

ALABAMA DEPARTMENT OF TRANSPORTATION

DATE: November 22, 2019

Special Provision No. 18-0703

EFFECTIVE DATE: January 1, 2020

SUBJECT: Thin Lift Asphalt Pavement

USAGE: This Special Provision shall only apply to the placement of Item 424-T and to the use of Items 410-H and 410-J in the placement and testing of Item 424-T. Any other Section 410 or Section 424 items or the use of Item 410-H in the placement of other Section 424 items will be governed by the Standard Specifications and other Special Provisions in this contract.

Alabama Standard Specifications, 2018 Edition, SECTION 410 and SECTION 424 shall be replaced with the following:

SECTION 410 ASPHALT PAVEMENTS

410.01 Description.

The work under this Section covers the general requirements that are applicable to all types of hot and warm mix asphalt pavements of the plant mix type. Deviations from these general requirements will be indicated in the specific requirements for various types of mixes noted in the following sections of these Specifications.

This work shall consist of one or more courses of hot and warm mix asphalt plant mix constructed in accordance with these specifications and the specific requirements of the type of mixture required and in reasonably close conformity with the lines, grades, thicknesses, and typical cross sections shown on the plans or established by the Engineer. The Contractor may use either hot mix or warm mix for all Superpave ESAL Range mixes in Section 424. Warm mix asphalt shall be defined as the use of an approved warm mix technology in the plant mix at the time of production.

Surface layers and wearing layers are defined as those layers where the pay item contains the wording "Wearing Surface".

All ALDOT procedures referenced are applicable to both hot and warm mix asphalt.

410.02 Materials.

(a) Applicable Sections of Specifications.

Materials shall conform to requirements given in Section 424.

(b) Products and Processes for the production of Warm Mix Asphalt.

Warm Mix Asphalt products and processes shall be selected from List II-27, "Warm Mix Asphalt Products and Processes" of the Department's manual titled "Materials, Sources, and Devices with Special Acceptance Requirements". Information concerning this list is given in Subarticle 106.01(f) and ALDOT-355.

(c) Anti-Stripping Agents.

All warm mix asphalt mixtures shall include an anti-stripping agent. The warm mix additive supplier may certify that an anti-stripping agent is an integral part of the warm mix additive.

All hot mix asphalt mixtures shall be tested during design to determine if an anti-stripping agent is needed. During design and production, all other mixes shall have a tensile strength ratio (TSR) of at least 0.80 when tested in accordance with AASHTO T 283 as modified by ALDOT-361. If

any TSR value falls below the minimum specified above, plant operations shall cease until corrective measures are taken. However, if any visual stripping occurs in the design or field production, an anti-stripping agent shall be required if deemed necessary by the Engineer. Should it become necessary for the Contractor to include an anti-strip agent in the mix due to the occurrence of visual stripping during field production of the mix after the design tests indicated that the same mix met the above listed TSR requirement, such work will be paid for as Extra Work as defined by Article 104.03. Additional payment for the anti-strip agent will not be made in cases where the same mix has been previously used in field production and visual stripping occurred.

1. Amines.

For amine based materials, the amount of anti-stripping agent, when required, shall be 0.25 to 1.0 % by weight {mass} of the liquid asphalt binder content for liquid agents and 0.5 to 2.0 % by weight {mass} of the total aggregate for powdered agents. Liquid anti-stripping agent shall be added to the liquid asphalt binder within $\pm 10\%$ of the specified rate, either at the refinery or the Contractor's mixing plant, using approved on-line blending equipment.

2. Hydrated Lime.

For hydrated lime materials the amount of anti-stripping agent, when required, shall be 0.5 to 2.0 % by weight {mass} of the total aggregate for powdered agents. Hydrated lime materials shall meet the requirements as given in Section 805.

3. OrganoSilanes.

For organosilane based materials the amount of anti-stripping agent, when required, shall be 0.05 to 0.1 % by weight {mass} of the liquid asphalt binder content for liquid agents. Liquid anti-stripping agent shall be added to the liquid asphalt binder by approved on-line blending equipment either at the refinery or the Contractor's mixing plant within $\pm 10\%$ of the specified rate.

4. Silicone

Silicone may be used in liquid asphalt binder, not to exceed 2 ounces per 5000 gallons {3 ml per 1000 L}. Except when producing Warm Mix Asphalt, other additives shall not be added to the liquid asphalt binder unless expressly authorized in writing by the Materials and Tests Engineer.

The use of any unauthorized additive will be cause for rejection of the mixture.

(d) Composition of Mixtures.

