 5° angle with the adjacent roadway surface and extend a minimum of five inches (5”) below the roadway pavement’s finished surface.

The safety edge shall be constructed with the top or final paving lift of a new pavement or overlay using a device that is mounted to or is a part of the screed portion of the laydown machine. The safety edge device shall be capable of constraining the asphalt concrete material to increase density of the extruded profile by reducing the volume. A conventional single strike-off plate is not acceptable. Compaction obtained from the extruded safety edge shall be acceptable when the extruded shape conforms to the specified shape.

During laydown operations if the extruded safety edge does not conform to the specified shape, the Contractor shall take immediate actions to correct the deficiency and to repair all non-compliant sections of safety edge. The Contractor shall stop paving operations until corrections to the laydown operation have been made and resumption of paving is approved by the Engineer or his designated representative.

**~~321~~326.8.10 Protection for Asphalt Base Course:** Arterial roadway traffic shall not be allowed on a new asphalt base course that is less than five inches (5”) in thickness without the written consent of the Engineer.

**~~321~~326.9 QUALITY CONTROL:**

It is the contractor’s responsibility to perform Quality Control monitoring and/or testing during asphalt concrete production to achieve the required compaction and to perform Quality Control monitoring and/or testing during asphalt concrete production to achieve the required mix properties. The Engineer may obtain samples of any portion of any material at any point of the operations for his own use. Also, the Engineer may order the use of any drying, proportioning and mixing equipment or the handling of any material discontinued which, in his/her opinion, fails to produce a satisfactory mixture.

The asphalt concrete produced shall conform to the requirements of the production tolerances established in Section ~~321~~326.10. When the asphalt concrete does not conform to the production tolerances, it shall be reported to the Engineer, and corrective quality control measures shall be implemented, or production shall cease immediately at no additional cost to the contracting Agency.

Requests for referee testing as described in Section ~~321~~326.11 will only be considered based on quality control test results performed by a laboratory accredited by the AASHTO Accreditation Program (AAP) for the tests being performed or a laboratory listed in the current ADOT Directory of Approved Materials Testing Laboratories for the set of tests in question. The laboratory shall use properly certified technicians in accordance with ASTM D3666, Section 7 (Personnel Qualifications).

**~~321~~326.10 ACCEPTANCE:**

**~~321~~326.10.1 Acceptance Criteria:** Asphalt concrete will be divided into lots for the purpose of acceptance. A lot shall be one day's production. Each lot shall be divided into sublots of 500 ton or fraction thereof. Tests used to determine acceptance will be performed by a laboratory accredited by the AASHTO Accreditation Program (AAP) for the tests being performed. The contracting agency shall provide an appropriately accredited laboratory or laboratories to perform the acceptance testing. laboratories shall use properly certified technicians in accordance with ASTM D3666, Section 7 (Personnel Qualifications). The acceptance laboratory will take representative samples of the asphalt concrete from each sublot to allow for testing of gradation, binder content, air voids, pavement thickness, and compaction of base and surface courses. Acceptance of each sublot will be based on the test data from the sample(s) from that sublot. All acceptance samples shall be taken using random locations or times designated by the Engineer in accordance with ASTM D3665. For permit work, testing that does not strictly adhere to the sampling and testing methodology and requirements outlined in this Section shall be disregarded and not considered in any acceptance determination. All required retesting shall be at the expense of the permittee.

