SECTION 4.06 - BITUMINOUS CONCRETE

Section 4.06 is being deleted in its entirety and replaced with the following:

**4.06.01—Description**

**4.06.02—Materials**

**4.06.03—Construction Methods**

**1. Material Documentation**

**2. Transportation of Mixture**

**3. Paving Equipment**

**4. Test Section**

**5. Transitions for Roadway Surface**

**6. Spreading and Finishing of Mixture**

**7.** **Longitudinal Joint Construction Methods**

**8. Contractor Quality Control (QC) Requirements**

**9. Temperature and Seasonal Requirements**

**10. Field Density**

**11. Acceptance Sampling and Testing**

**12. Density Dispute Resolution Process**

**13. Corrective Work Procedure**

**14. Protection of the Work**

**15. Cut Bituminous Concrete Pavement**

**4.06.04—Method of Measurement**

**4.06.05—Basis of Payment**

 **4.06.01—Description:** Work under this Section shall include the production, delivery, placement and compaction of a uniform textured, non-segregated, smooth bituminous concrete pavement to the grade and cross section shown on the plans.

 The following terms as used in this specification are defined as:

Bituminous Concrete: A composite material consisting of prescribed amounts of asphalt binder and aggregates. Asphalt binder may also contain additives engineered to modify specific properties and/or behavior of the composite material. References to bituminous concrete apply to all of its forms, such as those identified as hot-mix asphalt (HMA) or polymer-modified asphalt (PMA).

Bituminous Concrete Plant (Plant): A structure where aggregates and asphalt binder are combined in a controlled fashion into a bituminous concrete mixture suitable for forming pavements and other paved surfaces.

Course: A continuous layer (a lift or multiple lifts) of the same bituminous concrete mixture placed as part of the pavement structure.

Density Lot: The total tonnage of all bituminous concrete placed in a single lift which are:

PWL density lots = When the project total estimated quantity per mixture is larger than 3,500 tons

Simple Average density lots = When the project total estimated quantity per mixture is 3,500 tons or less

Disintegration: Erosion or fragmentation of the pavement surface which can be described as polishing, weathering-oxidizing, scaling, spalling, raveling, or formation of potholes.

Dispute Resolution: A procedure used to resolve conflicts between the Engineer and the Contractor’s results that may affect payment.

Hot Mix Asphalt (HMA): A bituminous concrete mixture typically produced at 325°F.

Job Mix Formula (JMF): A recommended aggregate gradation and asphalt binder content to achieve the required mixture properties.

Lift: An application of a bituminous concrete mixture placed and compacted to a specified thickness in a single paver pass.

Percent Within Limits (PWL): The percentage of the lot falling between the Upper Specification Limit (USL) and the Lower Specification Limit (LSL).

Polymer Modified Asphalt (PMA): A bituminous concrete mixture containing a polymer-modified asphalt binder and using a qualified warm mix technology.

Production Lot: The total tonnage of a bituminous concrete mixture from a single source that may receive an adjustment.

Production Sub Lot: Portion of the production lot typically represented by a single sample.

Quality Assurance (QA): All those planned and systematic actions necessary to provide CTDOT the confidence that a Contractor will perform the work as specified in the Contract.

Quality Control (QC): The sum total of activities performed by the vendor (Producer, Manufacturer, and Contractor) to ensure that a product meets contract specification requirements.

Superpave: A bituminous concrete mix design used in mixtures designated as “S\*” Where “S” indicates Superpave and \* indicates the sieve related to the nominal maximum aggregate size of the mix.

Segregation: A non-uniform distribution of a bituminous concrete mixture in terms of gradation, temperature, or volumetric properties.

Warm Mix Asphalt (WMA) Technology: A qualified additive or technology that may be used to produce a bituminous concrete at reduced temperatures and/or increase workability of the mixture.

 **4.06.02—Materials:** All materials shall meet the requirements of Section M.04.

**1. Materials Supply:** The bituminous concrete mixture must be from one source of supply and originate from one Plant unless authorized by the Engineer.

**2. Recycled Materials:** Reclaimed Asphalt Pavement (RAP), Crushed Recycled Container Glass (CRCG), Recycled Asphalt Shingles (RAS), or crumb rubber (CR) from recycled tires may be incorporated in bituminous concrete mixtures in accordance with Project Specifications.

 **4.06.03—Construction Methods**

 **1. Material Documentation:** All vendors producing bituminous concrete must have Plants with automated vehicle-weighing scales, storage scales, and material feeds capable of producing a delivery ticket containing the information below.

1. State of Connecticut printed on ticket.
2. Name of Producer, identification of Plant, and specific storage silo if used.
3. Date and time.
4. Mixture Designation, mix type and level. Curb mixtures for machine-placed curbing must state "curb mix only."
5. If WMA Technology is used, “-W”must be listed following the mixture designation.
6. Net weight of mixture loaded into the vehicle. (When RAP and/or RAS is used, the moisture content shall be excluded from mixture net weight.)
7. Gross weight (equal to the net weight plus the tare weight or the loaded scale weight).
8. Tare weight of vehicle (daily scale weight of the empty vehicle).
9. Project number, purchase order number, name of Contractor (if Contractor other than Producer).
10. Vehicle number - unique means of identification of vehicle.
11. For Batch Plants: individual aggregate, recycled materials, and virgin asphalt max/target/min weights when silos are not used.
12. For every mixture designation: the running daily and project total delivered and sequential load number.

 The net weight of mixture loaded into the vehicle must be equal to the cumulative measured weights of its components.

 The Contractor must notify the Engineer immediately if, during production, there is a malfunction of the weight recording system in the automated Plant. Manually written tickets containing all required information will be allowed for no more than 1 hour.

 The State reserves the right to have an Inspector present to monitor batching and/or weighing operations.

 **2. Transportation of Mixture:** The mixture shall be transported in vehicles that are clean of all foreign material, excessive coating or cleaning agents, and that have no gaps through which material might spill. Any material spilled during the loading or transportation process shall be quantified by re-weighing the vehicle. The Contractor shall load vehicles uniformly so that segregation is minimized. Loaded vehicles shall be tightly covered with waterproof covers acceptable to the Engineer. Mesh covers are prohibited. The cover must minimize air infiltration. Vehicles found not to be in conformance shall not be loaded

 Vehicles with loads of bituminous concrete being delivered to State projects must not exceed the statutory or permitted load limits referred to as gross vehicle weight (GVW). The Contractor shall furnish a list and allowable weights of all vehicles transporting mixture. The State reserves the right to check the gross and tare weight of any vehicle. If the gross or tare weight varies from that shown on the delivery ticket by more than 0.4%, the Engineer will recalculate the net weight. The Contractor shall correct the discrepancy to the satisfaction of the Engineer.

If a vehicle delivers mixture to the Project and the delivery ticket indicates that the vehicle is overweight, the load may not be rejected but a “Measured Weight Adjustment” will be taken in accordance with Article 4.06.04.