1. Adjustments to Rate of Placement.

The project designated rate per square yard {square meter} of the plant mix layers are designed assuming a compacted mix unit weight {mass} of not greater than 158 pounds per cubic foot {2530 kg/m³} for dense graded mixes (light weight aggregates excepted.) Hence, a correction to the plan designated rate per square yard {square meter} will be made in accordance with the following:

- If the compacted mix density as determined in the job mix formula design exceeds 158 , or is below 130, pounds per cubic foot, {2530 kg/m³, or is below 2080 kg/m³}, the correction will be based on the formula: $x = ab/158$ { $x = ab/2530$ }, where
 - x = corrected rate per square yard {square meter},
 - a = laboratory compacted mix unit weight in pounds per cubic foot {density in kilograms per cubic meter} as shown in the job mix formula, and
 - b = project designated rate per square yard {square meter} of plant mix as shown on the job plans.
- 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.

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 Section 424 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.

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 four 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.

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 424 mixes:
 - Plus or minus 4 % for the #4 through #100 {2.36 mm through 150 μ m} sieve requirements.
 - Plus or minus 2.0 % for the #200 {75 μ m} sieve requirement.

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)

1. Compliance with ALDOT-372.

On all projects utilizing recycled/reclaimed material in the mixture, the Contractor's paving operation and RAP 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.

The Contractor shall have the option to use a maximum RAP content of 20% with no more than 15% containing chert.

3. Processing and Restrictions for Aggregate in RAP.

RAP used in Section 424 "Superpave" Thin Lift Mix shall be processed so that 100 % of the RAP passes the 3/8" sieve {9.5 mm} sieve. The maximum size of the aggregate in the RAP shall meet the maximum size for the mix specified. The aggregate in the RAP shall meet the aggregate requirements of the mix it is used in and the requirements given in Sections 801 and 802.

Testing for RAP stockpile shall be included as part of the design JMF submittal.

(f) Omit.

(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.

410.03 Construction Requirements.

(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 both sides 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
- 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.

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

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
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 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. A material remixing device will also not be required 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 speed and mixture delivery shall be correlated so that the paver can operate at a constant speed and provide a finished surface of the required smoothness, evenness, and texture without tearing, gouging, streaking, 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 Engineer will not require operation with automatic slope controls when the requirement for "Match Existing" is given on the plans for the required finished cross slope.) 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 75 pounds per square yard {41 kg/m²} or less shall not be placed when the surface or air temperature is below 45 °F {7 °C}; air temperature shall be 45 °F {7 °C} before the spreading operation is started. Spreading operations shall be stopped when the air temperature is below 50 °F {10 °C} and falling.

Warm mix asphalt (WMA) layers of 75 pounds per square yard {41 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.

(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.

(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 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 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 75 pounds per square yard {41 kg/m²} or less.

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.

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 50 pounds per square yard {27 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 50 pounds per square yard {27 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).

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. Blank.

c. Spreading by Hand.

For areas inaccessible to mechanical spreading equipment, hand spreading of the hot and warm mix asphalt mixture may be permitted. The mixture shall be distributed immediately into place by means of suitable tools and spread in a uniformly loose layer.

(g) Compacting.

As soon as the mixture has been spread and has set sufficiently to prevent undue cracking or shoving, rolling shall begin. A delay in the initial rolling will not be tolerated and the initial or breakdown rolling should in general be performed by rolling longitudinally, beginning at the sides and proceeding toward the center of the surface.

The Contractor, as part of his QC plan, shall establish a rolling pattern using the nondestructive testing devices approved in Section 306 of the Specifications. The device shall either be calibrated to roadway cores or gage counts and shall be used to determine the rolling pattern producing

maximum density. Contractor QC personnel shall be on site throughout each day to perform periodic checks and verify that the rolling pattern continually produces the maximum density that is achievable.

When paving abuts a previously placed lane, the longitudinal joint shall be rolled in the first pass. On superelevated curves rolling shall begin at the low side and progress toward the high side.

If any displacement occurs during rolling, it shall be corrected at once. To prevent adhesion of surface mixture to the rollers, the wheels shall be kept adequately moistened with water and a non-foaming detergent, but an excess of water will not be permitted.

Adequate precaution shall be taken to prevent dropping of gasoline or oil on the pavement. In places inaccessible to a roller, compaction shall be obtained with hand or mechanical tampers that produce adequate pressure to obtain the required density.

When the roller is in contact with a bridge deck, vibratory mode shall be turned off and the roller shall operate in static mode only.