**~~321~~326.10.2 Gradation, Binder Content and Air Voids:** The acceptance laboratory will take a sample of the asphalt concrete in accordance with the requirements of Section 2 or 4 of Arizona Test Methods 104 or AASHTO T-168 from each sublot. The minimum weight of the sample shall be 45 pounds. Asphalt binder content and gradation shall be determined in accordance with AASHTO T-308 using the ignition furnace for each sublot. The acceptance laboratory is responsible for obtaining the necessary materials and performing an ignition furnace calibration as outlined in AASHTO T-308 for each asphalt concrete mixture utilized on the project. The correction factor used for each test shall be clearly indicated on the report. The bulk density for Marshall Mix designs shall be tested in accordance with AASHTO T-245. The bulk density for Gyratory mix designs shall be determined in accordance with AASHTO T-312. The maximum theoretical density shall be determined in accordance with the requirements of AASHTO T-209 including fan drying per AASHTO T-209 Section 15. Effective voids of the laboratory compacted specimens will be determined at a minimum of once per lot in accordance with the requirements of AASHTO T-269. Should the testing for effective air voids not meet the "Full Payment" or "No Corrective Action" requirements of Table ~~321~~326-5, additional testing for laboratory air voids on the remaining sublots will be performed as necessary to determine the extent of the deficiency. Acceptance testing results will be furnished to the contractor and the supplier within five working days of receipt of samples by the acceptance laboratory.

During production, the allowable deviations from the mix design gradation targets are listed in the tables below. The allowable production tolerances may fall outside of the mix design gradation bands.

| **TABLE ~~321~~326-3~~A~~** | |
|---|---|
| **GRADATION ACCEPTANCE LIMITS FOR ~~MARSHALL MIXES~~PMAC** | |
| Sieve Size | 1/2 inch Mix |
| 1 inch | --- |
| 3/4 inch | --- |
| 1/2 inch | ±7% |
| 3/8 inch | ±6% |
| No. 8 | ±6% |
| No. 40 | ±4% |
| No. 200 | ±2% |

| ~~TABLE 321-3B~~ | | | |
|---|---|---|---|
| ~~GRADATION ACCEPTANCE LIMITS FOR GYRATORY MIXES~~ | | | |
| ~~Sieve Size~~ | ~~3/8 inch Mix~~ | ~~1/2 inch Mix~~ | ~~3/4 inch Mix~~ |
| ~~3/4 inch~~ | ~~—~~ | ~~—~~ | ~~±7%~~ |
| ~~1/2 inch~~ | ~~—~~ | ~~±7%~~ | ~~±6%~~ |
| ~~3/8 inch~~ | ~~±7%~~ | ~~±6%~~ | ~~—~~ |
| ~~No. 8~~ | ~~±6%~~ | ~~±6%~~ | ~~±6%~~ |
| ~~No. 40~~ | ~~±4%~~ | ~~±4%~~ | ~~±4%~~ |
| ~~No. 200~~ | ~~±2%~~ | ~~±2%~~ | ~~±2%~~ |

If the results from a single acceptance sample fall outside of the acceptance limits in Table ~~321~~326-3~~A or 321-3B~~ as applicable, a second sample shall be taken and if the second acceptance sample is also outside of the acceptance limits the Contractor shall cease production of asphalt concrete. Production shall not begin again until calibration test results verify that adjustments made to materials or proportions yield a gradation that falls within acceptance limits in Table ~~321~~326-3~~A or 321-3B~~ as applicable.

If the asphalt binder content is within ± 0.540% of the mix design target value, the asphalt concrete will be paid for at the contract unit price. If the asphalt binder content deviates by more than ± 0.540% from the mix design target value, the deficient area will be evaluated within the sublot by coring one additional location at a maximum interval of 100 feet on each side of the deficient sample. The asphalt content of the original deficient sample will be averaged with the asphalt binder content of the two additional cores to determine compliance with the acceptance requirements. If the resulting average of the asphalt binder content deviates by more than ± 0.540% from the mix design target value, then Table ~~321~~326-4 shall apply to the sublot. If approved by the Engineer, the Contractor may obtain additional cores to assist in formulation of an Engineering Analysis, but the additional cores shall not be used for re-evaluating acceptance.