 Vehicle body coating and cleaning agents must not have a deleterious effect on the mixture. The use of solvents or fuel oil, in any concentration, is prohibited for the coating of vehicle bodies.

 For each delivery, the Engineer shall be provided a clear, legible copy of the delivery ticket.

 **3. Paving Equipment:** The Contractor shall have the necessary paving and compaction equipment at the Project Site to perform the work. All equipment shall be in good working order and any equipment that is worn, defective, or inadequate for performance of the work shall be repaired or replaced by the Contractor to the satisfaction of the Engineer. During the paving operation, the use of solvents or fuel oil, in any concentration, is strictly prohibited as a release agent or cleaner on any paving equipment (i.e., rollers, pavers, transfer devices, etc.).

 Refueling or cleaning of equipment is prohibited in any location on the Project where fuel or solvents might come in contact with paved areas or areas to be paved. Solvents used in cleaning mechanical equipment or hand tools shall be stored clear of areas paved or to be paved. Before any such equipment and tools are cleaned, they shall be moved off of areas paved or to be paved.

 Pavers: Each paver shall have a receiving hopper with sufficient capacity to provide for a uniform spreading operation and a distribution system that places the mix uniformly, without segregation. The paver shall be equipped with and use a vibratory screed system with heaters or burners. The screed system shall be capable of producing a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture. Pavers with extendible screed units as part of the system shall have auger extensions and tunnel extenders as necessary. Automatic screed controls for grade and slope shall be used at all times unless otherwise authorized by the Engineer. The controls shall automatically adjust the screed to compensate for irregularities in the preceding course or existing base. The controls shall maintain the proper transverse slope and be readily adjustable, and shall operate from a fixed or moving reference such as a grade wire or floating beam (minimum length 20 feet).

 Rollers: All rollers shall be self-propelled and designed for compaction of bituminous concrete. Roller types shall include steel wheeled, pneumatic, or a combination thereof. Rollers that operate in a dynamic mode shall have drums that use a vibratory or oscillatory system or combination. Vibratory rollers shall be equipped with indicators for amplitude, frequency, and speed settings/readouts to measure the impacts per foot during the compaction process. Oscillatory rollers shall be equipped with frequency indicators. Rollers can operate in the dynamic mode using the oscillatory system on concrete structures such as bridges and catch basins if at the lowest frequency setting.

 Pneumatic tire rollers shall be equipped with wide-tread compaction tires capable of exerting an average contact pressure from 60 to 90 psi uniformly over the surface. The Contractor shall furnish documentation to the Engineer regarding tire size, pressure and loading to confirm that the proper contact pressure is being developed and that the loading and contact pressure are uniform for all wheels.

 Lighting: For paving operations which will be performed during hours of darkness the paving equipment shall be equipped with lighting fixtures as described below or with an approved equal. Lighting shall minimize glare to passing traffic. The lighting options and minimum number of fixtures are listed in Tables 4.06-1 and 4.06-2.

## **TABLE 4.06-1: Minimum Paver lighting**

|  |  |  |  |
| --- | --- | --- | --- |
| **Option** | **Fixture Configuration** | **Fixture Quantity** | **Requirement** |
| 1 | Type A | 3 | Mount over screed area |
| Type B (narrow) or Type C (spot) | 2 | Aim to auger and guideline |
| Type B (wide)or Type C (flood) | 2 | Aim 25feet behind paving machine |
| 2 | Type D Balloon | 2 | Mount over screed area |

**TABLE 4.06-2: Minimum Roller Lighting**

|  |  |  |  |
| --- | --- | --- | --- |
| **Option** | **Fixture Configuration** | **Fixture Quantity** | **Requirement** |
| 1 | Type B (wide) | 2 | Aim 50 feet in front of and behind roller |
| Type B (narrow) | 2 | Aim 100 feet in front of and behind roller |
| 2 | Type C (flood) | 2 | Aim 50 feet in front of and behind roller |
| Type C (spot) | 2 | Aim 100 feet in front of and behind roller |
| 3 | Type D Balloon | 1 | Mount above the roller |

\*All fixtures shall be mounted above the roller.

Type A: Fluorescent fixture shall be heavy duty industrial type. Each fixture shall have a minimum output of 8,000 lumens. The fixtures shall be mounted horizontally and be designed for continuous row installation.

Type B: Each floodlight fixture shall have a minimum output of 18,000 lumens.

Type C: Each fixture shall have a minimum output of 19,000 lumens.

Type D: Balloon light – each balloon light fixture shall have minimum output of 50,000 lumens and emit light equally in all directions.

 Material Transfer Vehicle (MTV): A MTV shall be used when placing bituminous concrete surface course (a lift or multiple lifts) as indicated in the Contract except as noted on the plans or as directed by the Engineer. In addition, continuous paving lengths of less than 500 feet may not require the use of a MTV as determined by the Engineer.

 The MTV must be a vehicle specifically designed for the purpose of delivering the bituminous concrete mixture from the delivery vehicle to the paver. The MTV must continuously remix the bituminous concrete mixture throughout the placement process.

 The use of a MTV will be subject to the requirements stated in Article 1.07.05 Load Restrictions. The Engineer may limit the use of the vehicle if it is determined that the use of the MTV may damage highway components, utilities, or bridges. The Contractor shall submit to the Engineer at time of pre-construction the following information:

1. The make and model of the MTV.
2. The individual axle weights and axle spacing for each piece of paving equipment (haul vehicle, MTV and paver).
3. A working drawing showing the axle spacing in combination with all pieces of equipment that will comprise the paving echelon.

 **4. Test Section:** The Engineer may require the Contractor to place a test section whenever the requirements of this specification or Section M.04 are not met.

 The Contractor shall submit the quantity of mixture to be placed and the location of the test section for review and approval by the Engineer. The same equipment used in the construction of a passing test section shall be used throughout production.

 If a test section fails to meet specifications, the Contractor shall stop production, make necessary adjustments to the job mix formula, Plant operations, or procedures for placement and compaction. The Contractor shall construct test sections, as allowed by the Engineer, until all the required specifications are met. All test sections shall also be subject to removal as set forth in Article 1.06.04.

 **5. Transitions for Roadway Surface:** Transitions shall be formed at any point on the roadway where the pavement surface deviates, vertically, from the uniform longitudinal profile as specified on the plans. Whether formed by milling or by bituminous concrete mixture, all transition lengths shall meet the criteria below unless otherwise specified.

 Permanent Transitions: Defined as any gradual change in pavement elevation that remains as a permanent part of the work.

 A transition shall be constructed no closer than 75 feet from either side of a bridge expansion joint or parapet. All permanent transitions, leading and trailing ends shall meet the following length requirements:

|  |  |
| --- | --- |
| **Posted Speed Limit** | **Permanent Transition Length Required** |
| > 35 mph | 30 feet per inch of elevation change |
| 35 mph or less | 15 feet per inch of elevation change |

 In areas where it is impractical to use the above-described permanent transition lengths, the use of a shorter permanent transition length may be permitted when approved by the Engineer.

