



2022

**STANDARD
SPECIFICATIONS FOR
HIGHWAY CONSTRUCTION**

(d) Application.**1. General.**

Tack coat material application rates and temperatures shall meet the requirements given in the tables below:

UNDILUTED APPLICATION RATE BY SURFACE TYPE, gal/yd ²				
Tack Material	New HMA or New Surface Treatment	Existing HMA or Existing Surface Treatment	Milled Surface	PCC
Emulsions	0.03 - 0.07	0.06 - 0.11	0.06 - 0.12	0.05 - 0.08
PG Asphalt Binder	0.02 - 0.05	0.04 - 0.07	0.04 - 0.09	0.03 - 0.05

TACK APPLICATION TEMPERATURES, °F	
Cationic Emulsified Asphalt	130 - 170
Anionic Emulsified Asphalt	150 - 180
Non-Ionic Emulsified Asphalt	150 - 180
PG Asphalt Binder	275 - 375

Tack coat shall be applied uniformly to the pavement surface to obtain full coverage. Tack coat applications that are streaky or striped in appearance will not be allowed and shall be reapplied.

An asphalt distributor shall be provided for use on all accessible areas; inaccessible areas such as around manholes, etc. may be coated by other methods, approved by the Engineer.

Tack coat shall be applied to all contact surfaces of curbs, gutters and manholes. Tack shall also be applied to the adjacent pavement edges (transverse and longitudinal) of all new base layers of Section 424 (Superpave), binder and wearing layers of Section 424 (Superpave) and Section 423 (Stone Matrix Asphalt), and to the joints in the surface layers between existing HMA pavement and new HMA pavement. This tack may be applied with the pavement surface tacking operation or in a separate pass. In either case, the surfaces, edges, and joints shall be thoroughly coated with tack.

Adjacent surfaces, such as gutters and the like, that are not to be in contact with the mix shall be adequately protected from the spray by means of heavy paper securely fastened in place or by other satisfactory means. Any such surface soiled by tack coat material shall be cleaned and restored to its previous condition without additional compensation.

2. CrafcTM and PavonTM.

The following will apply if the Contractor uses CrafcTM or PavonTM for application on adjacent pavement edges and joints.

As a separate application from the tack coat, these products shall be applied by being sprayed or rolled on the face of the adjacent pavement edges and joints.

These products shall be placed at the rates and temperatures given in the following table.

APPLICATION RATES AND TEMPERATURES		
Product	Application Rate	Application Temperature
Pavon TM	40 gallons per mile per inch of lift with a +/- 10 % tolerance	Ambient Temperature
Crafc TM Pavement Joint Adhesive Part No. 34524	70 gallons per mile per inch of lift with a +/- 10 % tolerance	360 °F - 400 °F

- the pounds per square yard {kilograms per square meter} designated by the plans or proposal.
- If the plans provide for the use of lightweight aggregate (expanded clay or shale), the pounds per square yard {kilograms per square meter} of the layer shown by the plans or proposal will not be adjusted.
- If the plans provide for the use of an "Open Graded" plant mix layer, the pounds per square yard {kilograms per square meter} of the layer shown by the plans or proposal will not be adjusted.

2. Requirement for Approved Job Mix Formula (JMF).

Work shall not be started under this Section on a specific project until the Contractor has submitted and received approval of a job mix formula from the Materials and Tests Engineer and the job mix formula has been checked by the Area Materials Engineer for use on the project.

A change in aggregate sources will require a new job mix formula before the new material is used. A change in liquid asphalt binder source and anti-stripping agent will be allowed without a new job mix formula provided the design criteria is met by a one-point check of the mixture. The one-point check shall include the Air Void content, VMA, Stability, Flow, and TSR (Tensile Strength Ratio) and may be determined during the production of the mix. However, no change in the grade of liquid asphalt binder will be allowed without the written approval of the Materials and Tests Engineer.

3. **Contractor's Responsibility for Job Mix Formula.**

Designs for all mixes shall be the responsibility of the Contractor and shall be submitted by the Contractor for approval. Refer to applicable Sections (420, 424, etc.) for design criteria. The submitted formula shall have been designed by a certified technician (Level III - Designer) in a laboratory that has been certified by the Department. **Use an Approved ALDOT Mix Design.**

4. Approval of Job Mix Formula by Materials and Tests Engineer.

The Contractor shall submit to the Materials and Tests Engineer, for approval, a Job Mix Formula (JMF) for each mixture to be supplied from a specific plant. The Contractor shall allow at least four weeks for the evaluation and approval of the job mix formula.

The submitted formula shall include any additive by type and trade name and be accompanied by samples from the material sources the Contractor proposes to use in producing the mix. The job mix formula for each mixture shall establish a single percentage of aggregate passing each required sieve size, a single percentage of liquid asphalt binder to be added to the aggregate, a single percentage of any additive, and a mixing temperature range suitable for the type, grade, etc. of liquid asphalt binder to be used in the mix. Each job mix formula shall be accompanied by a test report from an approved laboratory certifying that all current Departmental design test parameters have been met (copies of the Departmental current design test parameters may be obtained from the office of the Materials and Tests Engineer). There will be no charge for the Department's checking of the Contractor's job mix formula.

The approved job mix formula for each mixture shall be in effect for a maximum of two years from the approval date on the job mix formula or until the Materials and Tests Engineer withdraws approval by written order.

5. Approval of Job Mix Formula by Area Materials Engineer.

At least two full working days prior to beginning the production of asphalt mix for a specific project, the Contractor shall submit a mix design (approved by the Materials and Tests Engineer) to the Area Materials Engineer. The project number shall be inserted on the approved job mix formula. The Area Materials Engineer will review the mix design to determine if the job mix formula is appropriate for the specific project. If the job mix formula is appropriate for the project, the Area Materials Engineer will sign the mix design as being approved, will note the date of approval, and will distribute copies for inspection of the asphalt production.

