

TABLE OF CONTENTS

DIVISION III
ROADWAY CONSTRUCTION

Section 304 – Constructing Density Control Strips

304.01 – Description B-2
304.02 – Materials B-2
304.03 – Equipment B-2
304.04 – Procedures B-2
305.05 – Tolerances B-2 – B-3
304.06 – Measurement and Payment B-25

Section 310 – Tack Coat

310.01 – Description B-3
310.02 – Materials B-3
310.03 – Procedures B-3 - B-4
310.04 – Measurement and Payment B-4

Section 311 – Prime Coat

311.01 – Description B-5
311.02 – Materials B-5
311.03 – Procedures B-5
311.04 – Measurement and Payment B-5

Section 315 – Asphalt Concrete Pavement (SUPERPAVE) (October 22, 2008)

315.01 – Description B-6
315.02 – Materials B-6
315.03 – Equipment B-6
315.04 – Placement Limitations B-7
315.05 – Procedures B-7 – B-15
315.06 – Pavement Samples B-15
315.07 – Pavement Tolerances B-15 – B-16
315.08 – Measurement and Payment B-16 – B-17

Section 317 – Stone Matrix Asphalt Concrete Pavement (October 27, 2007)

317.01 - Description B-18
317.02 - Materials B-18
317.03 - Composition of SMA Mixture B-18
317.04 - Acceptance B-18
317.05 - SMA Mixing Plant B-18
317.06 - Weather Restrictions B-18
317.07 - Placing and Finishing B-18
317.08 - Compaction B-19
317.09 - Trial Section B-19
317.10 - Prepaving Conference B-20
317.11- Measurement and Payment B-20

SPECIAL PROVISIONS

Special Provision for Trench Widening Asphalt Mixtures B-21 - B-22
BM-25.0(T), IM-19.0D(T) or IM-19.0A(T)

MEMORANDUM

Quality Hot Mix Asphalt Construction, Longitudinal Joint Construction and Application of Tack Coat for Plant Mix Schedules B-23 - B-34

SECTION 304--CONSTRUCTING DENSITY CONTROL STRIPS

304.01--Description.

This work shall consist of constructing control strips in accordance with the requirements of these specifications for the purpose of determining density requirements.

304.02--Materials.

Materials shall conform to the requirements for the material to be used in the course. Material used in each control strip shall be furnished from the same source and shall be of the same type as the material used in the test sections whose density requirements are established by the control strip.

304.03--Equipment.

Equipment shall be approved by the Engineer prior to use. The type and weight of compaction equipment shall be such that a uniform density is obtained throughout the depth of the layer of material being compacted. Control strips shall be compacted using equipment of the same type and weight to be used on the remainder of the course.

304.04--Procedures.

The subgrade or pavement structure course upon which a control strip is constructed shall be approved by the Engineer prior to construction of the control strip.

One control strip shall be constructed at the beginning of work on each roadway and shoulder course and each lift of each course. An additional control strip shall be constructed when a change is made in the type or source of material or whenever a significant change occurs in the composition of the material from the same source.

The project will be divided into "control strips" and "test sections" by the Engineer for the purpose of defining areas represented by each series of tests. The size of each control strip and test section will be in accordance with the requirements of VTM-10.

Control strips shall be constructed using the same procedure to be used in the construction of the remainder of the course. Rolling of the control strip shall be continued until no appreciable increase in density is obtained by additional roller coverages.

Upon completion of rolling, the mean density of the control strip will be based on 10 tests taken at randomly selected sites within the control strip area using a nuclear testing device. Compaction of the remainder of the course shall be governed by the density obtained in the control strip.

Each test section will be tested for required thickness. Areas that are deficient by more than the specified allowable tolerance shall be corrected in accordance with the applicable requirements of these specifications.

The Department may require an additional control strip after the completion of each 10 test sections.

Each control strip shall remain in place and become a section of the completed roadway.

304.05--Tolerances.

If the mean density of a test section (roadway or shoulder) does not conform to the applicable requirements stated herein, the Contractor shall continue his compactive effort or shall rework the entire test section until the required mean density is obtained. If an individual test value does not conform to the requirements stated herein, the Contractor shall continue his compactive effort or shall rework the entire area represented by that test until the required density is obtained.