 Temporary Transitions: Defined as a transition that does not remain a permanent part of the work.

 All temporary transitions shall meet the following length requirements:

|  |  |
| --- | --- |
| **Posted Speed Limit** | **Temporary Transition Length Required** |
| > 50 mph | Leading Transition: 15 feet per inch of vertical change (thickness)Trailing Transition: 6 feet per inch of vertical change (thickness) |
| 40, 45 or 50 mph | Leading and Trailing: 4 feet per inch of vertical change (thickness) |
| 35 mph or less | Leading and Trailing: 3 feet per inch of vertical change (thickness) |

 **Note:** Any temporary transition to be in place over the winter shutdown period or during extended periods of inactivity (more than 14 calendar days) shall meet the greater than 50 mph requirements shown above.

 **6. Spreading and Finishing of Mixture:** Prior to the placement of the mixture, the underlying base course shall be brought to the plan grade and cross section within the allowable tolerance.

 Immediately before placing a bituminous concrete lift, a uniform coating of tack coat shall be applied to all existing underlying pavement surfaces and on the exposed surface of a wedge joint. Such surfaces shall be clean and dry. Sweeping or other means acceptable to the Engineer shall be used.

 The mixture shall not be placed whenever the surface is wet or frozen.

 Tack Coat Application: The tack coat shall be applied by a pressurized spray system that results in uniform overlapping coverage at an application rate of 0.03 to 0.05 gal./s.y. for a non-milled surface and an application rate of 0.05 to 0.07 gal./s.y. for a milled surface. For areas where both milled and un-milled surfaces occur, the tack coat shall be an application rate of 0.03 to 0.05 gal /s.y. The Engineer must approve the equipment and the method of measurement prior to use. The material for tack coat shall be heated to 160°F ± 10°F and shall not be further diluted.

 Tack coat shall be allowed sufficient time to break prior to any paving equipment or haul vehicles driving on it.

 The Contractor may request to omit the tack coat application between bituminous concrete layers that have not been exposed to traffic and are placed during the same work shift. Requests to omit tack coat application on the upper and lower surfaces of a wedge joint will not be considered.

 Placement: The mixture shall be placed and compacted to provide a smooth, dense surface with a uniform texture and no segregation at the specified thickness and dimensions indicated in the plans and specifications.

 When unforeseen weather conditions prevent further placement of the mixture, the Engineer is

not obligated to accept or place the bituminous concrete mixture that is in transit from the Plant.

 In advance of paving, traffic control requirements shall be set up, maintained throughout placement, and shall not be removed until all associated work including density testing is completed.

 The mixture temperature will be verified by means of a probe or infrared type of thermometer. The placement temperature range shall be listed in the quality control plan (QCP) for placement and meet the requirements of Table M.04.03-4. Any HMA material that that falls outside the specified temperature range as measured by a probe thermometer may be rejected.

 The Contractor shall inspect the newly placed pavement for defects in mixture or placement before rolling is started. Any deviation from standard crown or section shall be immediately remedied by placing additional mixture or removing surplus mixture. Such defects shall be corrected to the satisfaction of the Engineer.

 Where it is impracticable due to physical limitations to operate the paving equipment, the Engineer may permit the use of other methods or equipment. Where hand spreading is permitted, the mixture shall be placed by means of suitable shovels and other tools, and in a uniformly loose layer at a thickness that will result in a completed pavement meeting the designed grade and elevation.

 Placement Tolerances: Each lift of bituminous concrete placed at a specified thickness shall meet the following requirements for thickness and area. Any pavement exceeding these limits shall be subject to an adjustment or removal. Lift tolerances will not relieve the Contractor from meeting the final designed grade. Lifts of specified non-uniform thickness, i.e. wedge or shim course, shall not be subject to thickness and area adjustments.

1. Thickness: Where the average thickness of the lift exceeds that shown on the plans beyond the tolerances shown in Table 4.06-3, the Engineer will calculate the thickness adjustment in accordance with Article 4.06.04.

**TABLE 4.06-3: Thickness Tolerances**

|  |  |
| --- | --- |
| **Mixture Designation** | **Lift Tolerance** |
| S1 | +/- 3/8 inch |
| S0.25, S0.375, S0.5 | +/- 1/4 inch |

 Where the thickness of the lift of mixture is less than that shown on the plans beyond the tolerances shown in Table 4.06-3, the Contractor, with the approval of the Engineer, shall take corrective action in accordance with this Section.

1. Area: Where the width of the lift exceeds that shown on the plans by more than the specified thickness, the Engineer will calculate the area adjustment in Article 4.06.04.
2. Delivered Weight of Mixture: When the delivery ticket shows that the truck exceeds the allowable gross weight for the vehicle type, the Engineer will calculate the weight adjustment in accordance with Article 4.06.04.

 Transverse Joints: All transverse joints shall be formed by saw-cutting to expose the full thickness of the lift. Tack coat shall be applied to the sawn face immediately prior to additional mixture being placed.

 Compaction: The Contractor shall compact the mixture to meet the density requirements as stated in Article 4.06.04 and eliminate all roller marks without displacement, shoving cracking, or aggregate breakage.

 When placing a lift with a specified thickness less than 1 1/2 inches, or a wedge course, the Contractor shall provide a minimum rolling pattern as determined by the development of a compaction curve. The procedure to be used shall be documented in the Contractor’s QCP for placement and demonstrated on the first day of placement.

 The use of the vibratory system on concrete structures is prohibited. When approved by the Engineer, the Contractor may operate a roller using an oscillatory system at the lowest frequency setting.

 If the Engineer determines that the use of compaction equipment in the dynamic mode may damage highway components, utilities or adjacent property, the Contractor shall provide alternate compaction equipment.

 Rollers operating in the dynamic mode shall be shut off when changing directions.

 These allowances will not relieve the Contractor from meeting pavement compaction requirements.

 Surface Requirements:

Each lift of the surface course shall not vary more than 1/4 inch from a Contractor-supplied 10 foot straightedge. For all other lifts of bituminous concrete, the tolerance shall be 3/8 inch. Such tolerance will apply to all paved areas.

 Any surface that exceeds these tolerances shall be corrected by the Contractor at its own expense.

 **7.** **Longitudinal Joint Construction Methods:** The Contractor shall use Method I - Notched Wedge Joint (see Figure 4.06-1) when constructing longitudinal joints where lift thicknesses are 1 ½ inches to 3 inches. S1.0 mixtures shall be excluded from using Method I. Method II - Butt Joint (see Figure 4.06-2) shall be used for lifts less than 1 1/2 inches or greater than 3 inches. Each longitudinal joint shall maintain a consistent offset from the centerline of the roadway along its entire length. The difference in elevation between the two faces of any completed longitudinal joint shall not exceed 1/4 inch at any location.