A copy of this approved job mix formula with the Materials and Tests Engineer's approval and the Area Materials Engineer's approval (with the date of approval) shall be available at the plant any time material is being delivered to the State.

6. **Establishment of Delivery Temperature.**

The Engineer will check and record the temperature of the mixture upon delivery to the project site. The minimum delivery temperature for warm mix asphalt shall be 220 °F {104 °C}. The minimum delivery temperature for hot mix asphalt shall be 250 °F {121 °C}. The Engineer should monitor the work to ensure that there is not high variability in the delivery temperatures or isolated loads of temperature differentials that appear extreme. **For pay items that do not require density as a pay**

factor (patching, widening, etc.) and for mixes that do not require density as a pay factor (OGFC, PATB, etc) the Contractor shall provide a +/- 25 °F {11 °C} delivery temperature range.

No loads will be accepted at a temperature greater than 350 °F {177 °C} for hot mix or warm mix asphalt.

7. Conformance to Approved Job Mix Formula.

All mixtures furnished for use on the project shall conform to the approved job mix formulas within the following ranges of tolerances:

- All liquid asphalt binders used shall meet the requirements given in Section 804. See appropriate pay factor table for liquid asphalt binder content requirements.
- The mixing temperature shall not exceed 350 °F {177 °C}.
- Tolerances for 327, 420 and 424 mixes:
 - Plus or minus 7 % for the #4 {4.75 mm} and larger sieve requirements.
 - Plus or minus 4 % for the #8 through #100 {2.36 mm through 150 μm} sieve requirements.
 - Plus or minus 2.0 % for the #200 {75 μm} sieve requirement.

See Section 423 for gradation requirements for 423 mixes.

The initial setting of the controls for all materials shall be those amounts shown on the job mix formula. The above tolerances are provided for slight variations inherent in job control applications. The Contractor shall make changes as necessary to ensure that the mixture produced is as close as practical to the job mix formula.

8. Consistency of Mix Design in Placement of Wearing Layer.

More than one job mix formula may be submitted and approved for a layer of pavement. The placement of the entire wearing layer shall be from the same job mix unless otherwise approved in writing by the Engineer. For layers other than the wearing layer, the Contractor shall notify the Engineer in writing of the mix design change prior to changing production.

(e) Recycled Asphalt Plant Mix (RAP) and Reclaimed Asphalt Shingles (RAS).

1. Compliance with ALDOT-372.

On all projects utilizing recycled/reclaimed material in the mixture, the Contractor's paving operation and RAP and RAS processing shall conform to the requirements given in ALDOT-372. The recycled hot and warm mix asphalt shall be a homogeneous mixture of reclaimed material, new aggregate (fine or coarse aggregate, or a mixture of fine and coarse aggregate) and new liquid asphalt binder material.

2. Allowable Usage of RAP and RAS.

The Contractor shall have the option to use RAP and RAS in accordance with the requirements given in the following table unless shown otherwise on the plans:

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blending. Wet mixing time shall be increased at least five seconds for cellulose fibers and up to five seconds for mineral fibers. Manual introduction of fibers shall not be used in drum plants.

b. Automatic Method.

Methodology and equipment for metering bulk loose and pelletized fiber into asphalt plants has been developed by the fiber suppliers. Whenever the fiber supplier's recommendations are more stringent than this specification, the fiber supplier's recommendations are controlling. This specification requires specialized equipment that can accurately proportion and meter, by weight {mass}, the proper amount per batch (for batch plants) or continuously, in a steady uniform manner (for drum plants). Fiber, pelletized or loose, shall not be fed through the cold feed bins or through the rap bin.

These proportioning devices shall be interlocked with the plant system and controlled to +/-10% of the weight of the fibers required so as to maintain the correct proportions for all production rates and batch sizes. During the test strip, an equipment calibration check which shows the fiber is being accurately metered and uniformly distributed into the mix shall be performed to the satisfaction of the Engineer. These metering devices shall provide in process high flow (+ 10% or more) and low flow (-10% or less) plant operator notification and interrupt the mix production where the fiber rate is not properly controlled. The fiber metering system shall also provide a record of feed rate (weight or mass per time) and include a section of translucent pipe for visual confirmation of consistent flow rates. Care shall be taken to insure that the fibers are not entrained in the plant's exhaust system. If there is any evidence of fiber in the bag-house or wet-washer fines, the liquid asphalt binder line and/or the fiber line shall be relocated so that the fiber is captured by liquid asphalt binder spray and incorporated into the mix. If there is any evidence of clumps of fibers or pellets at the discharge chute, the contractor shall increase the mixing time and/or intensity. This may entail extending the liquid asphalt binder and fiber feeding lines further into the drum.

(g) Sampling and Inspection.

Aggregates will be accepted in stockpiles in accordance with the Department's Testing Manual provided there is no segregation or contamination, but production of required gradation in the mix shall be the Contractor's responsibility.

Liquid asphalt binder will be accepted in accordance with the requirements given in ALDOT-243.

The right is reserved to take samples, including aggregates from stockpiles, plant mix from the hot elevator, plant mix from the spreader, liquid asphalt binder from storage tanks at the plant, etc., and to make further tests as needed as a basis for continued acceptance of the materials.

Samples of the mixture in use will be taken and tested in accordance with Subarticle 106.09(b).

When directed, the Contractor shall use mechanical equipment to cut samples for testing from the compacted pavement. Samples not smaller than 4 inches {100 mm} square or 4 inches {100 mm} in diameter for the full depth of the course to be tested shall be taken at the locations directed by the Engineer. Furnishing of suitable approved cutting equipment, the cutting of the samples, and the immediate repair of the sample holes with similar type of material shall be performed by the Contractor without extra compensation.