| **TABLE ~~321~~326-4** | | |
|---|---|---|
| **ASPHALT BINDER CONTENT ACCEPTANCE AND PENALTIES** | | |
| Deviation from that permitted | When the contracting agency is the owner:<br>Payment Reduction<br>($ per ton of asphalt concrete) | When the contracting agency is not the owner (i.e. permits):<br><br>Corrective Action |
| Over 0.2% above that permitted | Removal* or EA | Removal* or EA |
| Over 0.1% to 0.2% above that permitted | $6.00 | EA |
| Over 0.0% to0.1% above that permitted | $2.00 | EA |
| Within permitted range | Full Payment | No Corrective Action |
| Over 0.0% to0.1% below that permitted | $2.00 | EA |
| Over 0.1% to 0.2% below that permitted | $6.00 | EA |
| Over 0.2% below that permitted | Removal* or EA | Removal* or EA |

NOTES: *The Contractor shall remove and replace the entire sublot that is deficient.
EA = Engineering Analysis per Section ~~321~~326.10.6

If the laboratory air voids fall within a range of~~–~~ -1.5% to +2.0% of the design target~~2.8% to 6.2%~~, the asphalt concrete will be paid for at the contract unit price. If the laboratory air voids are outside of this range, the deficient area will be evaluated within the sublot by coring one additional location at a maximum interval of 100 feet on each side of the deficient sample. The laboratory air voids of the original deficient sample will be averaged with the laboratory air voids obtained from each of the two additional cores to determine compliance with the acceptance requirements. If the resulting average of the laboratory air voids is outside the indicated range, then Table ~~321~~326-5 shall apply to the sublot. If approved by the

Engineer, the Contractor may obtain additional cores to assist in formulation of an Engineering Analysis, but the additional cores shall not be used for re-evaluating acceptance.

| TABLE ~~321~~326-5 | | |
|---|---|---|
| LABORATORY VOIDS ACCEPTANCE AND PENALTIES | | |
| Laboratory Air Voids (Measured at $N_{des}$ or 75 blows as applicable) | When the contracting agency is the owner: Payment Reduction ($ per ton of asphalt concrete) | When the contracting agency is not the owner (i.e. permits): Corrective Action |
| Greater than -2.7% from Target~~1.5%~~ | Removal* or EA | Removal* or EA |
| -2.7% to -2.1% from Target ~~1.5 2.0%~~ | $5.00 | EA |
| ~~2.1 2.7%~~-2.0% to -1.6% from Target | $2.00 | EA |
| ~~2.8 6.2%~~-1.5% to +2.0% from Target | Full Payment | No Corrective Action |
| +2.1% to +2.9% from Target~~6.3 6.9%~~ | $2.00 | EA |
| +3.0% to +4.0% from Target~~7.0 8.0%~~ | $5.00 | EA |
| Greater than +4~~8~~.0% from Target | Removal* or EA | Removal* or EA |

NOTES: *The Contractor shall remove and replace the entire sublot that is deficient.
EA = Engineering Analysis per Section ~~321~~326.10.6

If an agency or Engineer is purchasing asphalt concrete directly from a commercial material supplier, the agency or Engineer will use Section ~~321~~326.10, and specifically Tables ~~321~~326-3~~A or 321 3B~~ as applicable, ~~321~~326-4 and ~~321~~326-5 from Section ~~321~~326.10, when determining the acceptance of the asphalt concrete with the material supplier.

**~~321~~326.10.3 Surface Testing:** If directed by the Engineer surface drainage test shall be performed. The completed surfacing shall be thoroughly compacted, smooth and true to grade and cross-section and free from ruts, humps, depressions or irregularities. An acceptable surface shall not vary more than 1/4 inch from the lower edge of a 12-foot straightedge when the straightedge is placed parallel to the centerline of the roadway. The straightedge shall be furnished by the contractor and shall be acceptable to the Engineer.

All streets shall be water tested for drainage in the presence of the Engineer or designated representative before final acceptance. Any areas not draining properly shall be corrected to the Engineer's satisfaction at the Contractor's expense. Water for this testing shall be provided and paid for by the Contractor.

When deviations in excess of the above tolerance are found, humps or depressions shall be corrected to meet the specified tolerance. The defective pavement shall be cut out along neat straight lines or for multiple course pavements the surface course may be milled out, and the removed pavement replaced with fresh hot mixture and thoroughly compacted to conform with and bond to the surrounding area. Materials and work necessary to correct such deviations shall be at no additional cost to the Contracting Agency.