(b) Shoulders:

1. **Aggregate shoulders:** The density of each test section of select or aggregate material used in the construction of shoulders will be evaluated based on the results of five tests performed at randomly selected sites within the test section. The mean density obtained for the five tests in each test section shall be within 95 ± 2 percent of the mean density obtained in the approved control strip. In addition, each individual test value obtained in a test section shall be within 95 ± 5 percent of the mean density obtained in the approved control strip.

2. **Asphalt shoulders:** The density of each test section of asphalt concrete used in the construction of shoulders will be evaluated based on the results of five tests performed at randomly selected sites within the test section. The mean density obtained for the five tests in each test section shall be at least 98 percent of the mean density obtained in the approved control strip. In addition, each individual test value obtained within a test section shall be at least 95 percent of the mean density obtained in the approved control strip.

304.06--Measurement and Payment.

This item is considered incidental to the cost of furnishing, placing, and compacting the specified course and will not be measured for payment. The cost of constructing density control strips shall be included in the cost of the material for which the control strip is required.

SECTION 310--TACK COAT (Oct. 25, 2007)

310.01--Description.

This work shall consist of preparing and treating an existing asphalt or concrete surface with asphalt in accordance with the requirements of these specifications and in reasonably close conformity with the lines shown on the plans or as established by the Engineer.

310.02--Materials.

Asphalt for tack coat shall be CRS-1, CRS-2, CRS-1h or CSS-1h and shall conform to the requirements of Section 210. CMS-2, conforming to the requirements of Section 210, may be used during the winter months. With the exception of CMS-2, asphalt for tack coat may be diluted with 50 percent water provided that resulting material produces a uniform application of the tack.

310.03--Procedures.

Equipment for heating and applying asphalt shall conform to the requirements of Section 314.04(b). The maximum application temperature of liquid asphalt shall conform to the requirements of Table III-1.

**TABLE III-1
Liquid Asphalt Application Temperature**

Grade	Max. Temperature (° F)
RC-70	180
RC-250	220
RC-800	225
RC-3000	290
MC-70	180
MC-250	220
MC-800	255
MC-3000	290
AC-5	300
AC-10	300
AC-20	300
AC-40	300
RS-2	175
SS-1h	180
AE-4	150
CRS-2	175
CSS-1h	180
CMS-2	200
CRS-1h	175

The existing surface shall be patched, cleaned, and rendered free from irregularities to the extent necessary to provide a reasonably smooth and uniform surface. Unstable corrugated areas shall be removed and replaced with suitable patching materials. The edges of existing pavements that are to be adjacent to new pavement shall be cleaned to permit adhesion of asphalt.

Tack material shall be uniformly applied with a pressure distributor conforming to the requirements of Section 314.04(b). Hand spray equipment shall not be used except in areas inaccessible by a pressure distributor. Undiluted asphalt shall be applied at the rate of 0.05 to 0.10 gallons per square yard. Diluted asphalt shall be applied at the rate of 0.10 to 0.15 gallons per square yard.

The tack coat shall be applied in a manner to offer the least inconvenience to traffic and permit one-way traffic without pickup or tracking of the asphalt.

The tack coat shall not be applied immediately prior to the course being placed. The tack coat shall be applied in accordance with the same weather limitations that apply to the course being placed. The quantity, rate of application, temperature, and areas to be treated shall be approved prior to application.

During the application of asphalt, care shall be taken to prevent spattering adjacent items. The distributor shall not be cleaned or discharged into ditches or borrow pits, onto shoulders, or along the right of way. When not in use, equipment shall be parked so that the spray bar or mechanism will not drip asphalt on the surface of the traveled way.

310.04--Measurement and Payment.

Tack coat, when a pay item, will be measured in liters and will be paid for at the contract unit price per liter. When not a pay item, the cost thereof shall be included in the price for other appropriate pay items.

Patching will be paid for at the contract unit price for the various items used unless a reconditioning item is included in the Contract.

Payment will be made under:

Pay Item	Pay Unit
Tack coat	Gallons

SECTION 311--PRIME COAT (Oct. 22, 2008)

311.01--Description.

This work shall consist of preparing and treating an existing surface with asphalt, and cover material if required, in accordance with the requirements of these specifications and in reasonably close conformity with the lines shown on the plans or as established by the Engineer.

311.02--Materials.