 **Method I - Notched Wedge Joint:**

 A notched wedge joint shall be constructed as shown in Figure 4.06-1 using a device that is attached to the paver screed and is capable of independently adjusting the top and bottom vertical notches. The device shall have an integrated vibratory system. The top vertical notch must be located at the centerline or lane line in the final lift. The requirement for paving full width “curb to curb” as described in Method II may be waived if addressed in the QC plan and approved by the Engineer.

 The taper portion of the wedge joint shall be evenly compacted using equipment other than the paver or notch wedge joint device. The compaction device shall be the same width as the taper and not reduce the angle of the wedge or ravel the top notch of the joint during compaction.

 When placed on paved surfaces, the area below the sloped section of the joint shall be treated with tack coat. The top surface of the sloped section of the joint shall be treated with tack coat prior to placing the completing pass.

 The taper portion of the wedge joint shall not be exposed to traffic for more than 5 calendar days.

**Figure 4.06-1: Notched Wedge Joint** (Not to Scale)

**Hot side**

**Cold Side**

12” Taper

Top

Vertical Notch

1/2 - 3/4”

Tack coat

Bottom

Vertical Notch

1/4” - 1/2”

Lift Thickness

 1 1/2” - 3”

Varies

 Any exposed wedge joint must be located to allow for the free draining of water from the road surface.

 The Engineer reserves the right to define the paving limits when using a wedge joint that will be exposed to traffic.

 If Method I cannot be used on those lifts which are 1 ½ inches to 3 inches, Method III may be substituted according to the requirements below for “Method III - Butt Joint with Hot Poured Rubberized Asphalt Treatment.”

 **Method II - Butt Joint:**

 When adjoining passes are placed, the Contractor shall use the end gate to create a near vertical edge (refer to Figure 4.06-2). The completing pass (hot side) shall have sufficient mixture so that the compacted thickness is not less than the previous pass (cold side). During placement of multiple lifts, the longitudinal joint shall be constructed in such a manner that it is located at least 6 inch from the joint in the lift immediately below. The joint in the final lift shall be at the centerline or at lane lines. The end gate on the paver should be set so there is an overlap onto the cold side of the joint.

 The Contractor shall not allow any butt joint to be incomplete at the end of a work shift unless otherwise allowed by the Engineer. When using this method, the Contractor is not allowed to leave a vertical edge exposed at the end of a work shift and must complete paving of the roadway full width “curb to curb.”

**Figure 4.06-2: Butt Joint** (Not to Scale)

Lift Thicknesses

Less than 1 1/2”

 Greater than or

equal to 3”

**Hot side**

**Cold Side**

Joint

 **Method III - Butt Joint with Hot Poured Rubberized Asphalt Treatment**:

 If Method I cannot be used due to physical constraints in certain limited locations, the Contractor may submit a request in writing for approval by the Engineer to use Method III as a substitution in those locations. There shall be no additional measurement or payment made when Method III is substituted for Method I. When required by the Contract or approved by the Engineer, Method III (see Figure 4.06-3) shall be used.

**Figure 4.06-3: Butt Joint with Hot Poured Rubberized Asphalt Treatment**

(Not to Scale)

**Hot side**

**Cold Side**

Hot poured rubberized asphalt treatment

 All of the requirements of Method II must be met with Method III. In addition, the longitudinal vertical edge must be treated with a rubberized joint seal material meeting the requirements of ASTM D6690, Type 2. The joint sealant shall be placed on the face of the “cold side” of the butt joint as shown above prior to placing the “hot side” of the butt joint. The joint seal material shall be applied in accordance with the manufacturer’s recommendation so as to provide a uniform coverage and avoid excess bleeding onto the newly placed pavement.

 **8. Contractor Quality Control (QC) Requirements:** The Contractor shall be responsible for maintaining adequate quality control procedures throughout the production and placement operations. Therefore, the Contractor must ensure that the materials, mixture, and work provided by Subcontractors, Suppliers, and Producers also meet Contract specification requirements.

 This effort must be documented in Quality Control Plans (QCP) and must address the actions, inspection, or sampling and testing necessary to keep the production and placement operations in control, to determine when an operation has gone out of control and to respond to correct the situation in a timely fashion.

 The Standard QCP for production shall consist of the quality control program specific to the production facility.

 There are 3 components to the QCP for placement: a Standard QCP, a Project Summary Sheet that details Project-specific information, and, if applicable, a separate Extended Season Paving Plan as required in 4.06.03-9 “Temperature and Seasonal Requirements.”

 The Standard QCP for both production and placement shall be submitted to the Department for approval each calendar year and at a minimum of 30 days prior to production or placement.

 Production or placement shall not occur until all QCP components have been approved by the Engineer.

 Each QCP shall include the name and qualifications of a Quality Control Manager (QCM). The QCM shall be responsible for the administration of the QCP, and any modifications that may become necessary.

 The QCM shall have the ability to direct all Contractor personnel on the Project during paving operations.

 The QCPs shall also include the name and qualifications of any outside testing laboratory performing any QC functions on behalf of the Contractor. The QC Technician performing in-place density testing shall be NETTCP certified as a paving inspector.

 Approval of the QCP does not relieve the Contractor of its responsibility to comply with the Project specifications. The Contractor may modify the QCPs as work progresses and must document the changes in writing prior to resuming operations. These changes include but are not limited to changes in quality control procedures or personnel. The Department reserves the right to deny significant changes to the QCPs.

 QCP for Production: Refer to M.04.03-1.

 QCP for Placement: The Standard QCP, Project Summary Sheet, and Extended Season Paving Plan shall conform to the format provided by the Engineer. The format is available at <http://www.ct.gov/dot/lib/dot/documents/dconstruction/pat/qcp_outline_hma_placement.pdf>

 The Contractor shall perform all quality control sampling and testing, provide inspection, and exercise management control to ensure that bituminous concrete placement conforms to the requirements as outlined in its QCP during all phases of the work. The Contractor shall document these activities for each day of placement.

 The Contractor shall submit complete field density testing and inspection records to the Engineer within 48 hours in a manner acceptable to the Engineer.

 The Contractor may obtain 1 mat core and 1 joint core per day for process control, provided this process is detailed in the QCP. The results of these process control cores shall not be used to dispute the Department’s determinations from the acceptance cores. The Contractor shall submit the location of each process control core to the Engineer for approval prior to taking the core. The core holes shall be filled to the same requirements described in Subarticle 4.06.03-10.