When pavement is cut out along neat straight lines, full depth longitudinal joints shall not be located within a lane wheel path or within forty-eight inches (48") of an asphalt pavement edge. Longitudinal joints shall comply with the restrictions for Type A Trench Repairs in Section 336.3.

**~~321~~326.10.4 Asphalt Pavement Thickness:** Asphalt pavement thickness will be determined from cores secured from each lift of each sublot. Such cores will be taken and measured by the Asphalt Concrete Coring Method. This method can be found

in Section ~~321~~326.14. Each core location will be patched by the party responsible for the testing.

Acceptance or assessment of penalties for asphalt pavement thickness will be based on the combined total thickness of all asphalt concrete layers omitting all layers of asphalt-rubber asphalt concrete. If the final total pavement thickness exclusive of all ARAC layers is deficient from the target thickness by 0.25 inches or less, it will be paid for at the contract unit price.

If the thickness deficiency of the pavement core exceeds 0.25 inch, the thickness deficiency shall be evaluated by coring at a maximum interval of 100 feet on each side of the deficient core. The thickness of the original deficient core will be averaged with the thicknesses of the cores taken from each side of it to determine compliance with the acceptance requirements.

If the pavement thickness deficiency is greater than 0.25 inches and the contracting agency is not the owner (i.e. permits) the following will apply:

(1) If the pavement thickness deviates from the target thickness by more than 0.25 inch but not more than 0.50 inch, corrective action will be required. This corrective action shall consist of application of a Type II slurry seal coat in accordance to Section 715. The Contractor may present an Engineering Analysis outlining other proposed remedial measures for the consideration by the Engineer. The Engineer will review the engineering analysis and decide within 30 working days whether to accept the proposed remedial measures.

(2) If the pavement thickness deviates from the target thickness by more than 0.50 inch, corrective action will be required. The deficient area shall be overlaid with no less than a 1 inch thick lift, for the full width of the pavement to meet or exceed the designed thickness, with appropriate end and edge milling, with a mixture approved by the Engineer. The Contractor may present an engineering analysis outlining other proposed remedial measures for the Engineer's consideration. The Engineer will review the engineering analysis and decide within ten working days whether to accept the proposed remedial measures. If the Engineer chooses to reject the Engineering Analysis, the indicated overlay shall be constructed by the Contractor at no additional cost to the Owner.

If the contracting agency is the owner and the pavement thickness deficiency is greater than 0.25 inches but less than 0.50 inches, Table ~~321~~326-6 will apply. If the pavement thickness deficiency is greater than 0.5 inches, the deficient area shall be overlaid with no less than a 1-inch thick lift for the full width of the pavement to meet or exceed the designed thickness using an asphalt mixture approved by the Engineer. The Contractor shall provide appropriate end and edge milling. The overlay and milling shall be accomplished by the Contractor at no additional cost to the contracting agency.

**TABLE ~~321~~326-6**

**ASPHALT PAVEMENT THICKNESS PAYMENT REDUCTION**
**For Thickness Deficiency of More Than 0.25 inches and less than 0.50 inches**

| Total Specified Asphalt Pavement Thickness exclusive of ARAC (if any) | Reduction in Payment Applied to asphalt concrete Except ARAC layers (if any) |
|---|---|
| Less than 1.5 inches | 50% |
| 1.50 inches to 1.99 inches | 33% |
| 2.00 inches to 2.49 inches | 25% |
| 2.50 inches to 2.99 inches | 20% |
| 3.00 inches and greater | 17% |

**~~321~~326.10.5 Density:**

**~~321~~326.10.5.1 Pavement 1-1/2 Inches or Less in Nominal Thickness:**

Compaction shall consist of a "Rolling Method Procedure" using an established sequence of coverage with specified types of compactors. A pass shall be defined as one movement of a compactor in either direction. Coverage shall be the number of passes as are necessary to cover the entire width being paved.