- (a) **Asphalt** may be changed one viscosity grade by the Engineer during construction at no change in the contract unit price. Asphalt shall conform to the applicable requirements of Section 210.
- (b) **Cover material** shall conform to the applicable requirements of Section 202 or 203. Lightweight aggregate shall conform to the requirements of Section 206. Cover material shall not be hauled directly from a washing plant for immediate use in the work.

311.03--Procedures.

The rates of application of materials shall be determined in accordance with the method described in Education Series No. 12 of the Asphalt Institute entitled *Asphalt Surface Treatments Construction Techniques*.

The weather limitations of Section 314.03 shall apply to asphalt prime coat work. When asphalt is to be used as a cover for cement stabilization or as a primer for asphalt concrete, the weather limitations specified for these particular operations shall apply.

Equipment for heating and applying asphalt and cover material shall conform to the requirements of Section 314.04. The maximum application temperature of the liquid asphalt shall conform to the requirements of Table III-1.

The surface to be primed shall be shaped to the required grade and section; rendered free from ruts, corrugations, segregated material, or other irregularities; and uniformly compacted.

Delays in priming may necessitate reprocessing or reshaping to provide a smooth compacted surface.

Asphalt shall be applied by means of a pressure distributor in a uniform continuous spread. When traffic is maintained, not more than 1/2 the width of the section shall be treated in one application. Care shall be taken that the application of asphalt at junctions of spreads is not in excess of the specified amount. Excess asphalt shall be removed from the surface by a squeegee. Skipped areas or deficiencies shall be corrected.

During the application of asphalt, care shall be taken to prevent spattering adjacent items. The distributor shall not be cleaned or discharged into ditches or borrow pits, onto shoulders, or along the right of way. When not in use, equipment shall be parked so that the spray bar or mechanism will not drip asphalt on the surface of the traveled way.

When traffic is maintained, one-way traffic shall be permitted on the untreated portion of the roadbed. When the asphalt has been absorbed by the treated surface and will not pick up, traffic shall be transferred to the treated portion and the remaining width of the section primed.

The quantity, rate of application, temperature, and areas to be treated shall be approved before application of the prime coat.

If after application of the prime coat the asphalt fails to penetrate within the time specified and the roadway must be used by traffic, cover material shall be spread at the Contractor's expense in an amount that will prevent pickup of the asphalt.

311.04--Measurement and Payment.

Prime coat will be measured and paid for at the contract unit price per gallon for asphalt and per ton for cover material, in accordance with the requirements of Section 313.

SECTION 315--ASPHALT CONCRETE PAVEMENT (December 3, 2009)

315.01--Description.

This work shall consist of constructing one or more courses of asphalt concrete on a prepared foundation in accordance with the requirements of these specifications and within the specified tolerances for the the lines, grades, thicknesses, and cross sections shown on the plans or as established by the Engineer. At the Contractor's option, Warm Mix Asphalt (WMA) additive or process may be used in lieu of the appropriate Hot mix Asphalt (HMA).

315.02--Materials.

- (a) **Asphalt concrete** shall conform to the requirements of Section 211. If SUPERPAVE design densities begin to exceed 98 percent of the theoretical maximum density during construction, the Contractor shall alter the design.
- (b) **Asphalt for tack coat and prime coat** shall conform to the requirements of Section 310. Asphalt may be changed one viscosity grade by the Engineer at no change in the contract unit price.
- (c) **Curb backup material** shall be asphalt concrete conforming to any surface or intermediate mixture listed in Table II-13 and II-14.
- (d) **Liquid asphalt coating (emulsion) for rumble strip** shall conform to the requirements of Section 210 of the Specifications. For centerline rumble strips, CSS-1h or CQS-1h conforming to Section 210 of the Specifications shall be used. The CSS-1h or CQS-1h may be diluted by up to 30 percent at the emulsion manufacturer's facility

315.03--Equipment.