Throughout the process of compacting, tests for surface smoothness as required by Article 410.05 and density as required by Section 306 shall be made continuously.

(h) Joints.

1. General.

Placing of hot and warm mix asphalt shall be as continuous as possible. All joints shall be constructed in such a way as to provide a smooth, well-bonded, and sealed joint meeting the density and surface requirements of Articles 410.04 and 410.05. Failure to meet requirements noted above shall be cause for ordering the removal and reconstruction of the joint without additional compensation.

The contact surface of concrete structures shall be treated with a thin coat of liquid asphalt binder material, tack material, or the liquid asphalt binder material used in the mix, prior to construction of the joint. When directed by the Engineer, the same treatment noted above shall be used on cold asphalt joints.

2. Longitudinal.

Longitudinal joints in the wearing surface shall conform with the edges of proposed traffic lanes, insofar as practical. Any necessary longitudinal joints in underlying layers shall be offset so as to be at least 6 inches {150 mm} from the joint in the next overlying layer.

3. Transverse.

Transverse joints shall be carefully constructed. Rollers shall not pass over the unprotected edge of the freshly laid mixture unless laying operations are to be discontinued. To facilitate the expeditious removal of the plant mix joint when laying operations are resumed, the Contractor may place a heavy wrapping paper on the underlying surface across the joint and place plant mix on top of the paper.

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 Omit.

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.

2. Perpendicular to Centerline of Roadway.

The finished surface 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.

The require cross slope on tangent sections will be shown as "Match Existing." "Match Existing" shall be the placement of pavement layers without the need for making adjustments to the rates of placement to change the cross slope or superelevation that exists at the time of placement.

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, 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 Data Collection.

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. If Item 410-J Smoothness Data Collection - Certified Inertial Profiler is included on the plans or in the proposal, only the collection of mean roughness data shall be required. Mean roughness data obtained from Item 410-J will be used for informational purposes only.

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.

Placement Layer	410-J Smoothness Testing - Certified Inertial Profiler
Wearing Surface Layer	Data Collection Required

410.06 Correction of Deficiencies and Defects.

Deficiencies in surface smoothness as determined in Subarticle 410.05(a) shall be remedied to the extent practicable by rolling while the material is still workable. Otherwise the layer shall be removed and replaced as necessary to obtain required smoothness. "Skin patching" of a surface layer to correct low areas or heating and scraping to correct high areas will not be permitted.

Deficiencies in thickness shall be remedied as specified in Item 410.03(f)1.

All areas containing excessive or deficient amounts of liquid asphalt binder, all areas showing unacceptable segregation of materials, and all areas unbonded after rolling shall be removed and replaced at no cost to the Department. Unacceptable segregation of a hot and warm mix asphalt mat is defined as any area in which two six inch {150 mm} cores are taken and the average percent liquid asphalt binder content of the cores have an absolute difference greater than 0.50 percentage points of the design liquid asphalt binder content, or the combined gradation analysis of the two cores on selected sieves has an absolute difference greater than 10 percentage points from the job mix formula. All testing shall be in accordance with ALDOT-389, "Evaluation of Segregated Areas in Hot Mix Asphalt Pavement." The location of all cores taken for segregation evaluation will be determined by the Department. All coring and traffic control required by ALDOT-389 shall be conducted/supplied by the Contractor at no cost to the Department; however, the Contractor will be reimbursed \$500.00 per core when core results are within tolerances and the coring operations require additional traffic control.

At any time that segregation is determined to be unacceptable, work shall be automatically suspended if positive corrective action is not taken by the Contractor to prevent further segregation in the mat. Upon suspension, the Contractor shall place a test section not to exceed 500 tons {500 metric tons} of the affected mixture for evaluation by the Engineer. However, if after a few loads it is apparent that the corrective actions were not adequate, work shall again be suspended and the segregated areas evaluated in accordance with ALDOT-389. Likewise, if after 500 tons {500 metric tons} it is apparent that the problem has been solved, work will be allowed to continue.

Removal and replacement of hot and warm mix asphalt wearing surface layers shall be a minimum of the full mat width and 10 feet {3 m} in length. All surface tolerance requirements shall apply to the corrected areas for both subsurface and surface mixes.

Areas found deficient in density shall be removed and replaced or immediately re-rolled until density is acceptable.

All work specified in this Article shall be performed without additional compensation.

410.07 Maintenance and Protection.

Sections of newly finished work shall be protected from all traffic until properly hardened. Maintenance shall include immediate repairs of any defects that may occur on the work; such repairs shall be repeated as often as necessary to maintain the work in a continuously satisfactory condition. The Contractor shall be responsible for the protection of the work and protection of any traffic using the work. No additional compensation will be paid for maintenance and protection.