A laboratory shall be furnished for the control of each hot and warm mix asphalt plant in accordance with the provisions of Section 601.

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(a) Equipment.

In general, the choice of equipment will be left to the Contractor. It is the Contractor's responsibility to provide proper sized and amounts of equipment that will produce, deliver to the roadbed, spread, and compact the plant mixed material in sufficient quantities for the continuous movement of the spreaders under normal operating conditions.

The mixing plant, hauling, spreading, and compaction equipment shall meet the requirements listed below; however, other equipment that will produce equally satisfactory results, such as electronically or automatically controlled devices of proven performance, will be considered for use in lieu thereof.

The Contractor shall secure the Engineer's approval of all equipment prior to beginning work and any equipment determined by the Engineer to be unsatisfactory shall be promptly replaced or supplemented.

1. Requirements for all Plants.

Mixing plants shall comply with the requirements of AASHTO M 156 as modified by ALDOT-324, Mixing Plant Requirements for Hot-Mixed, Hot-Laid Asphalt Paving Mixtures. In addition to the above, if a recycled/reclaimed mix is used, the mixing plant shall be modified as necessary to accommodate the use of the reclaimed material and necessary additives. Mixing plants shall be inspected at least annually to insure compliance with the requirements of AASHTO M 156 and ALDOT-324. The Contractor/Vendor will be charged a fee as specified by ALDOT-355, General Information Concerning Materials, Sources, and Devices with Special Acceptance Requirements. If the plant is relocated or substantially modified in any way within a year of the last inspection, an additional inspection and related fee will be required.

The plant shall be equipped with a dust collector constructed to waste or store and later return uniformly to the aggregate mixture all or any part of the material collected.

2. Scales.

A digital recorder shall be installed as part of the platform truck scales. The recorder shall produce a printed digital record on a ticket of the gross and tare weights {masses} of the delivery trucks along with a time and date print for each ticket. Provisions shall be made so that scales may not be manually manipulated during the printing process, and so interlocked as to allow printing only when the scale has come to rest. The scales and recorder shall be of sufficient capacity and size to accurately determine the weight {mass} of the heaviest loaded truck or tractor trailers that are used for the delivery of the hot and warm mix asphalt from that plant.

In lieu of plant and truck scales, the Contractor may provide either (1) an approved automatic printer system which will print the weights {masses} of the material delivered (evidenced by a weight {mass} ticket for each load), provided the system is used in conjunction with an approved automatic batching and control system, or (2) an electronic load cell weight {mass} determination system with associated computer hardware and automated printing system.

The Contractor may provide a "weigh {mass} batcher" system utilizing a weigh {mass} hopper equipped with load cells that determine the net amount of mix delivered from the weight {mass} hopper. An automated weigh {mass} printing system shall be provided to accurately print the weight {mass} of material delivered, the time, and the date for each ticket.

All scales which determine the weight {mass} of the mix for pay purposes shall meet the requirements of Subarticle 109.01(h).

3. Hauling and Remixing Equipment.

a. Load Limitations.

Reference is made to Article 105.12 concerning load limitations on hauling equipment.

Wherever a Material Remixing Device is used, the following restrictions shall apply:

- The device shall be empty while on a bridge.
- The device shall be moved across a bridge without any other vehicles or equipment being on the bridge.
- The device shall be moved on a bridge only within the limits of a lane and shall not be moved on the shoulder of a bridge.
- The device shall move at a speed no greater than 5 miles {8 km} per hour without acceleration or deceleration.

b. Trucks.

Each truck shall have a hole approximately 5/16 of an inch {8 mm} in diameter suitably placed in the side of the body, to allow for temperature measurement of the asphalt mix.

Trucks used for hauling hot and warm mix asphalt mixtures shall have tight, clean, smooth metal beds that have been thinly coated with a minimum amount of approved asphalt release agent (List II-6, Hot Mix Asphalt Release Coating for Truck Beds, in the MSDSAR manual) to prevent the mixture from adhering to the beds. The use of gasoline, kerosene, diesel or other volatile material is prohibited.

Each truck shall be equipped with a tarpaulin that shall be used as needed to protect the mixture from adverse conditions. The tarpaulin shall be made of water repellent material, be of sufficient weight and strength to resist tearing and be in good condition with no holes or tears. The tarpaulin shall be large enough to cover the load.

Mixture shall not leave the plant unless the load is covered when the following conditions exist:

- when the air temperature is below 60 °F {15 °C};
- when hauling time exceeds 30 minutes; or

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- when threatening weather is present.

c. Material Remixing Device.

When Pay Item 410-H is included in the contract, a material remixing device shall be used for the placement of all asphalt layers except the following:

- 327-E, Permeable Asphalt Treated Base (PATB);
- A layer placed directly on top of PATB if the placement must be accomplished by operating the remixing device on the PATB.

If a pay item is not shown on the Plans, the Contractor may use a material remixing device without compensation.

A material remixing device shall not be placed on a Permeable Asphalt Treated Base.

The material remixing device shall be capable of remixing plant mix between the trucks and the finished mat. Plant mix shall be remixed in the device prior to being laid by the paver or spreader. The plant mix delivered by the material remixing device shall be a homogeneous, non-segregated mixture.