- (a) **Hauling Equipment:** Trucks used for hauling asphalt mixtures shall have tight, clean, smooth metal or other non-absorptive/inert material bodies equipped with a positive locking metal tailgate. Surfaces in contact with asphalt mixtures shall be given a thin coat of an aliphatic hydrocarbon invert emulsion release agent (nonpuddling), a lime solution, or other material on the Department's list of approved release agents. Except where a nonpuddling release agent is used, the beds of dump trucks shall be raised to remove excess agent prior to loading. Only a nonpuddling agent shall be used in truck beds that do not dump. Each truck shall be equipped with a tarpaulin or other cover that will protect the mixture from moisture and foreign matter and prevent the rapid loss of heat during transportation.
- (b) **Asphalt Pavers:** The asphalt paver shall be designed and recommended by the manufacturer for the type of asphalt to be placed and shall be operated in accordance with the manufacturer's recommendations. Written recommendations pertaining to handling and placing of the mix shall be made readily available on the project site to the Engineer. In the absence of manufacturer's recommendations, the recommendations of the National Asphalt Pavement Association shall be followed. The paver (including when screed extensions are used) shall be capable of producing a smooth uniform texture, dense joints and a smooth riding surface.
- (c) **Rollers:** Rollers shall be steel wheel, static or vibratory, or pneumatic tire rollers and shall be capable of reversing without backlash. Rollers shall be operated at speeds slow enough to avoid displacement of the mixture. The number and mass of rollers shall be sufficient to compact the mixture to the required density while it is still in a workable condition. The use of equipment that results in excessive crushing of aggregate or marring of the pavement surface will not be permitted.

If, during construction, it is found that the equipment being used mars the surface to the extent that imperfections cannot satisfactorily be corrected or produces permanent blemishes, the use of the equipment shall be discontinued and it shall be replaced with satisfactory units.
- (d) **Rotary Saw:** A gasoline-powered rotary saw with a carbide blade shall be furnished for cutting test samples from the pavement. The Contractor shall furnish gasoline, oil, additional carbide blades, and maintenance for the rotary saw. The Contractor shall cool the pavement prior to sawing the sample. In lieu of a rotary saw, the Contractor may furnish the necessary equipment for coring and testing 4 inch core samples in accordance with the requirements of VTM-22.
- (e) **Material Transfer Vehicle (MTV):** When required in the contract, a MTV shall be a self-propelled storage unit capable of receiving material from trucks, storing the material and transferring the material from the unit to a paver hopper insert via a conveyor system. The required paver hopper

insert and unit shall have a combined minimum storage capacity of 15 tons. Prior to placing the asphalt material on the roadway surface, the storage unit or paver hopper insert must be able to remix the material in order to produce a uniform, non-segregated mix, having a uniform temperature.

315.04--Placement Limitations.

Asphalt concrete mixtures shall not be placed when weather or surface conditions are such that the material cannot be properly handled, finished or compacted. The surface upon which asphalt mixtures are to be placed shall be free of standing water, dirt, and mud and the base temperature shall conform to the following:

(a) **Warm Mix Asphalt (WMA):**

1. **When the base temperature is above 40 degrees F,** laydown will be permitted at any temperature below the maximum limits given in Section 211.08 of the Specifications.
2. **When the laydown temperature is between 301 °F and 325 °F,** the number of compaction rollers will be the same number as required for 300 °F or less.

(b) **Hot Mix Asphalt (HMA):**

1. **When the base temperature is above 80 °F,** mixture laydown will be permitted at any temperature conforming to the limits specified in Section 211 of the Specifications.
2. **When the base temperature is between 40 °F and 80 °F,** the Nomograph, Table III-2, shall be used to determine the minimum laydown temperature of the asphalt concrete mixes. At no time should the minimum base temperature for base (BM) and Intermediate (IM) mixes be less than 40 degrees. at no time should the minimum laydown temperature for base (BM) and intermediate (IM) mixes be less than 250 degrees F.

For surface mixes (SM), at no time should the minimum base and laydown temperature be less than the following:

PG Binder/Mix Designation	Percentage of Reclaimed Asphalt Minimum Base Temperature	Minimum Base Temperature	Minimum Placement Temperature
Pg 64-22 (A)	<=20%	40 °F	250 °F
Pg 64-22 (A)	> 20 %	50 °F	270 °F
Pg 70-22 (D)	<= 30%	50 °F	270 °F
Pg 76-22 (E)	<= 15 %	50 °F	290 °F
Pg 64-22 (S)	<= 30%	50 °F	290 °F

3. **When the laydown temperature is between 301 °F and 325 °F,** the number of compaction rollers will be the same number as required for 300 °F.

Intermediate and base courses which are placed at rates of application which exceed the application rates shown in Table III-2 shall conform to the requirements for the maximum application rate shown for 8 minute and 15 minute compaction rolling as per number of rollers used.