410.08 Method of Measurement.

(a) General.

The accepted quantity of hot and warm mix asphalt plant mix used as directed will be measured in tons of 2000 pounds {metric tons} in accordance with the following:

1. For determining weight {mass}, each load of hot and warm mix asphalt mixture shall have its weight {mass} determined on approved certified scales, as specified in Article 109.01, furnished by the Contractor without direct compensation.
2. The weight {mass} measurement shall include all components of the mixture. No deductions will be made for any of the components, including the liquid asphalt binder material, contained in the mixture.

(b) Acceptance of the Mixture.

The hot and warm mix asphalt mixture will be evaluated at the plant on a LOT to LOT basis. The material will be tested for acceptance in accordance with the provisions of Section 106 and the following requirements. However, any load or loads of mixture, which, in the opinion of the Engineer, are obviously unacceptable, will be rejected for use in the work.

The Contractor shall control all operations in the handling, preparation, and mixing of the hot and warm mix asphalt plant mix so that the percent liquid asphalt binder and voids in laboratory compacted samples or gradation will meet the approved job mix formula within the tolerance shown in Table III for the 1.00 pay factor. In recognition of the fact that the drying and screening operations may generate additional dust over that shown in the approved mix design, the Contractor's attention is directed to the fact that the dust must be controlled in order to control VMA and voids in the total mix.

Acceptance of the mixture will be in accordance with Subarticle 106.09(c).

LOT pay factors for asphalt content and air voids will be determined from Table III for Section 424 mixes after the requirements of Item 106.09(c)3 are satisfied.

Calculations for the acceptance test results for asphalt content and voids in total mix shall be carried to the thousandths (0.001) and rounded to the nearest hundredth (0.01). Calculations for averages shall be carried to the thousandths (0.001) and rounded to the nearest hundredth (0.01) in accordance with ASTM E 29 rules of rounding. LOT pay factors will be calculated to the nearest hundredth (0.01).

Payment for a Section 424 mix will be on the basis of Table III Acceptance Schedule for Payment.

(c) Suspension and Voluntary Termination of Lots.

The production process will be considered out of control when any individual test result (asphalt content, gradation, or air voids) from a LOT has a pay factor equal to 0.80 computed from the "1 Test" row in Table III. When this happens, production shall be suspended. If mix from the suspended LOT is contained in storage/surge bins, that mix will be considered part of the suspended LOT and shall not be placed on any State project.

When production is suspended as described above, or when the contractor voluntarily terminates a lot, production shall not be re-started until after all of the following has been accomplished:

- (1) the Contractor shall notify the Project Manager immediately that the process is out of control, or that the LOT has been terminated voluntarily, and that production has been suspended;
- (2) the Contractor shall determine the appropriate adjustments to make in order to bring the process under control and inform the Project Manager in writing of these adjustments;
- (3) after adjustments, the Contractor shall produce a trial batch of mix (approximately 25 to 35 tons {25 to 35 metric tons}) and test for control characteristics (asphalt content, gradation, and air voids);
- (4) adjustments, trial batches, and tests shall be repeated as many times as necessary until pay factors for asphalt content, gradation, and air voids equal 1.00, minimum, at which time production may be re-started. Mix utilized as a trial batch shall not be used on the project.

(d) Acceptance Schedule of Payment for Asphalt Plant Mix Characteristics.

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.						

TABLE V	
COMPARISON OF ALDOT AND CONTRACTOR TESTING	
TEST	ACCEPTABLE
ASPHALT CONTENT	± 0.30 %
AIR VOIDS	± 0.50 %

(e) Omit.

(f) Tack Coat.

Tack coat liquid asphalt material will be measured and paid for as specified in Section 405.

(g) Wasted and Excess Materials Applied.

Deductions in measurement will be made for all material wasted or lost due to negligence of the Contractor or applied beyond the limits of the work.

(h) Material Remixing Device.

The number of material remixing devices measured for payment will be the number of units approved by the Engineer for use. These devices will be measured per each device.

(i) Certified Inertial Profiler.

The number of certified inertial profilers measured for payment will be the actual number of units ordered and accepted.

410.09 Basis of Payment.

(a) Unit Price Coverage.

Compensation for plant mix material, measured as provided above, will be made on a tonnage {metric tonnage} basis and the contract unit price per ton {metric ton} for each individual item shall be full compensation for construction of the hot and warm mix asphalt plant mix layer complete in

place on the roadbed as specified or directed, including all materials, procurement, handling, hauling, and processing cost, and includes all equipment, tools, labor, and incidentals required to complete the work.