The rolling sequence, the type of compactor to be used, and the number of coverages required shall be as shown in Table ~~321~~326-7.

| TABLE ~~321~~326-7 | | | | |
|---|---|---|---|---|
| ROLLING SEQUENCE FOR LIFT THICKNESS 1½" OR LESS | | | | |
| Rolling Sequence | Type of Compactor | | No. of Coverages | |
| | Option No. 1 | Option No. 2 | Option No. 1 | Option No. 2 |
| Initial | Static Steel | Vibrating Steel | 1 | 1 |
| Intermediate | Pneumatic Tired | Vibrating Steel | 4 | 2- 4* |
| Finish | Static Steel | Static Steel | 1-3 | 1-3 |
| * Based on the roller pattern which exhibits the best performance. | | | | |

The Contractor shall select the option for compaction and, when pneumatic-tired compactors are used will designate the tire pressure. Steel wheel compactors shall not be used in the vibratory mode for courses of one inch or less in thickness nor when the temperature of the asphaltic concrete falls below 180 degrees F. Initial and intermediate compaction shall be accomplished before the temperature of the asphaltic concrete falls below 200 degrees F.

Compaction will be deemed to be acceptable on the condition that the asphaltic concrete is compacted using the type of compactors specified, ballasted and operated as specified, and with the number of coverages of the compactors as specified.

**~~321~~326.10.5.2 Pavement Greater than 1-1/2 Inches in Nominal Thickness:**

Achieving the required compaction is the responsibility of the contractor. The number and types of rollers is the contractor's responsibility and shall be sufficient to meet these requirements.

In-place air voids shall be determined in accordance with AASHTO T-269 utilizing cores taken from the finished pavement. The maximum theoretical density used in the determination of in-place air voids will be the average value from the acceptance samples determined for the lot as outlined in ~~321~~326.10.1.

The Engineer will designate one random test location for each sublot and the acceptance laboratory will obtain one core from that location. Regardless of sublot quantities or boundaries, a minimum of one core will be obtained per residential street and a minimum of one core per travel lane for collector and arterial streets. The outside one foot of each pass of the pavement course or any unconfined edge will be excluded from testing. The Engineer may exclude areas from the compaction lot that are not accessible by normal compaction equipment.

The Contractor shall provide the traffic control to facilitate any coring operations necessary for compaction acceptance.

Cores will be taken per the Asphalt Concrete Coring Method. This method can be found in Section ~~321~~326.14. Acceptance testing results will be furnished to the contractor within five working days of receipt of samples by the acceptance laboratory.

If the pavement density has in-place voids of between 4.0% and 8.0%, the asphalt concrete will be paid for at the contract unit price. If the acceptance core for a sublot indicates that the pavement density has in-place voids of less than 4.0% or greater than 8.0%, the deficient area will be evaluated by coring two additional locations at maximum intervals of 100 feet from the deficient core. The in-place voids of the original deficient core will be averaged with the in-place voids of the cores taken from 100 feet on each side of it to determine compliance with the acceptance requirements. If the resulting average of the in-place voids is outside the indicated range, then Table ~~321~~326-8 shall apply to the sublot. If approved by the Engineer, the Contractor may obtain additional cores to assist in formulation of an Engineering Analysis, but the additional cores shall not be used for re-evaluating acceptance.

| TABLE ~~321~~326-8 | | |
|---|---|---|
| PAVEMENT DENSITY PENALTIES | | |
| Limits of In-place Air Voids for design lift thicknesses 1.5 inches and greater | When the contracting agency is the owner<br><br>Payment Reduction<br>($ per ton of asphalt concrete) | When the contracting agency is not the owner i.e. permits<br><br>Corrective Action |
| Below 3.0% | Removal* or EA | Removal* or EA |
| 3.0% to below 4.0% | $10.00 | EA and Type II Surry Seal |
| 4.0% to 8.0% | Full Payment | No Corrective Action |
| Greater than 8.0% to ~~less than~~ 9.0% | $6.00 | EA |
| Greater than 9.0% to 10.0% | $10.00 | EA and Type II Surry Seal |
| Greater than 10.0% | Removal* or EA | Removal* or EA |