Should the Contractor be unable to complete the compaction rolling within the applicable 8 minute or 15 minute period, the placing of asphalt mixture shall either cease until sufficient rollers are utilized or other corrective action taken to complete the compaction rolling within the specified period.

Compaction rolling shall be completed prior to the mat cooling down to 175 °F. Finish rolling may be performed at lower mat temperature.

The final asphalt pavement finish course shall not be placed until construction pavement markings are no longer required.

315.05--Procedures.

- (a) **Base Course:** The subgrade or subbase shall be prepared as specified in Section 305. The course upon which the pavement is to be placed, including the area that will support the paving equipment, shall be graded and compacted to the required profile.
- (b) **Conditioning Existing Surface:** When the surface of the existing pavement or base is irregular, it shall be brought to a uniform grade and cross section as directed by the Engineer. The surface on which the asphalt concrete is to be applied shall be prepared in accordance with the requirements of the applicable specifications and shall be graded and compacted to the required profile and cross section.

When specified, prior to placement of asphalt concrete, longitudinal and transverse joints and cracks in hydraulic cement concrete shall be sealed by the application of an approved joint sealing compound.

Contact surfaces of curbing, gutters, manholes, and other structures projecting into or abutting the pavement and cold joints of asphalt shall be painted with a thick, uniform coating of asphalt prior to placement of asphalt mixture.

A tack or prime coat of asphalt will be required as specified below and shall conform to the applicable requirements of Section 310 and Section 311 of the Specifications. Asphalt classed as cutbacks or emulsions shall be applied ahead of the paving operations, and the time interval between applying and placing the pavement mixture shall be sufficient to ensure a tacky residue providing maximum adhesion of the paving mixture to the base. The mixture shall not be placed on tack or prime coats that have been damaged by traffic or contaminated by foreign material. traffic shall be excluded from such sections.

1. Priming and Tacking:

- a. **Priming aggregate base or subbase:** Unless otherwise specified in the contract documents, priming with asphalt materials will not be required on aggregate subbase or base materials prior to the placement of asphalt base, intermediate or surface layers.
- b. **Tacking:** Application of tack at joints, adjacent to curbs, gutters, or other appurtenances shall be applied with a hand wand or spray bar at the rate of 0.2 gallons per square yard. At joints, the tack applied by the hand wand or a spray bar shall be 2 feet in width with 4 to 6 inches protruding beyond the joint for the first pass. Tack for the adjacent pass shall completely cover the vertical face of the mat edge, so that slight puddling of asphalt occurs at the joint, and extends a minimum of 1 foot into the lane to be paved.

Milled faces that are to remain in place shall be tacked in the same way for the adjacent pass. Use of tack at longitudinal joint vertical faces of longitudinal joints will not be required when paving in echelon.

On rich sections or those that have been repaired by the extensive use of asphalt patching mixtures, the tack coat shall be eliminated when directed by the Engineer.

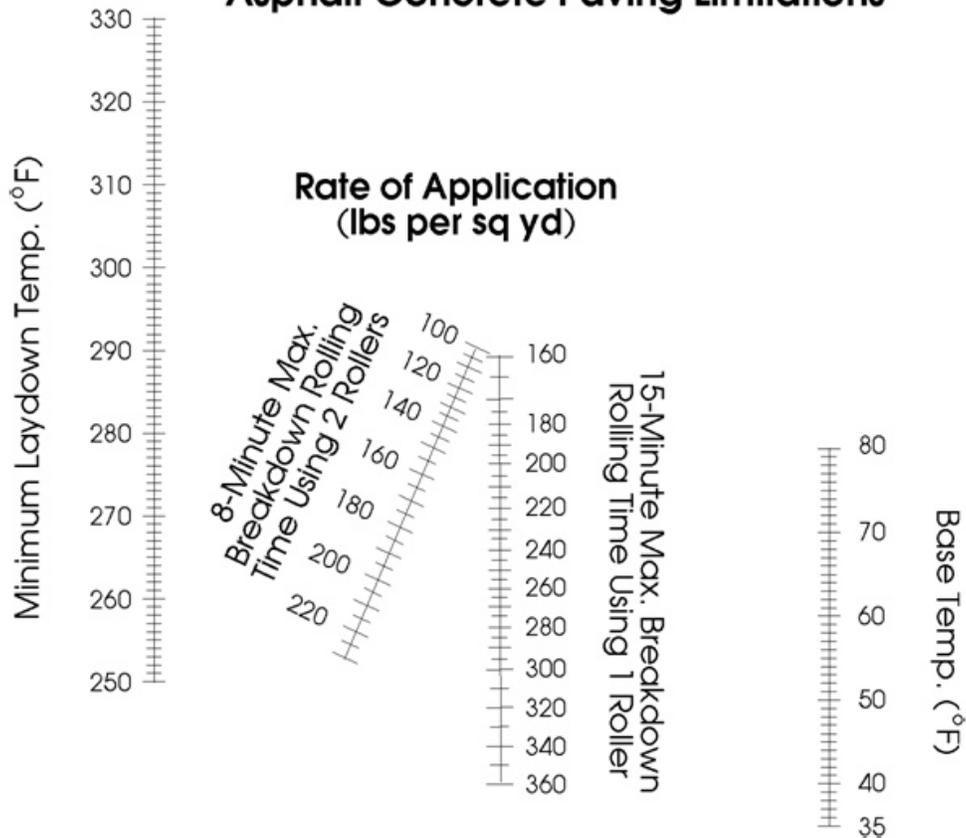
Tack shall not be required atop asphalt stabilized open-graded material drainage layers.