No payment will be made for unacceptable material; for material needed to overlay layers deficient in thickness; for material used in replacing defective or condemned construction; for material wasted in handling, hauling, or otherwise; or for maintaining the work.

When the average rate of placement is found to exceed the tolerance given in Item 410.03(f)1., the tonnage {metric tonnage} placed above the specified rate in that unit will be paid for at 50 percent of the contract unit price.

Smoothness data collection, measured with a certified inertial profiler as noted above, will be paid for at the contract unit bid price which shall be full compensation for furnishing the inertial profiler and portable storage device(s) and includes all equipment, tools, labor, calibration, maintenance, services, supplies, and incidentals necessary to complete these items of work.

The number of approved remixing devices, measured as noted above, will be paid for at the contract unit bid price. This price shall be full compensation for furnishing the vehicles and shall include all equipment, tools, labor, calibration, maintenance, services, operator, and all other items necessary to furnish and operate the vehicles.

(b) Payment will be made under Item No.:

See Appropriate Section for Type of Plant Mix Involved.

410-H Material Remixing Device - per Each

410-J Smoothness Data Collection - Certified Inertial Profiler-per Each

SECTION 424 SUPERPAVE BITUMINOUS CONCRETE BASE, BINDER, AND WEARING SURFACE LAYERS

424.01 Description

The work covered by this Section shall consist of a hot or warm bituminous plant mixed pavement layer placed on a prepared surface in accordance with these specifications and in reasonably close conformity with the lines, grades, typical cross section, and placement rate shown on the plans or as directed by the Engineer.

The Contractor may use either hot mix or warm mix for all Superpave ESAL Range mixes in Section 424.

General requirements for all bituminous concrete pavements as specified in Section 410 are applicable to this Section, subject to any exceptions contained herein. Quality Control/Quality Assurance (QC/QA) requirements as specified in Section 106 are applicable to this section, subject to any exceptions contained herein.

The work will be accepted on a LOT by LOT basis in accordance with the applicable requirements.

424.02 Materials.

The materials furnished for use shall conform to the requirements of Section 410 and the following:

(a) Aggregates.

1. Procedure for acceptance of Coarse and Fine Aggregates.

All fine and coarse aggregate furnished shall come from an approved producer who is participating in and meeting the requirements of ALDOT-249, *Procedure for Acceptance of Coarse and Fine Aggregates*. The producer's name shall be listed in the Department's *Materials, Sources, and Devices with Special Acceptance Requirements Manual*, List I-1. The Department has established a list of qualified producers of fine and coarse aggregates. Refer to Subarticle 106.01(f) and ALDOT-355 concerning this list.

2. Types of acceptable Coarse Aggregates for Superpave.

Coarse aggregate shall be aggregate retained on the No. 4 {4.75 mm} sieve.

Coarse aggregate shall consist of crushed (or uncrushed) gravel with a bulk specific gravity greater than 2.550 (AASHTO T 85), crushed stone, or crushed slag, or a combination thereof having hard, strong, durable pieces, free from adherent coatings, and meeting all requirements of these specifications.

3. Flat and elongated particles in Coarse Aggregates for Superpave.

The maximum amount of flat and elongated particles in coarse aggregate for Superpave is given in the following table.

PERCENT OF FLAT AND ELONGATED PARTICLES IN COARSE AGGREGATE FOR SUPERPAVE		
Test	Method	Maximum
Flat & Elongated % by Count 5:1 (max to min)	ASTM D 4791 Section 8.4	10 % *
* Shall not apply to the 3/8 inch {9.5 mm} mix or to ESAL Range A/B		

4. Coarse Aggregate Soundness for Superpave.

The percent degradation of the source aggregate by the sodium sulfate soundness test (AASHTO T 104, Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate) after five cycles of testing shall not exceed 10 %.

5. Deleterious Materials and Absorption in Coarse Aggregate for Superpave.

The amount of deleterious substances and absorption in the coarse aggregate shall not exceed the following limits:

RESTRICTION OF DELETERIOUS MATERIALS AND ABSORPTION IN COARSE AGGREGATE FOR SUPERPAVE	
Coal and Lignite (Visual)	0.25 %
Clay Lumps and Friable Particles (AASHTO T 112)	0.25 %
Other local deleterious substances (Shale, Mica, Marcasite, etc.) (Visual)	2.0 %
Absorption (Absorption on the material passing the 3/4 inch {19.0 mm} sieve and retained on the No. 4 {4.75 mm sieve}) (AASHTO T 85 *). Applies to gravel aggregates only.	2.0 %
* Section 8.1 of AASHTO T 85 modified to require a 15 minute vacuum saturation period as per Section 6.3 of AASHTO T 209 prior to the required 15-19 hour soaking period.	