NOTES: *The Contractor shall remove and replace the entire sublot that is deficient.
EA = Engineering Analysis per Section ~~321~~326.10.6

**~~321~~326.10.6 Engineering Analysis (EA)**: Within 10 working days after receiving notice that a lot or sublot of asphalt concrete is deficient and is found to fall within the "Removal or EA" band per Table(s) ~~321~~326-4, ~~321~~326-5, and/or ~~321~~326-8 the contractor may submit a written proposal (Engineering Analysis) to accept the material in place at the applicable penalties along with possible remediation(s) listed in the "Removal or EA" category. Engineering Analysis can also be proposed for non-removal categories of "Corrective Actions" when the contracting agency is not the owner (i.e. permits).

The Engineering Analysis shall contain an analysis of the anticipated performance of the asphalt concrete if left in place. The Engineering Analysis shall also detail the effect of any proposed corrective action to the material(s) in place as it relates to the in-place material's performance. The Engineering Analysis shall be performed by a professional engineer experienced in asphalt concrete testing and mix designs.

If a lot or sublot is accepted for referee testing and the referee test results still show a deficiency, the contractor shall have ten working days to submit an Engineering Analysis beginning upon notification of referee test results.

When an Engineering Analysis recommends that a specific lot or sublot should not be removed, the Engineering Analysis will recommend that the following penalties (Table ~~321~~326-9) be paid when the contracting agency is the owner, for the specific criteria being reviewed by the EA.

| TABLE ~~321~~326-9 | | |
|---|---|---|
| ENGINEERING ANALYSIS PENALTIES for REMOVAL* LOTS/SUBLOTS LEFT IN-PLACE | | |
| **Acceptance Criteria** | **Acceptance Limits** | **Penalty When Contracting Agency is the Owner ($/Ton)** |
| Asphalt Binder Content | Over 0.2% points from that Permitted | $9.00 |
| Laboratory Air Voids (Measured at $N_{des}$ or 75 blows as applicable) | Less than 1.5% or Greater Than 8.0% | $7.50 |
| Limits of In-place Air Voids | Less than 3% or<br>Greater than 10.0% | $15.00 |

Within 15 working days, the Engineer will determine whether or not to accept the contractor's proposed Engineering Analysis.

**~~321~~326.11 REFEREE:**

If the Contractor has reason to question the validity of any of the acceptance test results, the Contractor may request that the Engineer consider referee test for final acceptance. Any request for referee testing must describe the contractor's reasons for questioning the validity of the original acceptance test results and must clearly describe which set of acceptance tests are in question. The engineer may either accept or reject the request for referee testing. When referee testing is accepted the Contractor (at the Contractors own expense) will engage an independent laboratory accredited by the AAP or a laboratory listed in the current ADOT Directory of Approved Materials Testing Laboratories as appropriate the acceptance tests that are being questioned. The independent referee laboratory shall use properly certified technicians in accordance with ASTM D3666, Section 7 (Personnel Qualifications). For the set of test results in question the referee laboratory shall perform a new set of acceptance tests (as required by Section ~~321~~326.10 representing the area for the set of tests in question). The referee tests will replace the original acceptance tests that were in question.

For permit work, the permittee, responsible for hiring the testing laboratory, whose results necessitate referee testing, shall bear all expenses in the additional testing (i.e. secondary and the referee testing) if the original results are not substantiated by the referee testing procedure outlined in this Section. Additionally, any testing performed that does not strictly ahere to the sampling and testing methodology and requirements in Section 321.10 shall be disregarded and not allowed in any acceptance determination. Disregarded tests will be re-performed at the expense of the permittee.

These tests may include asphalt binder content, aggregate gradation, Marshall or Gyratory unit weight, maximum theoretical unit weight, laboratory air voids and in-place air voids (compaction). Samples for referee testing shall come from representative samples obtained from the completed pavement, as directed by the Engineer.