 **9. Temperature and Seasonal Requirements**: Paving, including placement of temporary pavements, shall be divided into 2 seasons, “In-Season” and “Extended-Season.” In-Season paving occurs from May 1 to October 14, and Extended Season paving occurs from October 15 to April 30. The following requirements shall apply unless otherwise authorized or directed by the Engineer:

* Mixtures shall not be placed when the air or subbase temperature is less than 40°F regardless of the season.
* Should paving operations be scheduled during the Extended Season, the Contractor must submit an Extended Season Paving Plan for the Project that addresses minimum delivered mix temperature considering WMA, PMA, or other additives; maximum paver speed; enhanced rolling patterns; and the method to balance mixture delivery and placement operations. Paving during Extended Season shall not commence until the Engineer has approved the plan.

 **10. Field Density** The Contractor shall obtain cores for the determination of mat and longitudinal joint density of bituminous concrete pavements. Within five calendar days of placement, mat and joint cores shall be extracted on each lift with a specified thickness of 1 1/2 inches or more. Joint cores shall not be extracted on HMA S1.0 lifts.

 The Contractor shall extract cores from random locations determined by the Engineer in accordance with ASTM D3665. Four (4) or six (6) inch diameter cores shall be extracted for S0.25, S0.375 and S0.5 mixtures; 6 inch diameter cores shall be required for S1.0 mixtures. The Contractor shall coordinate with the Engineer to witness the extraction, labeling of cores, and filling of the core holes.

Each lift will be separated into lots as follows:

1. Simple Average Density Lots: For total estimated quantities below 2,000 tons, the lift will be evaluated in one lot which will include the total paved tonnage of the lift and all longitudinal joints between the curb lines.

For total estimated quantities between 2,000 and 3,500 tons, the lift will be evaluated in two lots in which each lot will include approximately half of the total tonnage placed for the full paving width of a lift including all longitudinal joints between the curb lines.

1. PWL Density Lots: Mat density lots will include each 3,500 tons of mixture placed within 30 calendar days. Joint density lots will include 14,000 linear feet of constructed joints. Bridge density lots will always be analyzed using simple average lot methodology.
2. Partial Density Lot (For PWL only): A mat density lot with less than 3,500 tons or a joint density lot with less than 14,000 linear feet due to:
* completion of the course; or
* a lot spanning 30 calendar days.

 Prior to paving, the type and number of lot(s) will be determined by the Engineer. Noncontiguous areas such as highway ramps may be combined to create one lot.

 After the lift has been compacted and cooled, the Contractor shall cut cores to a depth equal to or greater than the lift thickness and shall remove them without damaging the lift(s) to be tested. Any core that is damaged or obviously defective while being obtained will be replaced with a new core from a location within 2 feet measured in a longitudinal direction.

 A mat core shall not be located any closer than 1 foot from the edge of a paver pass. If a random number locates a core less than 1 foot from any edge, the location will be adjusted by the Engineer so that the outer edge of the core is 1 foot from the edge of the paver pass.

 Method I, Notched Wedge Joint cores shall be taken so that the center of the core is 5 inches from the visible joint on the hot mat side (Figure 4.06-4).

**Figure 4.06-4: Notched Wedge Joint Cores** (Not to Scale)



 When Method II or Method III Butt Joint is used, cores shall be taken from the hot side so the edge of the core is within 1 inch of the longitudinal joint.

 The cores shall be labeled by the Contractor with the Project number, date placed, lot number, and sub-lot number. The core’s label shall include “M” for a mat core and “J” for a joint core. For example, a mat core from the first lot and the first sub-lot shall be labeled with “M1 – 1.” A mat core from the second lot and first sub-lot shall be labeled “M2-1” (see Figure 4.06-5). The Engineer shall fill out a MAT-109 to accompany the cores. The Contractor shall deliver the cores and MAT-109 to the Department’s Central Lab. The Contractor shall use a container approved by the Engineer. The container shall have a lid capable of being locked shut and tamper proof. The Contractor shall use foam, bubble wrap, or another suitable material to prevent the cores from being damaged during handling and transportation. Once the cores and MAT-109 are in the container the Engineer will secure the lid using security seals at the removable hinges(s) and at the lid opening(s). The security seals’ identification number must be documented on the MAT-109. All sealed containers shall be delivered to the Department’s Central Lab within two working days from time of extraction. Central Lab personnel will break the security seal and take possession of the cores.

**Figure 4.06-5: Labeling of Cores**

**Project #**

**(M or J) Lot - Sub lot**

**85-219**

**M2 - 1**

07/26/16

Date Placed

 Each core hole shall be filled within 4 hours upon core extraction. Prior to being filled, the hole shall be prepared by removing any free water and applying tack coat using a brush or other means to uniformly cover the cut surface. The core hole shall be filled using a bituminous concrete mixture at a minimum temperature of 240°F containing the same or smaller nominal maximum aggregate size and compacted with a hand compactor or other mechanical means to the maximum compaction possible. The bituminous concrete shall be compacted to 1/8 inch above the finished pavement.

***Simple Average Density Lots***:

 A standard simple average density lot is the quantity of material placed within the defined area excluding any bridge decks.

 A combo simple average density lot is the quantity of material placed within the defined area including bridge decks less than or equal to 500 feet long.

 A bridge simple average density lot is the quantity of material placed on a bridge deck longer than 500 feet.

 The number of cores per lot shall be determined in accordance with Table 4.06-4. If a randomly selected mat or joint core location is on a bridge deck, the core is to be obtained on the bridge deck in addition to the core(s) required on the bridge deck.

 The number of cores per lot shall be determined in accordance with Table 4.06-5. Multiple bridge decks can be combined into one lot if the paving and underlying conditions are comparable. If multiple bridge decks are combined into a single bridge lot, at least one mat and joint core shall be obtained on each bridge.

 The longitudinal locations of mat cores within a standard, combo, or bridge lot containing multiple paving passes will be determined using the combined length of the paving passes within the lot.

**TABLE 4.06-4: Number of Cores per Lot (Simple Average)**

|  |  |  |
| --- | --- | --- |
| **Lot Type** | **No. of Mat Cores** | **No. of Joint Cores** |
| Standard Lot < 500 Tons | 3 | 3 |
| Standard Lot ≥ 500 Tons | 4 | 4 |
| Combo Lot < 500 Tons | 2 plus | 1 per bridge(< 300’)2 per bridge(301’ – 500’) | 2 plus | 1 per bridge(< 300)2 per bridge(301’ – 500’) |
| Combo Lot ≥ 500 Tons(1) | 4 plus | 4 plus |

 **TABLE 4.06-5: Number of Core per Bridge Density Lot (Simple Average)**

|  |  |  |
| --- | --- | --- |
| **Length of Bridge(s) (Feet)** | **Minimum No. of Mat Cores** | **Minimum No. of Joint Cores** |
| < 500 | 2 | 2 |
| 501 – 1,500 | 3 | 3 |
| 1,501 – 2,500 | 4 | 4 |
| 2,501 and greater | 5 | 5 |

***PWL Density Lots***:

 A PWL mat density lot is 3,500 tons of material placed within the defined area excluding any bridges. One mat core will be obtained per every 500 tons placed.