Equipment known to accomplish this remixing operation and currently approved by ALDOT are listed below:

Manufacturer	Model
Astec	SB 3000
Blaw-Knox	MC-330/TWIN PUG TUB
ROADTEC	Shuttlebuggy SB-1500, SB-2500 MTV-1000D, MTV-1000E
Terex/Cedarapids	CR 662 RM
Weiler	E1250, E1650, E2850

A material remixing device will not be required for the following situations:

- temporary work of short duration,
- bridge replacements having less than 1000 feet {300 m} of pavement at each end of a bridge,
- acceleration and deceleration lanes less than 1000 feet {300 m} in length,
- tapered sections, widening, patching, spot leveling, shoulders, crossovers, side street returns and other areas designated by the Engineer.
- when placing a continuous leveling layer where the thickness of the layer is required to be transversely tapered (i.e. to correct cross slope) to a thickness less than twice the maximum aggregate size of the layer being placed.

The Contractor shall use a hopper insert with a material remixing device if Pay Item 410-H is included in the contract. On projects where Pay Item 410-H is not included in the contract, use of a hopper insert is preferred, but not required.

4. Asphalt Pavers or Spreaders.

Asphalt pavers or spreaders shall be self-contained and of sufficient size, power, and stability to receive, distribute, and strike off the asphalt material at rates and widths consistent with the specified typical section requirements and details shown on the plans and noted in Item 410.03(f)2.

All asphalt pavers or spreaders used for mainline paving, including shoulders and interchange ramps, shall be equipped with a full width vibratory, or other compactive type, screed. The augers used to move the material across the width of the screed shall extend within 1.5 feet {450 mm} of the edge of the screed. It will be permissible to use a hydraulically extendable strikeoff for paving turnouts and short sections of pavement including variable width sections and crossovers.

When laying mixtures, the paver shall be capable of being operated at forward speeds consistent with satisfactory laying of the mixture, providing a finished surface of the required evenness and texture without tearing, gouging, or shoving of the mixture.

All asphalt paving machines shall be operated with automatic grade and slope controls unless otherwise directed by the Engineer. The automatic grade controls shall be a contact ski, a mobile stringline, or non-contact sonic averaging sensors. The effective length of these controls shall be a minimum of 24 feet {7.3 m}. In the event of a malfunction of the automatic control system, the spreading operation shall be discontinued after one hour until the equipment is repaired.

If shown to be required on the plans, special attachments to the pavers and spreaders will be required to shape and finish the pavement.

5. Compaction Equipment.

Compaction equipment shall be capable of compacting the mixture to the required density throughout the depth of the layer while it is still in a workable condition without damage to the material. The Contractor shall be responsible for the selection of the types and number of rollers to be used.

(b) Daylight, Wet Weather, and Temperature Limitations.

1. Operations in Daylight.

Placement and compaction operations shall be performed during daylight hours unless noted otherwise on the plans or directed otherwise by the Engineer. (The requirements for lighting for nighttime work are given in Subarticle 104.04(a)).

2. Wet Weather.

The mixture shall be laid only upon an approved underlying course, which is dry, and only when weather conditions are suitable. The Engineer may, however, permit work of this character to continue when overtaken by sudden rains, up to the amount which may be in transit from the plant at the time, provided the surface just ahead of the placement is swept clear of water and the mixture is within the allowable temperature tolerances. The layer placed under such conditions shall be at the Contractor's risk and shall be removed and replaced by the Contractor without extra compensation should it prove unsatisfactory.

3. Cold Weather Restrictions.

Hot mix asphalt (HMA) layers of 200 pounds per square yard {110 kg/m²} or less shall not be placed when the surface or air temperature is below 40 °F {4 °C}; air temperature shall be 40 °F {4 °C} before the spreading operation is started. Spreading operations shall be stopped when the air temperature is below 45 °F {7 °C} and falling. For HMA layers over 200 pounds per square yard {110 kg/m²}, the above temperature may be lowered 5 °F {2 °C}. Unless otherwise stated in the plans and specifications, polymer modified HMA layers of 200 pounds per square yard {110 kg/m²} or less shall not be placed when the surface or air temperature is below 60 °F {15 °C}; for layers over 200 pounds per square yard {110 kg/m²}, the above temperature may be lowered 10 °F {5 °C}.

Warm mix asphalt (WMA) layers of 200 pounds per square yard {110 kg/m²} or less shall not be placed when the surface or air temperature is below 32 °F {0 °C}; air temperature shall be 32 °F {0 °C} before the spreading operation is started. Spreading operations shall be stopped when the air temperature is below 35 °F {2 °C} and falling. For WMA layers over 200 pounds per square yard {110 kg/m²}, the above temperature may be lowered 5 °F {2 °C}. Unless otherwise stated in the plans and specifications, polymer modified WMA layers of 200 pounds per square yard {110 kg/m²} or less shall not be placed when the surface or air temperature is below 50 °F {10 °C}; for layers over 200 pounds per square yard {110 kg/m²}, the above temperature may be lowered 10 °F {5 °C}.

With the exception of Section 420 "Polymer Modified Open Graded Friction Course" layers and any asphalt mixes containing RAS, the Contractor may place HMA and WMA layers at temperatures lower than the cold weather limits. The Contractor is warned that other factors such as wind speed and percent humidity may increase the heat loss from the HMA and WMA layers. All other requirements for the installation and quality of the HMA and WMA layers shall be applicable to the work even when the restrictions against placement of the HMA and WMA during cold weather are not followed. The layers placed under such conditions shall be at the Contractor's risk and shall be removed and replaced without extra compensation if they are unacceptable. There will be no direct payment for additional costs associated with the placement of HMA and WMA during cold weather.

(c) Preparation of Underlying Surface.

1. General.

The underlying surface must be approved by the Engineer before the placement of a plant mix application will be allowed. The underlying surface, whether an old surface or a new surface, shall be thoroughly cleaned of all foreign or loose material and maintained in such condition in advance of the placement operations.