The number of samples taken will be the same as specified in Section ~~321~~326.10. The independent laboratory shall compile the test results and transmit them to both the Engineer and the contractor. The independent laboratory shall include a report sealed and signed by an Engineer registered in the State of Arizona, who is experienced in asphalt concrete testing and mix design development. The signed report shall give an opinion that the material evaluated does or does not comply with project specifications, shall clearly describe any deficiencies, and the results will be binding between all parties.

**~~321~~326.12 MEASUREMENT:**

Asphalt concrete pavement will be measured by the ton, or by the square yard, for the mixture actually used as allowed above, which shall include the required quantities of mineral aggregates, asphalt binder, and mineral admixture. Measurement shall include any tonnage used to construct intersections, roadways, streets, or other miscellaneous surfaces indicated on the plans or as directed by the Engineer.

Measurement for safety edge preparation only applies to overlays of existing pavements that require the construction of a safety edge when none exists. Safety edge preparation will be measured by the linear foot. Safety edge preparation will not be measured when a safety edge is part of new pavement construction, pavement widening, or when overlaying an existing pavement that contains a safety edge. The asphalt concrete pavement measurement shall include the tonnage used to construct safety edges or the square yard measurement for asphalt concrete pavement will be increased by the horizontal extension of the safety edge beyond the roadway pavement edge.

**~~321~~326.13 PAYMENT:**

The asphalt concrete measured as provided above will be paid for at the contract price per ton or square yard, as adjusted per Section ~~321~~326.10, which price shall be full compensation for the item complete, as herein described and specified.

Payment for tack coat will be by the ton diluted, based on the rate of application, as directed by the Engineer.

No payment will be made for any overrun in quantity of asphalt concrete in excess of 10 percent for newly constructed pavement having a total thickness equal to or greater than 2.5 inches. The overrun quantity is excess tonnage above the tonnage calculated based on actual field measurement of area covered, design thickness, and the mix design unit weight. The calculations for overrun will be by individual pay item. To compensate or adjust for a thickness deficiency in an underlying asphalt concrete course, the Engineer may authorize a quantity increase in excess of 10 percent for a subsequent asphalt concrete course. In such cases, the quantity in excess of 10 percent will be paid for at the lowest unit price.

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Removal of raised pavement markers, pavement repars, and surface pavement replacments required prior to roadway overlay operations will be paid for by other pay items unless otherwise specified.

Except as otherwise specified, no separate payment will be made for work necessary to construct thickened edges, safety edges, or other miscellaneous items or surfaces of asphalt concrete.

Payment for safety edge preparation will be at the contract unit price for the quantities measured as described above.

**~~321~~326.14 ASPHALT CORE METHOD: Core Drilling of Hot Mix Asphalt (HMA) for Specimens of 4" or 6" diameter**

**~~321~~326.14.1 Scope:** This method is to establish a consistent method of the use of a diamond bit core to recover specimens of 4 or 6 inch diameter for laboratory analysis and testing. The method will require the use of: water, ice (bagged or other suitable type), dry ice, and a water-soap solution to be utilized when coring asphalt rubber concrete. Individuals doing the specimen recovery should be observing all safety regulations from the equipment manufacturer as well as the required job site safety requirements for actions, and required personal protective equipment.

**~~321~~326.14.2 Core Drilling Device:** The core drilling device will be powered by an electrical motor, or by an acceptable gasoline engine. Either device used shall be capable of applying enough effective rotational velocity to secure a drilled specimen. The specimen shall be cored perpendicularly to the surface of pavement, and that the sides of the core are cut in a manner to minimize sample distortion or damage. The machinery utilized for the procedure shall be on a mounted base, have a geared column and carriage that will permit the application of variable pressure to the core head and carriage throughout the entire drilling operation. The carriage and column apparatus shall be securely attached to the base of the apparatus; and the base will be secured with a mechanical fastener or held in place by the body weight of the operator. The core drilling apparatus shall be equipped with a water spindle to allow water to be introduced inside of the drill stem while operating. The cutting edge of the core drill bit shall be of hardened steel or other suitable material with embedded diamond chips in the cutting surface. The core barrel shall be of sufficient diameter to secure a specimen that is a minimum of four or six inches or whichever is prescribed for necessary testing. The core barrel shall not be missing more than one of the teeth used for cutting; if so it shall be discarded and another barrel shall be used. The core barrel shall also be a minimum of two inches longer than the anticipated depth of pavement in accordance with project paving plans. For permit work, testing of cores obtained in a manner that does not strictly adhere to the methodology outlined in this Section shall be disregarded and not considered in any acceptance determination. Retesting shall be at the expense of the permittee.