 A PWL joint density lot is 14,000 linear feet of longitudinal joint excluding any joints on bridge decks. One joint core will be obtained per every 2,000 linear feet of joint.

 Bridge density lots will always be analyzed as using the simple average lot methodology. The number of cores per lot shall be determined in accordance with Table 4.06-5. Multiple bridge decks can be combined into one lot if the paving and underlying conditions are comparable. If multiple bridge decks are combined into a single bridge lot, at least one mat and joint core shall be obtained on each bridge.

 **11. Acceptance Sampling and Testing:** Sampling shall be performed in accordance with ASTM D3665 or a statistically-based procedure of stratified random sampling approved by the Engineer.

 Plant Material Acceptance: The Contractor shall provide the required sampling and testing during all phases of the work in accordance with M.04. The Department will verify the Contractor’s acceptance test results. Should any test results exceed the specified tolerances in the Department’s current QA Program for Materials, the Contractor’s test results for a subject lot or sub lot may be replaced with the Department’s results for the purpose of calculating adjustments. The verification procedure is included in the Department’s current QA Program for Materials.

 Density Acceptance: The Engineer will perform all acceptance testing in accordance with AASHTO T 331. The density of each core will be determined using the daily production’s average maximum theoretical specific gravity (Gmm) established during the testing of the parent material at the Plant. When there was no testing of the parent material or any Gmm exceeds the specified tolerances in the Department’s current QA Program for Materials, the Engineer will determine the maximum theoretical density value to be used for density calculations.

 **12. Density Dispute Resolution Process:** The Contractor and Engineer will work in partnership to avoid potential conflicts and to resolve any differences that may arise during quality control or acceptance testing for density. Both parties will review their sampling and testing procedures and results and share their findings. If the Contractor disputes the Engineer’s test results, the Contractor must submit in writing a request to initiate the Dispute Resolution Process within five calendar days of the notification of the test results. No request for dispute resolution will be allowed unless the Contractor provides quality control results from samples taken prior to and after finish rolling, and within the timeframe described in 4.06.03-8 supporting its position. No request for dispute resolution will be allowed for a density lot in which any core was not taken within the required 5 calendar days of placement. Should the dispute not be resolved through evaluation of existing testing data or procedures, the Engineer may authorize the Contractor to obtain a new core or set of core samples per disputed lot. The core samples must be extracted no later than seven calendar days from the date of the Engineer’s authorization. All such core samples shall be extracted and the core hole filled using the procedure outlined in 4.06.03-10.

a) Simple Average Lots: The Contractor may only dispute any simple average lot that is adjusted at or below 95 percent payment. The number and location (mat, joint, or structure) of the cores taken for dispute resolution must reflect the number and location of the original cores. The location of each core shall be randomly located within the respective original sub lot. The dispute resolution results shall be combined with the original results and averaged for determining the final in-place density value.

b) PWL Lots: The Contractor may dispute any PWL sublot when the PWL falls below 50% calculated in accordance with section 4.06.04.2.b. An additional random core in the sublot may be taken to validate the accuracy of the core in question.  The Department will verify the additional core test result and may average the original test result with the additional core result for purpose of calculating adjustments.

 **13. Corrective Work Procedure:**

 If pavement placed by the Contractor does not meet the specifications, and the Engineer requires its replacement or correction, the Contractor shall:

1. Propose a corrective procedure to the Engineer for review and approval prior to any corrective work commencing. The proposal shall include:
* Limits of pavement to be replaced or corrected, indicating stationing or other landmarks that are readily distinguishable.
* Proposed work schedule.
* Construction method and sequence of operations.
* Methods of maintenance and protection of traffic.
* Material sources.
* Names and telephone numbers of supervising personnel.
1. Any corrective courses placed as the final wearing surface shall match the specified lift thickness after completion.

 **14. Protection of the Work:** The Contractor shall protect all sections of the newly finished pavement from damage that may occur as a result of the Contractor’s operations for the duration of the Project.

 **15. Cut Bituminous Concrete Pavement**: Work under this item shall consist of making a straight-line cut in the bituminous concrete pavement to the lines delineated on the plans or as directed by the Engineer. The cut shall provide a straight, clean, vertical face with no cracking, tearing or breakage along the cut edge.

 **4.06.04—Method of Measurement:**

 **1. HMA S\* or PMA S\*:** Bituminous concrete will be measured for payment as the amount of material in tons placed as determined by the net weight on the delivered tickets and adjusted by area, thickness and weight as follows:

Quantity Adjustments**:** Adjustments may be applied to the placed bituminous concrete quantities that will be measured for payment using the following formulas:

**Yield Factor** for Adjustment Calculation = 0.0575 tons/SY/inch

**Actual Area (SY)** = [(Measured Length (ft)) x (Avg. of width measurements (ft))]÷9 s.f./SY

**Actual Thickness (t)** = Total tons delivered / [Actual Area (SY) x 0.0575 tons/SY/inch]

1. Area: If the average width exceeds the allowable tolerance, an adjustment will be made using the following formula. The tolerance for width is equal to the specified thickness (inch) of the lift being placed.

**Quantity Adjusted for Area (TA)** = [(L x Wadj)/9] x (t) x 0.0575 Tons/SY/inch = (-) tons

Where: L = Length (ft)

(t) = Actual thickness (inches)

Wadj = (Designed width (ft) + tolerance /12) - Measured Width)

1. Thickness: If the actual average thickness is less than the allowable tolerance, the Contractor shall submit a repair procedure to the Engineer for approval. If the actual thickness exceeds the allowable tolerance, an adjustment will be made using the following formula:

**Quantity Adjusted for Thickness (TT)** = A x tadj x 0.0575 = (-) tons

Where: A = Area = {[L x (Design width + tolerance (lift thickness)/12)] / 9}

tadj = Adjusted thickness = [(Dt + tolerance) - Actual thickness]

 Dt = Designed thickness (inches)

1. Weight: If the quantity of bituminous concrete representing the mixture delivered to the Project is in excess of the allowable gross vehicle weight (GVW) for each vehicle, an adjustment will be made using the following formula:

**Quantity Adjusted for Weight (TW)** = GVW – DGW= (-) tons

Where: DGW = Delivered gross weight as shown on the delivery ticket or measured on a certified scale

**2. Bituminous Concrete Adjustment Cost**:

1. Production Lot Adjustment: An adjustment may be applied to each production lot as follows:
	1. Non-PWL Production Lot (less than 3,500 tons):

 The adjustment values in Tables 4.06-6 and 4.06-7 will be calculated for each sub lot based on the Air Void (AV) and Asphalt Binder Content (PB) test results for that sub lot. The total adjustment for each day’s production (lot) will be computed as follows:

**Tons Adjusted for Superpave Design (TSD)** = [(AdjAVt + AdjPBt) / 100] x Tons

Where: AdjAVt: Percent adjustment for air voids

 AdjPBt: Percent adjustment for asphalt binder

 Tons: Weight of material (tons) in the lot adjusted by 4.06.4-1

 Percent Adjustment for Air Voids = AdjAVt = [AdjAV1 + AdjAV2 + AdjAVi + … + AdjAVn)] /n

Where: AdjAVt = Total percent air void adjustment value for the lot

AdjAVi = Adjustment value from Table 4.06-6 resulting from each sub lot or the average of the adjustment values resulting from multiple tests within a sub lot, as approved by the Engineer.

n = number of sub lots based on Table M.04.03-2

**TABLE 4.06-6: Adjustment Values for Air Voids**

|  |  |
| --- | --- |
| **Adjustment Value****(AdjAVi) (%)** | **S0.25, S0.375, S0.5, S1****Air Voids (AV)** |
| +2.5 | 3.8 - 4.2 |
| +3.125\*(AV-3) | 3.0 - 3.7 |
| -3.125\*(AV-5) | 4.3 – 5.0 |
| 20\*(AV-3) | 2.3 – 2.9 |
| -20\*(AV-5) | 5.1 – 5.7 |
| -20.0 | ≤ 2.2 or ≥ 5.8 |

Percent Adjustment for Asphalt Binder = AdjPBt = [(AdjPB1 + AdjPB2 + AdjPBi + … + AdjPBn)] /n

Where: AdjPBt= Total percent liquid binder adjustment value for the lot

AdjPBi = Adjustment value from Table 4.06-7 resulting from each sub lot

n = number of binder tests in a production lot

**TABLE 4.06-7: Adjustment Values for Binder Content**

|  |  |
| --- | --- |
| **Adjustment Value****(AdjAVi) (%)** | **S0.25, S0.375, S0.5, S1****Pb** |
| 0.0 | JMF Pb ± 0.3 |
| - 10.0 | ≤ JMF Pb - 0.4 or ≥ JMF Pb + 0.4 |

* 1. PWL Production Lot (3500 tons or more):

 For each lot, the adjustment values will be calculated using PWL methodology based on AV, VMA, and PB test results. The results will be considered as being normally distributed and all applicable equations in AASHTO R 9 and AASHTO R 42 Appendix X4 will apply.

 Only one test result will be considered for each sub lot. The specification limits are listed in M.04.

 For AV, PB, and voids in mineral aggregate (VMA), the individual material quantity characteristic adjustment (Adj) will be calculated as follows:

 For PWL between 50 and 90%: Adj(AVt or PBt or VMAt)= (55 + 0.5 PWL) - 100

 For PWL at and above 90%: Adj(AVt or PBt or VMAt)= (77.5 + 0.25 PWL) - 100

Where: AdjAVt = Total percent AV adjustment value for the lot

AdjPBt= Total percent PB adjustment value for the lot

AdjVMAt= Total percent VMA adjustment value for the lot

 A lot with PWL less than 50% in any of the 3 individual material quality characteristics will be evaluated under 1.06.04.

 The total adjustment for each production lot will be computed using the following formula:

**Tons Adjusted for Superpave Design (TSD)** = [(0.5AdjAVt + 0.25AdjPBt + 0.25 AdjVMAt) / 100] X Tons

Where Tons: Weight of material (tons) in the lot adjusted by 4.06.4-1

* 1. Partial Lots:

 Lots with less than 4 sub lots will be combined with the prior lot. If there is no prior lot with equivalent material or if the last test result of the prior lot is over 30 calendar days old, the adjustment will be calculated as indicated in 4.06.04-2.a)i.

 Lots with 4 or more sub lots will be calculated as indicated in 4.06.04-2.a)ii.

**Production Lot Adjustment: TSD x Unit Price = Est. (Pi)**

Where: Unit Price = Contract unit price per ton per type of mixture

Est. ( Pi)= Pay Unit in dollars representing incentive or disincentive per lot

1. Density Lot Adjustment: An adjustment may be applied to each density lot as follows:
2. Simple Average Density Lot (less than 3500 tons) and Bridge Lots:

The final lot quantity shall be the difference between the total payable tons for the Project and the sum of the previous lots. If either the Mat or Joint adjustment value is “remove and replace,” the density lot shall be removed and replaced (curb to curb).

 No positive adjustment will be applied to a density lot in which any core was not taken within the required 5 calendar days of placement.

**Tons Adjusted for Density (TD)** = [{(PAM x 0.50) + (PAJ x 0.50)} / 100] X Tons

Where: TD =Total tons adjusted for density for each lot

PAM = Mat density percent adjustment from Table 4.06-8

PAJ = Joint density percent adjustment from Table 4.06-9

 Tons: Weight of material (tons) in the lot adjusted by 4.06.4-1

**TABLE 4.06-8: Adjustment Values for Pavement Mat density**

|  |  |
| --- | --- |
| **Average Core Result** | **Percent Adjustment (Bridge and Non-Bridge) (1)(2)** |
| **Percent Mat Density** |
| 97.1 - 100 | -1.667\*(ACRPD-98.5) |
| 94.5 – 97.0 | +2.5 |
| 93.5 – 94.4 | +2.5\*(ACRPD-93.5) |
| 92.0 – 93.4 | 0 |
| 90.0 – 91.9 | -5\*(92-ACRPD) |
| 88.0 – 89.9 | -10\*(91-ACRPD) |
| 87.0 – 87.9 | -30 |
| 86.9 or less | Remove and Replace (curb to curb) |

**Notes:**

(1) ACRPD = Average Core Result Percent Density

(2) All Percent Adjustments to be rounded to the second decimal place; for example round 1.667 to 1.67.

**TABLE 4.06-9: Adjustment Values for Pavement Joint Density**

|  |  |
| --- | --- |
| **Average Core Result** | **Percent Adjustment (Bridge and Non-Bridge) (1)(2)** |
| **Percent Joint Density** |
| 97.1 – 100 | -1.667\*(ACRPD-98.5) |
| 93.5 – 97.0 | +2.5 |
| 92.0 – 93.4 | +1.667\*(ACRPD-92) |
| 91.0 – 91.9 | 0 |
| 89.0 – 90.9 | -7.5\*(91-ACRPD) |
| 88.0 – 88.9 | -15\*(90-ACRPD) |
| 87.0 – 87.9 | -30 |
| 86.9 or less | Remove and Replace (curb to curb) |

**Notes:**

(1) ACRPD = Average Core Result Percent Density

(2) All Percent Adjustments to be rounded to the second decimal place; for example round 1.667 to 1.67

Additionally, any sublot with a density result below 87% will be evaluated under 1.06.04.

1. PWL Density Lot (3,500 tons or more):

 For each lot, the adjustment values will be calculated using PWL methodology based on mat and joint density test results. Only one result will be included for each sublot. The results will be considered as being normally distributed and all applicable equations in AASHTO R 9 and AASHTO R 42 Appendix X4 will apply.