Failures in existing pavement or base shall be corrected, as noted in Item 410.03(c)2, in advance of the placement of an overlying layer.

A prime coat, when required, shall be placed in accordance with Section 401. Tack coat shall be placed in accordance with Section 405.

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2. Patching.

When patching of an existing surface is provided by the plans, the Engineer will examine the pavement surface and designate the area to be patched. The designated areas shall be trimmed to the depth of the unstable material as directed. The loose faulty material shall be picked up and removed from the area. The newly exposed patch area shall be cleaned and treated with prime or tack material as directed before placement of patching material. The hot and/or warm mix asphalt patching material shall be placed and compacted by methods approved by the Engineer until the patch area is filled to the elevation of the surrounding surface. Compaction of the patching material shall be to the degree that further consolidation of the patching material is not anticipated and is acceptable to the Engineer.

3. Leveling.

When leveling of an existing pavement or base is provided by the plans, the surface shall be brought to required grade and cross section with plant mix material. The surface to be treated shall be prepared as noted herein and approved before placing the new material. The plant mix material shall be spread in accordance with the provisions of Item 410.03(f)2 and shall be compacted to the satisfaction of the Engineer.

Leveling shall include the placement of asphalt plant mix layers to correct superelevation when directed.

4. Widening.

When widening is provided by the plans, the widening shall be placed at the locations designated by the plans and/or as directed by the Engineer. The requirements for placing the widening shall be the same, as far as practical, as for the placing of the normal roadway. Compaction of the widening material shall be to the degree that further consolidation of the widening material is not anticipated and is acceptable to the Engineer.

(d) Preparation of Mixtures.

1. Liquid Asphalt Binder.

The liquid asphalt binder material shall be heated in a manner that insures the even heating of the entire mass under efficient and positive control at all times. Any liquid asphalt binder material which, in the opinion of the Engineer, has been damaged shall be rejected.

2. Aggregate.

a. Aggregate Used for Batch Mixing and Continuous Mixing Operations.

All aggregates shall be dried so that the moisture content of the hot and warm mix asphalt at the point of sampling is less than 0.20 % by weight {mass} in accordance with ALDOT-130. The temperature of the aggregate at the dryer shall not exceed 600 °F {315 °C}.

When more than two ingredients enter into the composition of the mineral aggregate, they shall be combined as directed.

The aggregate, immediately after being heated, shall be screened into three or more sizes and conveyed into separate bins, ready for batching and mixing with liquid asphalt binder material. However, for mixes using aggregate of 1/2 inch {12.5 mm} maximum size, the number of bins may be reduced to two.

b. Aggregates for Dryer Drum Mixing Operations.

Maintenance of a uniform aggregate gradation is essential for a dryer drum operation; hence, caution and care shall be exercised in stockpiling of materials to avoid segregation.

3. Mixing.

a. Mixing Temperature.

The mixing temperature of HMA and WMA shall be in accordance with the refineries' recommendations, based upon the temperature-viscosity curve, and shall be adequate to produce a mixture in accordance with the specification requirements. The mixing temperature shall not exceed 350 F {177 C}.

The mixing temperature for HMA and WMA shall be continuously recorded and delivered to the Engineer on the next working day.

b. Batch Mixing.

The dried mineral aggregate, and measured mineral filler when used, prepared as prescribed above, shall be combined in uniform batches by determining the weight {mass} of and conveying into the mixer the proportionate amounts of each aggregate required to meet the job mix formula.

The largest size aggregate shall be introduced first, then smaller sizes progressively, with mineral filler last, or all mineral components may be added simultaneously. The mineral components shall be thoroughly mixed. The required quantity of liquid asphalt binder material for each batch shall be measured by weight {mass} using scales or a liquid asphalt binder material metering device attached to the liquid asphalt binder material bucket.

After the mineral components have been mixed, the liquid asphalt binder material shall be added and the mixing continued for a period of at least 45 seconds, or longer if necessary to produce a homogeneous mixture. However, if a check by ASTM D 2489 (Ross Method) shows that 95% plus coating is obtained, a shorter mixing time will suffice. The Engineer may then give written permission for a change. Each batch must be kept separate throughout the weight {mass} determining and mixing operations.

The mixture shall be uniform in composition, free from lumps or balls of material containing an excess quantity of asphalt, or from pockets deficient in asphalt.

c. Continuous Mixing.

Components shall be introduced and proportioned volumetrically by continuous methods utilizing equipment specified herein for continuous plants. Amounts of aggregate and liquid asphalt binder material entering the mixer, and the rate of travel through the mixer, shall be so coordinated that a uniform mixture of specified gradation and liquid asphalt binder content will be produced.

d. Dryer-Drum Mixing.

Components shall be proportioned by weight {mass} as noted herein in Item 410.03(a)1 for this method of mixing. Amounts of aggregate and liquid asphalt binder material entering the mixer, and the rate of travel through the mixer, shall be so coordinated that a uniform mixture of specified gradation and liquid asphalt binder content will be produced. An anti-stripping agent may be required to insure adequate coating of the aggregates, if so directed by the Engineer.

4. Recycled Mixtures.

a. New Aggregate Temperature.

The new aggregate shall be super-heated to a temperature such that, when combined with the reclaimed material, the specified discharge temperature is produced; however, in no case shall the temperature of the new aggregate exceed 600 °F {315 °C}.

b. Mixing.

The plant shall be designed and operated so that heat transfer will take place in the mixing unit without damage to, or vaporization of, the liquid asphalt binder material. For batch type plants, a minimum dry mixing cycle of 15 seconds shall be required for the new aggregate and reclaimed material before introduction of the new liquid asphalt binder material. All environmental regulations shall be met as required by Article 107.22.

(e) Transporting the Mixture.