6. Los Angeles Abrasion Criteria for Coarse Aggregate for Superpave.

The percent loss of the coarse aggregate by the LA Abrasion test (AASHTO T 96, Resistance to Abrasion of Small Size Aggregate by use of the Los Angeles Machine) shall not exceed 48 % except that, for Sandstone and Blast Furnace Slag, the LA Abrasion shall not exceed 55 %.

7. Fine Aggregate for Superpave.

Fine aggregate shall be aggregate passing the No. 4 {4.75 mm} sieve. Gravel used to manufacture fine aggregate shall have a bulk specific gravity greater than 2.550 (AASHTO T 85).

The fine aggregate shall be non-plastic when tested in accordance with AASHTO T 89, as modified by ALDOT-232, and AASHTO T 90 and shall have a maximum of 1.0 % clay lumps and friable particles as determined by AASHTO T 112. It shall consist of hard, tough grain, free of injurious amounts of clay, loam, or other deleterious substances.

8. Clay Content for Superpave.

The amount of clay material, as indicated by the sand equivalent, measured on the aggregate passing the No. 4 {4.75 mm} sieve as determined by AASHTO T 176, Plastic Fines in Graded Aggregates and Soils by Use of the Sand Equivalent Test, shall be no less than the values

defined in the following table according to the total design traffic in equivalent single axle loads (ESALs).

CLAY CONTENT CRITERIA FOR SUPERPAVE		
ESAL Range	Traffic (ESALs)	Sand Equivalent
A/B	ESALs < 1.0x10 ⁶	≥ 40.0
C/D	1.0x10 ⁶ ≤ ESALs < 1.0x10 ⁷	≥ 45.0

9. Mineral Filler for Superpave.

Mineral filler shall consist of finely divided mineral matter such as rock dust, slag dust, hydrated lime, hydraulic cement, or fly ash meeting the requirements of Section 805.

The introduction of mineral filler shall be in accordance with AASHTO M 156, Section 3.3, as specified in ALDOT-324, with the additional requirement that accurate proportioning shall be accomplished by means of pneumatic or mechanical metering.

(b) Recycled Asphalt Pavement (RAP).

The requirements for allowing the use of RAP is given in Article 410.02.

(c) Blend of Aggregates.

1. Gradations for blend of Aggregates.

The coarse and fine aggregates, mineral filler, and recycled material shall be combined in a total blend that will produce an acceptable job mix within the gradation limits determined by the maximum and minimum control points as shown in the following tables. Maximum particle size is defined as the sieve size that is two sizes larger than the first sieve to retain more than 10 % of the material. The sequence of sieve sizes to be used in determining maximum particle size is given in the following tables. Gradation charts illustrating gradation requirements are given in Article 424.03.

The required mix will be shown on the plans.

AGGREGATE GRADATION CONTROL POINTS FOR SUPERPAVE		
Thin Lift Mix		
	Control Point (Percent Passing)	
Sieve Size	Minimum	Maximum
No. 200 {75 μm}	6	13
No. 16 {1.18 mm}	30	60
No. 4 {4.75 mm} Nominal	90	100
3/8" {9.5 mm} Maximum	100	

2. Coarse Aggregate Angularity for blend of Aggregates.

The coarse aggregate angularity shall be measured on the total blended aggregate retained on the No. 4 {4.75 mm} sieve in accordance with ASTM D 5821.

A fractured face is defined as an angular, rough, or broken surface of an aggregate particle created by crushing, by other artificial means, or by nature. A face is considered fractured only if it has a projected area at least as large as one-quarter of the maximum projected area (maximum cross-sectional area) of the particle and has sharp, well-defined edges.

The percent by weight {mass} of the coarse particles of the blended aggregate retained on the No. 4 {4.75 mm} sieve with one fractured face and with two or more fractured faces shall be no less than the values in the following table.

COARSE AGGREGATE ANGULARITY REQUIREMENTS FOR SUPERPAVE		
ESAL Range	Traffic (ESALs)	Wearing Surface
A/B	ESALs < 1.0x10 ⁶	75 / -
C/D	1.0x10 ⁶ ≤ ESALs < 1.0x10 ⁷	85 / 80
Note: "85 / 80" denotes that 85 % of the coarse aggregate has at least one fractured face and 80 % has two or more fractured faces.		