**~~321~~326.14.3 Accessory Equipment:** A sufficient supply of ice and dry ice shall be provided to sufficiently cool the pavement prior to securing the samples from the designated areas in the pavement. The ice should also be used to adjust the temperature of the water used to cool the core bit. A water supply (usually a plastic 35 – 55 gal drum) with sufficient hose to introduce the water into and through the spindle of the coring device by gravity feed. The drum should be white or light in color to minimize excessive thermal heating of the water (*for coring of asphalt rubber cores see Note 1*). At no time shall the water utilized in the coring operation exceed 65 degrees F during the coring operation. Ice shall be utilized to ensure the temperature control of the water being introduced during the cutting operation. An ice chest or other suitably insulated container that can maintain a temperature of less than 70 degrees F shall be used to secure the specimens during transport. The container will be equipped with flat shelving that will support the drilled cores throughout the entire specimen dimension during transport back to the testing facility.

Miscellaneous hand tools to remove the drilled specimen from the drill hole or the core barrel taking great care in not disturbing the specimen more than necessary (refer to fig. 1 in ASTM D5361).

**~~321~~326.14.4 Process:** The pavement surface at the time of coring shall not exceed a temperature of 90 degrees F; the pavement shall be conditioned with ice or dry ice to ensure that this requirement is met. Immediately after it has been ensured that the pavement has dropped to the required temperature, core drilling shall begin. The operator will then apply an even and continuous pressure (Note 2) to penetrate through the full depth of the pavement. The operator will concurrently ensure that enough water is moving over the core surface as to adequately remove any and all cuttings that could damage the drilled core. After the pavement thickness has been penetrated the core shall be carefully removed from either the drill hole or the core barrel and be immediately transferred to an ice chest or other suitable container. Each individual core shall be placed on a shelf in the cooler with the exposed side of the specimen facing down, or the "top side" down. If the specimen is a two lift core, the only acceptable means of separating lifts is with a power or other acceptable wet saw type of equipment (conforming to ASTM D5361); however, at no time shall cores be split using a mallet and screwdriver or metal straight edge when being tested for bulk density. Perpendicularity of the specimen shall be checked in the field after the specimen has been extracted from the surface. The core operator shall hold the core up to eye level and place the core top side down in a "speed square" or small carpenters square. The specimen placed in the square shall not depart from perpendicular to the axis more than 0.5$^{o}$ (approximately equivalent to 1/16 of an inch in 6 inches). If the specimen is outside of this distance from square it

shall be discarded in the field and another sample cored that falls within tolerance. The cores upon arriving at the laboratory for testing shall be carefully cleaned and measured for thickness in accordance with ASTM D3549. A speed square shall be utilized to

measure perpendicularity as compared to a 90 degrees angle and shall not depart from perpendicular to the axis more than 0.5 degrees (approximately equivalent to 1/16 of an inch in 6 inches). All remaining testing shall be done within the parameters of the current project and/or agency required specification.

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*Note 1 – It should be noted that when the material to be cored is a rubberized asphalt mixture a wetting agent such as liquid dish soap shall be added to the water barrel to hinder the material from sticking or allowing the binder to spread during coring.

*Note 2 – This refers to pressure exerted on the core barrel and machine during the coring process. Too much pressure can cause damage to the core barrel and the motor; and too little pressure can cause a glazing of the diamonds, reducing cutting efficiency and premature wear of the barrel.

***-End of Section-***