The mixture shall be transported in haul trucks meeting the requirements of Item 410.03(a)3. The equipment shall be in sufficient numbers to deliver the material to the roadbed without delay in the quantity required. Loads shall not be delivered too late in the day to be spread, compacted, and finished during daylight hours, unless nighttime work is allowed as shown on the plans or directed by the Engineer. Loads shall not be delivered at a temperature greater than 350 F {177 C} , or less than 220 °F {105 °C} without written permission of the State Materials and Tests Engineer.

(f) Placing the Mixture.

1. Rate of Placement.

The placement rate of plant mix will be specified by the plans; however, this rate may require correction to adjust for the compacted mix unit weight {density} as determined in the job mix formula design as outlined in Subarticle 410.02(b). The Engineer may direct in writing that the designated weight {mass} be increased or decreased in certain areas. It shall be the Contractor's responsibility to place and spread the material uniformly and compact it to such a thickness that will produce the specified rate, separately for each layer of base, binder, and surface, and to maintain a continuing check on tonnage {mass} and yardage {area} throughout the day's operation to insure uniform specified rate.

The unit for checking the average rate shall be approximately 5000 square yards {5000 m²} to the nearest even truck load. If the last check performed in any day or any section of roadway is between 2000 and 5000 square yards {2000 and 5000 m²}, this section shall be classified as a unit; if less than 2000 square yards {2000 m²}, this section shall be added to the previous unit and the revised unit

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rechecked. When the initial day's operation is less than 2000 square yards {2000 m²}, this initial section will be carried over to subsequent days' operations to make a unit of approximately 5000 square yards {5000 m²}.

In any unit checked, the average rate shall not vary from the specified rate by more than 10 pounds per square yard {5 kg/m²} for layers of 225 pounds per square yard {120 kg/m²} or less, and 15 pounds per square yard {8 kg/m²} for layers greater than 225 pounds per square yard {120 kg/m²}. On the first applied layer of resurfacing where there is no required milling or leveling, this tolerance is increased to 15 pounds per square yard {8 kg/m²} for layers of 225 pounds per square yard {120 kg/m²} or less, and 25 pounds per square yard {13 kg/m²} for layers greater than 225 pounds per square yard {120 kg/m²}. This tolerance is for providing leeway in equipment adjustment only. A consistent and uncorrected variation from the specified rate, even within this tolerance, will not be allowed without the Engineer's written approval. This tolerance does not apply to patching, leveling, and widening.

If the average rate of any unit is found deficient by more than the above referenced tolerance, the Engineer will determine (1) whether the Contractor shall remove and replace the deficient unit without payment for the removal or the material removed, or (2) whether the Contractor may leave the deficient unit in place and cover it with a layer of the same mix of adjusted maximum size aggregate of not less than 80 pounds per square yard {45 kg/m²} average. In case (2), the surface layer shall not be feather-edged at the end of the overlay layer, but a sufficient amount of the surface beyond the ends of the deficient unit shall be removed, to a neat line across the pavement, to allow placing the full 80 pounds per square yard {45 kg/m²} and to make a joint that will meet the surface requirements. There will be no payment for any portion of the overlay needed to bring the total up to the designated average rate for that unit.

If the average rate of any unit is found to exceed the above referenced tolerance, the tonnage {metric tonnage} in the unit that is in excess of the specified rate will be paid for as specified in Subarticle 410.09(a).

Unless otherwise provided in the following sections of these specifications, or shown on the plans, the average rate placed and compacted in one layer shall not exceed 350 pounds per square yard {200 kg/m²} for base or binder layers, and 225 pounds per square yard {120 kg/m²} for surface layers. Where the amount to be placed exceeds these limits, it shall be placed and compacted in two or more approximately equal layers or as shown on the plans.

2. Spreading.

a. General.

Spreading of the hot and warm mix asphalt mixture shall be performed by equipment meeting the requirements of Item 410.03(a)4, except as noted in this Item. Approved specialized equipment may be employed to spread the hot and warm mix asphalt material where standard full scale equipment is impractical due to size and irregularity of the area to be paved.

Spreading operations shall be correlated with plant operations and hauling equipment such that the spreading operation, once begun, shall proceed at a speed as uniform and continuous as practical. The continual forward movement of the spreader requires the use of hauling vehicles capable of supplying the spreader with hot and warm mix asphalt material while the spreader is in motion. Repetitive interruptions or stopping of the spreader shall be cause for the Engineer to suspend the work until the Contractor evaluates the cause of the stoppage and has provided a definite action plan for correction of the interruptions. Any interruption will require the thorough check of the area immediately under the spreader and any variances shall be corrected immediately or the material removed and replaced, as directed, without additional compensation.

Material placed in the spreader shall be immediately spread and screeded to a uniform depth so that the specified rate of the mixture required is achieved. Alignment of the outside edges of the pavement shall be controlled by preset control lines, and shall be finished in conformity with these controls.

Any spreading operation, which cannot produce acceptable joints within the surface tolerances and density requirements, shall be cause for requiring the Contractor to modify his operations to include additional spreading equipment.

b. Spreading by Motor Grader.

For areas of a hot and warm mix asphalt plant mix surface inaccessible to the mechanical spreader, patching of pot holes and correcting failures in existing pavement, the plant mix may be

410.04 Density Requirements.

Upon resumption of the work, a neat vertical joint shall be formed into the previously laid material to expose the full depth of the layer. The fresh mixture shall be raked and tamped to provide a well-bonded and sealed joint meeting surface and density requirements.

410.04 Density Requirements.

Density requirements shall be as specified in Table IV, Subarticle 410.08(e).

410.05 Surface and Edge Requirements.

(a) Surface Smoothness Requirements.