3. Fine Aggregate Angularity for blend of Aggregates.

The percent air voids in loosely compacted fine aggregate, measured according to AASHTO T 304, Method "A", or ASTM C 1252, Method "A", *Uncompacted Void Content of Fine Aggregate (as Influenced by Particle Shape, Surface Texture, and Grading)* shall be no less than the values in the following table:

FINE AGGREGATE ANGULARITY REQUIREMENTS FOR SUPERPAVE		
ESAL Range	Traffic (ESALs)	Minimum % Air Void
		Surface
A/B	ESALs < 1.0x10 ⁶	43
C/D	1.0x10 ⁶ ≤ ESALs < 1.0x10 ⁷	45

4. Restrictions in the use of Carbonate Stone for blend of Aggregates.

CRITERIA FOR THE USE OF CARBONATE STONE IN SUPERPAVE	
BPN 9 Value Of Aggregate Source *	Maximum Allowable Percentage Of Carbonate Stone
≤ 25	30
26 through 28	35
29 through 31	40
32 through 34	45
≥ 35	50
* This value, BPN 9, is made using the British Pendulum Tester on aggregate source specimen polished for 9 hours on an accelerated polishing machine known as the British Wheel as per ASTM D 3319, ASTM E 303 and ALDOT-382.	

In no case shall the total amount of virgin carbonate stone in the combined mixture used as actual wearing surface layers that are exposed to traffic exceed the percentage shown in the above table. When parts of the carbonate stone used in the mix are from differing strata

of material or coming from multiple sources that are represented by different BPN 9 values, the lowest BPN 9 value will be used.

(d) Liquid Asphalt Binder.

Liquid asphalt binders shall come from an approved producer who is participating in and meeting the requirements of ALDOT-243, *Acceptance Program For Asphalt Materials*. The producer's name shall be listed in the Department's *Materials, Sources, and Devices With Special Acceptance Requirements Manual*, List I-4. The Department has established a list of qualified producers of asphalt materials. Refer to Subarticle 106.01(f) and ALDOT-355 concerning this list. Unless shown otherwise on the plans or in the proposal, liquid asphalt binder for use in all mixes shall meet the requirements of AASHTO M 320, *Standard Specification For Performance Graded Asphalt Binder*, as modified by the requirements given in Section 804.

Asphalt Binders shall meet the requirements of Section 804 and shall be a PG 67-22.

(e) Mix Properties.

1. Air Voids (Va).

The design air voids shall be 4.0 %

2. Voids in Mineral Aggregate (VMA).

The job mix shall be designed at a minimum VMA given in the following table.

VOIDS IN MINERAL AGGREGATE DESIGN VMA FOR SUPERPAVE ***		
Maximum Aggregate Size * (inches) {mm}	Nominal Aggregate Size (inches) {mm}	Minimum VMA (%)
3/8 {9.5 }	No. 4 {4.75}	16.5 **
<p>* As defined in Subarticle 424.02(c)</p> <p>** All Thin Lift Mixes where the ESAL range is greater than A/B shall have a maximum VMA of 18.0.</p> <p>*** Production VMA may be 0.5 lower than the Minimum VMA given above.</p>		

3. Liquid Asphalt Binder Content (Pb).

The job mix shall be designed at a minimum 6.2% Liquid Asphalt Binder Content (Pb) at Nd=60 gyrations.

4. Dust Proportion (D/Pbe).

The ratio of the percent by weight {mass} of aggregate passing the No. 200 {75 µm} sieve to the effective asphalt content expressed as percent by weight {mass} of the total mix shall be between 0.60 and 1.4. All 3/8 inch {9.5 mm} mixes shall have a dust to effective asphalt ratio range of 0.90 to 2.00. These ratio limits apply to both the design and production phases. Effective asphalt content is that liquid asphalt binder not absorbed into the aggregate pore structure and is determined in accordance with Section 4.09 of the Asphalt Institute's, *MS-2, Mix Design Methods for Asphalt Concrete*.