 The specification limits for the PWL determination are as follows:

Mat Density: 91.5-98%

Joint Density: 90-98%

 For mat and joint density, the individual percent adjustment (PA) will be calculated as follows:

 For PWL between 50 and 90%: PA (M or J)= 0.25 \* PWL – 22.50

 For PWL at and above 90%: PA (M or J)= 0.125 \* PWL – 11.25

Where: PAM = Total percent mat density adjustment value for the PWL mat density lot

PAJ= Total percent joint density adjustment value for the PWL joint density lot

No positive adjustment will be applied to a density lot in which any core was not taken within the required 5 calendar days of placement.

A lot with PWL less than 50% will be evaluated under 1.06.04.

The total adjustment for each PWL mat density lot will be computed as follows:

**Tons Adjusted for Mat Density (TMD)** = (PAM / 100) X Tons

Where: Tons= Weight of material (tons) in the lot adjusted by 4.06.4-1.

 The total adjustment for each PWL joint density lot will be computed as follows:

**Tons Adjusted for Joint Density (TJD)** = (PAJ / 100) X J\_Tons

Tons Adjusted for Joint Densitywill be calculated at the end of each project or project phase.

Where: $ J\\_Tons=Tons in project or phase adjusted by 4.06.4-1 x \frac{Lot joint length}{Joint length in project or phase}$

All bridge density lot adjustments will be evaluated in accordance with 4.06.04-2.b)i.

Additionally, any sublot with a density result below 87% will be evaluated under 1.06.04.

1. Partial Lots:

 Lots with less than 4 sub lots will be combined with the prior lot. If there is no prior lot with equivalent material and placement conditions or if the last test result of the prior lot is over 30 calendar days old, the mat and joint individual adjustments will be calculated in accordance to Tables 4.06-8 and 4.06-9. TMD and TJD will be calculated as indicated in 4.06.04-2.b)i.

 Lots with 4 or more sub lots will be calculated as indicated in 4.06.04-2.b)ii.

**Density Lot Adjustment (Simple Average Lots): TD x Unit Price = Est. (Di)**

**Density Lot Adjustment (PWL Lots): (TMD or TJD) x Unit Price = Est. (DMi or DJi)**

 Where: Unit Price = Contract unit price per ton per type of mixture

Est. (Di)= Pay Unit in dollars representing incentive or disincentive per simple average density lot

Est. (DMi)= Pay Unit in dollars representing incentive or disincentive per PWL mat lot

Est. (DJi)= Pay Unit in dollars representing incentive or disincentive per PWL joint lot

Additionally, any sublot with a density result below 87% will be evaluated under 1.06.04.

 **3.**  **Transitions for Roadway Surface:** The installation of permanent transitions will be measured under the appropriate item used in the formation of the transition.

 The quantity of material used for the installation of temporary transitions will be measured for payment under the appropriate item used in the formation of the transition. The installation and removal of a bond breaker and the removal and disposal of any temporary transition formed by milling or with bituminous concrete pavement is not measured for payment.

 **4. Cut Bituminous Concrete Pavement:** The quantity of bituminous concrete pavement cut will be measured in accordance with 2.02.04.

 **5. Material for Tack Coat:** The quantity of tack coat will be measured for payment by the number of gallons furnished and applied on the Project and approved by the Engineer. No tack coat material shall be included that is placed in excess of the tolerance described in 4.06.03.

a. Container Method – Material furnished in a container will be measured to the nearest 1/2 gallon. The volume will be determined by either measuring the volume in the original container by a method approved by the Engineer or using a separate graduated container capable of measuring the volume to the nearest 1/2 gallon. The container in which the material is furnished must include the description of material, including lot number or batch number and manufacturer or product source.

b. Vehicle Method

1. Measured by Weight: The number of gallons furnished will be determined by weighing the material on calibrated scales furnished by the Contractor. To convert weight to gallons, one of the following formulas will be used:

Tack Coat (gallons at 60°F) = Measured Weight (pounds) / Weight per gallon at 60°F

Tack Coat (gallons at 60°F) = 0.996 x Measured Weight (pounds) / Weight per gallon at 77°F

1. Measured by automated metering system on the delivery vehicle:

Tack Coat (gallons at 60°F) = 0.976 x Measured Volume (gallons).

 **6. Material Transfer Vehicle (MTV):** The furnishing and use of a MTV will be measured separately for payment based on the actual number of surface course tons delivered to a paver using the MTV.

 **4.06.05—Basis of Payment:**

**1. HMA S\* or PMA S\*:** The furnishing and placing of bituminous concrete will be paid for at the Contract unit price per ton for " HMA S\*" or " PMA S\*."

All costs associated with providing illumination of the work area are included in the general cost of the work.

 All costs associated with cleaning the surface to be paved, including mechanical sweeping, are included in the general cost of the work. All costs associated with constructing longitudinal joints are included in the general cost of the work.

 All costs associated with obtaining cores for acceptance testing and dispute resolution are included in the general cost of the work.

 **2. Bituminous Concrete Adjustment Costs**: This adjustment will be calculated using the formulas shown below if all of the measured adjustments in 4.06.04-2 are not equal to zero. A positive or negative adjustment will be applied to monies due the Contractor.

 **Production Lot: Ʃ Est (Pi) = Est. (P)**

 **Density Lot (Simple Average Lots): Ʃ Est (Di) = Est. (D)**

 **Density Lot (PWL): Ʃ Est (DMi) + Ʃ (DJi) = Est. (D)**

 **Bituminous Concrete Adjustment Cost= Est. (P) + Est. (D)**

Where: Est. ( )= Pay Unit in dollars representing incentive or disincentive in each production or density lot calculated in 4.06.04-2

 The Bituminous Concrete Adjustment Cost item, if included in the bid proposal or estimate, is not to be altered in any manner by the Bidder. If the Bidder should alter the amount shown, the altered figure will be disregarded and the original estimated cost will be used for the Contract.

 **3. Transitions for Roadway Surface:** The installation of permanent transitions will be paid under the appropriate item used in the formation of the transition. The quantity of material used for the installation of temporary transitions will be paid under the appropriate pay item used in the formation of the transition. The installation and removal of a bond breaker, and the removal and disposal of any temporary transition formed by milling or with bituminous concrete pavement is included in the general cost of the work.

 **4.** The cutting of bituminous concrete pavement will be paid in accordance with 2.02.05.

 **5.** Material for tack coat will be paid for at the Contract unit price per gallon at 60°F for "Material for Tack Coat."

 **6.** The Material Transfer Vehicle (MTV) will be paid at the Contract unit price per ton for "Material Transfer Vehicle."

 Pay Item Pay Unit

HMA S\* ton

PMA S\* ton

Bituminous Concrete Adjustment Cost est.

Material for Tack Coat gal.

Material Transfer Vehicle ton