1. General.

Surface smoothness and roadway section will be checked by the use of string, Engineer's level, and straight edge.

The Contractor shall furnish string, straightedges, and the necessary personnel to handle them under the supervision of the Engineer.

Surface smoothness tests shall be made continuously during and immediately after rolling so that irregularities may be eliminated to the extent possible by rolling while the material is still workable; otherwise, deficiencies shall be corrected as provided in Article 410.06.

2. Perpendicular to Centerline of Roadway.

The finished surface of all base, binder, and wearing surface layers shall not vary more than 1/4 of an inch {6 mm} from a 10 foot {3.0 m} straightedge placed perpendicular (at a right angle) to the centerline of the roadway anywhere on the surface.

Unless shown otherwise on the plans, the slope shall not vary by more than 0.20 % from the required slope in any 10 foot {3.0 m} distance over which the slope is measured without the Engineer's written approval. (If, for example, a 2.0 % slope is required, the measured slope shall not be greater than 2.2 % or less than 1.8 %.)

3. Parallel to Centerline of Roadway.

The surface shall not vary more than 1/4 of an inch {6 mm} from a 16 foot {4.8 m} straightedge placed parallel to the centerline anywhere on the surface. A 16 foot {4.8 m} rolling straightedge, equipped with marking capability, may be used in lieu of the fixed straightedge if approved by the Engineer.

The finished surface shall not vary more than 3/8 of an inch {9 mm} in any 25 foot {8 m} section from a taut string applied parallel to the surface at the following locations: 1 foot {300 mm} inside of the edges of pavement, at the centerline, and at other points designated by the Engineer. The variance from the designated grade shall not increase or decrease by more than 1/2 of an inch {12 mm} in 100 feet {30 m}.

(b) Edge Requirements.

Unless shown otherwise on the plans, surface, binder, and leveling pavement edges not confined by curbing or other structures may be lightly tamped behind the placement operation as a preventative measure against cracking and bulging during the rolling process. This procedure shall also be required on the initial edge of a longitudinal cold joint. These edges shall be neatly shaped to line behind the breakdown roller and shall be trimmed as necessary after final rolling, to an accurately lined string or wire providing a maximum tolerance of 2 inches {50 mm} outside the theoretical edge of pavement, with a maximum variation from a true line of 1/2 of an inch {12 mm} in 10 feet {3 m} and a slope not flatter than 1:1. Edges that are distorted by rolling shall be corrected promptly.

(c) Smoothness Requirements.

The smoothness requirements and testing covered in this Subarticle shall apply for pay factor adjustments as indicated in the table below only if Item 410-I Smoothness Testing - Certified Inertial Profiler is included on the plans or in the proposal.

1. Testing Device.

a. Description.

The testing device shall be an inertial profiler that satisfies the requirements of ALDOT-448, "Evaluating Pavement Profiles," including the portable storage device(s) referenced herein. Portable storage devices containing profile measurements shall become the property of the Department at the time the measurements are taken.

b. Equipment Requirements.

The inertial profiler shall be a certified, non-contact, laser-based device capable of simultaneously measuring both wheelpaths meeting all the requirements of ALDOT-448.

Portable storage device(s) for the inertial profiler shall be furnished in sufficient quantities for all calibration, test runs, and actual tests deemed necessary by the Engineer. Unless approved in advance by the Engineer, all portable storage devices provided by the Contractor will take the form of commonly available 2G USB flash drives.

2. Testing Procedure.

a. Description.

The testing device shall be an inertial profiler that satisfies the requirements of ALDOT-448, "Evaluating Pavement Profiles," including the portable storage device(s) referenced herein. Portable storage devices containing profile measurements shall become the property of the Department at the time the measurements are taken.

	410-I Smoothness Testing - Certified Inertial Profiler
Open Graded Friction Course Layer	Data Collection Required & Pay Factors Apply
Wearing Surface Layer	Data Collection Required & Pay Factors Apply

Smoothness testing shall be performed and reported daily until the contractor demonstrates the ability to achieve a Mean Roughness Index (MRI) value of less than 65 in/mile. If the Contractor demonstrates the ability to achieve a MRI value of less than 65 in/mile then the Contractor may elect to perform and report the smoothness testing at a frequency he determines but not to exceed 5 working days production.

b. Smoothness Requirements.

The results of the inertial profiler tests shall be evaluated by Department personnel as outlined in ALDOT-448.

If a Mean Roughness Index (MRI) value of 90 inches per mile {1.4 m/km} is exceeded in any test section of any daily paving operation, the paving operation will be suspended as soon as possible after results of the unacceptable test section are obtained. The paving will not be allowed to resume until corrective action is taken by the Contractor.

When the MRI is more than 65 inches per mile {1.0 m/km}, per section, a unit price reduction will be assessed. When the MRI is less than 45 inches per mile {0.7 m/km} per section, a unit price increase will be added. The price adjustments are given in Table 1.