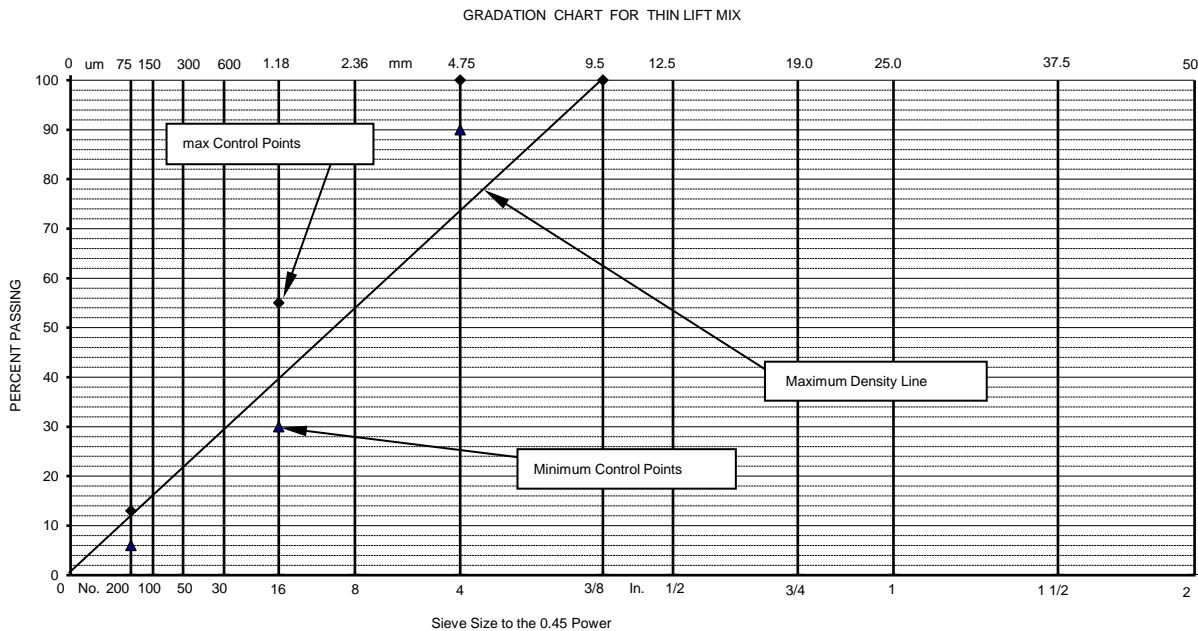
6. Resistance to Moisture-Induced Damage.

All mixes shall be designed and produced to have a tensile strength ratio (TSR) of at least 0.80 when compacted according to ALDOT-384 at 7.0 % air voids and tested in accordance with AASHTO T 283 as modified by ALDOT-361, except the specimen shall be 6.00" {150 mm} in diameter and 3.75" {95 mm} in height.

(f) Design Procedure.

All Superpave mixes shall be designed in accordance with ALDOT-384, *Superpave Mix Design Procedure for Asphalt Mixtures*. All Superpave Gyratory Compactors shall have their angle of gyration verified by the Engineer following the procedure in AASHTO T 344, Standard Method of Test for Evaluation of Superpave Gyratory Compactor (SGC) Internal Angle of Gyration Using Simulated Loading. This includes all design, quality control, and quality assurance SGCs. The compactors shall tilt the specimen molds at an average internal angle of 20.2 ± 0.35 mrad (1.16 ± 0.02 degrees).

424.03 Gradation Requirements.



424.04 Construction Requirements.

(a) General.

The mixing temperature of the asphalt mixture shall not exceed 350 °F {177 °C}.

(b) Wearing Surface Layer.

Construction requirements shall be as specified in Articles 410.03 through 410.07.

(c) Omit

(d) Preparation of Mixtures - Moisture Content.

Each time an asphalt content measurement is made (ALDOT-354 or AASHTO T 308), the amount of moisture in the mixture shall be determined, regardless of aggregate type, as specified in ALDOT-130 and reported on Form BMT-20. The moisture determination shall be used in computing the corrected asphalt content. Moisture samples shall be taken with the asphalt content samples from the loaded truck. Moisture in the mixture shall not exceed 0.20% by weight {mass}.

(e) Production Tolerances.

All mixtures furnished for use shall conform to the approved job mix formula (JMF) within the tolerances set in Article 410.02. Mixture gradations may be produced provided the gradations are within the tolerances.

424.05 Method of Measurement.

The accepted quantities of Superpave Bituminous Concrete Thin Lift Wearing Surface Layer will be measured as provided in Article 410.08, subject to any exceptions contained herein.

424.06 Basis of Payment.

(a) Unit Price Coverage.

Superpave Bituminous Concrete Thin Lift Wearing Surface Layer will be paid for at the contract unit price bid in accordance with Article 410.09, subject to any exceptions contained herein.

(b) Payment will be made under Item No.:

424-T Superpave Bituminous Concrete Wearing Layer, Thin Lift Mix, ESAL Range ____ - per ton
{metric ton}