TABLE I	
Mean Roughness Index Inches/Mile/Section {meters/Kilometer/Section}	Contract Price Adjustment Percent of Pavement Unit Bid Price
Under 35 {Under 0.6}	105
35 to less than 45 {0.6 to less than 0.7}	$105 - (MRI - 35)/2$ { $105 - (MRI - 0.6)/0.02$ }
45 to less than 65 {0.7 to less than 1.0}	100
65 thru 90 {1.0 thru 1.4}	$100 - (MRI - 65)/1.25$ { $100 - (MRI - 1.0)/0.02$ }
Over 90 {Over 1.4}	Unacceptable

For Pay Item 410-I, any price adjustment for smoothness considerations will be applied to the theoretical tonnage {metric tonnage}, calculated using the plan specified rate of placement, placed

TABLE III						
SECTION 424 MIXES (SUPERPAVE)						
ACCEPTANCE SCHEDULE OF PAYMENT FOR ASPHALT PLANT MIX CHARACTERISTICS						
Arithmetic Average of the Absolute Values of Deviations of the LOT Acceptance Tests From Job Mix Formula Values						
Asphalt Content						
LOT Pay Factor - >	1.02	1.00	0.98	0.95	0.90	0.80*
1 Test	-	0.00-0.62	0.63-0.68	0.69-0.75	0.76-0.88	Over 0.88
2 Tests	-	0.00-0.44	0.45-0.48	0.49-0.53	0.54-0.62	Over 0.62
3 Tests	-	0.00-0.36	0.37-0.39	0.40-0.43	0.44-0.51	Over 0.51
4 Tests	0.00-0.19	0.20-0.31	0.32-0.34	0.35-0.38	0.39-0.44	Over 0.44
Voids in Total Mix (Lab. Compacted Samples)						
LOT Pay Factor - >	1.02	1.00	0.98	0.95	0.90	0.80*
1 Test	-	0.00-2.50	2.51-2.70	2.71-3.00	3.01-3.50	Over 3.50
2 Tests	-	0.00-1.77	1.78-1.91	1.92-2.12	2.13-2.47	Over 2.47
3 Tests	-	0.00-1.44	1.45-1.56	1.57-1.73	1.74-2.02	Over 2.02
4 Tests	0.00-0.75	0.76-1.25	1.26-1.35	1.36-1.50	1.51-1.75	Over 1.75
* If approved by the Department, the Contractor may accept the indicated LOT partial pay. The Department may require removal and replacement. If the LOT pay factor is greater than 0.80, the Contractor has the option to remove at no cost to the Department and to replace at contract unit bid price rather than accepting the reduced LOT payment.						

$$\% \text{ TMD} = \frac{\text{In Place Density}}{\text{Maximum Mix Density}} \times 100$$

Maximum mix density is equated to maximum mix specific gravity as measured with AASHTO T 209, Flask determination with dry back. The maximum mix specific gravity used will be the average of the values from the four most recent determinations using Contractor data.

The appropriate pay factor for each SUBLOT will be determined from Table IV for the appropriate number of test results. The pay factor for the LOT will be determined by computing the weighted average of the SUBLOTS:

$$\text{LOT Pay Factor (PF)} = \frac{\text{PF SUBLOT 1 (Length SUBLOT 1)} + \text{PF SUBLOT 2 (Length SUBLOT 2)} + \dots}{\text{Length SUBLOT 1} + \text{Length SUBLOT 2} + \dots}$$

Calculations for the acceptance test results for in-place density will be carried to the hundredths (0.01) and rounded to the nearest tenth (0.1). LOT and SUBLOT pay factor calculations will be carried to the thousandths (0.001) and rounded to the nearest hundredth (0.01) in accordance with ASTM E 29 rules of rounding.

The low rates of placement at which minimum density does not apply are given in Section 306. Density pay factors will not be applied to pavement layers placed at these rates.

TABLE IV ACCEPTANCE SCHEDULE OF PAYMENT FOR IN-PLACE DENSITY					
SECTION 423 MIXES (STONE MATRIX ASPHALT)					
Characteristic	SUBLOT PAY FACTOR	Arithmetic Average of the Absolute Values of Deviations of SUBLOT Acceptance Tests From Target**			
		1 Test	2 Tests	3 Tests	4 Tests
In-Place Density	1.02	0.00 - 2.00	0.00 - 1.41	0.00 - 1.15	0.00 - 1.00
	1.00	2.01 - 3.33	1.42 - 2.36	1.16 - 1.92	1.01 - 1.67
	0.98	3.34 - 3.60	2.37 - 2.55	1.93 - 2.08	1.68 - 1.80
	0.95	3.61 - 4.00	2.56 - 2.83	2.09 - 2.31	1.81 - 2.00
	0.90	4.01 - 4.67	2.84 - 3.30	2.32 - 2.69	2.01 - 2.33
	0.80*	Over 4.67	Over 3.30	Over 2.69	Over 2.33
SECTION 424 MIXES (SUPERPAVE)					
Characteristic	SUBLOT PAY FACTOR	Arithmetic Average of the Absolute Values of Deviations of SUBLOT Acceptance Tests From Target**			
		1 Test	2 Tests	3 Tests	4 Tests
In-Place Density	1.02	0.0-2.25	0.0-1.59	0.0-1.30	0.0-1.12
	1.00	2.26-3.75	1.60-2.65	1.31-2.17	1.13-1.88
	0.98	3.76-4.05	2.66-2.86	2.18-2.34	1.89-2.02
	0.95	4.06-4.50	2.87-3.18	2.35-2.60	2.03-2.25
	0.90	4.51-5.25	3.19-3.71	2.61-3.03	2.26-2.62
	0.80*	Over 5.25	over 3.71	over 3.03	Over 2.62
* If approved by the Department, the Contractor may accept the indicated partial SUBLOT pay. The Department may require removal and replacement. The Contractor has the option to remove at no cost to the Department and replace at contract unit bid price rather than accepting the reduced SUBLOT payment. ** Target density shall be 94.0 % of the theoretical maximum density for all mixes except for: - the range of placement rates given in Item 306.03(g)3 (140 pounds per square yard or greater {76 kg per square meter or greater} and less than 200 pounds per square yard {109 kg per square meter} over surface treatments) the target density shall be 92.0 % and; - ESAL Range A and B mixes where the Contractor demonstrates and explains in writing why 94 % of the theoretical maximum density cannot be achieved and the Engineer informs the Contractor by written notification that the target density can be reduced to 93 % or 92 %.					