Tack shall be applied between the existing asphalt surface and each asphalt course placed thereafter.

- 2. **Removing depressions and elevating curves:** Where irregularities in the existing surface will result in a course more than 3 inches in thickness after compaction, the surface shall be brought to a uniform profile by patching with asphalt concrete and thoroughly tamping or rolling until it conforms with the surrounding surface. The mixture used shall be the same as that specified for the course to be placed.

When the Contractor elects to conduct operations to eliminate depressions, elevate curves, and place the surface course simultaneously, he shall furnish such additional spreading and compacting equipment as required to maintain the proper interval between the operations.

TABLE III-2
Cold Weather Paving Limitations
Asphalt Concrete Paving Limitations



- (c) **Placing and Finishing:** Asphalt concrete shall not be placed until the surface upon which it is to be placed has been approved by the Engineer.

A continuous line to mark the edge of the pavement and provide proper control of pavement width and horizontal will not be required for this project.

An asphalt paver shall be used to distribute asphalt concrete over the widest pavement width practicable. Wherever practicable and when the capacity of sustained production and delivery is such that more than one paver can be operated, pavers shall be used in echelon to place the wearing course in adjacent lanes. Crossovers, as well as areas containing manholes or other obstacles that prohibit the practical use of mechanical spreading and finishing equipment, may be constructed using hand tools. However, care shall be taken to obtain the required thickness, jointing, compaction, and surface smoothness.

Prior to application of tack coat and commencement of paving operations the Contractor shall clean the existing pavement surface of all accumulated dust, mud, or other debris that may affect the bond of the new overlay, as determined by the Engineer. The Contractor shall ensure the surface remains clean until commencement of paving operations. The cost for cleaning and surface preparation shall be in the bid price for hot mix asphalt concrete.

When required in a Schedule, an MTV shall be used during the placement of designaed asphalt mixes on full lane width applications.

The longitudinal joint in one layer shall offset that in the layer immediately below by approximately 6 inches. However, the joint in the wearing surface shall be at the centerline of the pavement if the roadway comprises two traffic lanes or lane lines if the roadway is more than two lanes in width. Offsetting layers will not be required when adjoining lanes are paved in echelon and the rolling of both lanes occurs within 15 minutes after laydown.

The Contractor shall have a certified Asphalt Field Technician present during paving operations where more than 100 tons of material is placed in a single location. Immediately after placement and screeding, the surface and edges of each layer shall be inspected and straightened by the technician and necessary corrections performed prior to compaction. The finished pavement shall be uniform and smooth.

The placement of asphalt concrete shall be as continuous as possible and shall be scheduled such that the interruption occurring at the completion of each day's work will not detrimentally affect the partially completed work. Material that cannot be spread and finished in daylight shall not be dispatched from the plant unless the use of artificial lighting has been approved. When paving is performed at night, sufficient light shall be provided to properly perform and thoroughly inspect every phase of the operation. Such phases include cleaning planed surfaces, applying tack, paving, compacting, and testing. Lighting shall be provided and positioned such as to not create a blinding hazard to the traveling public.

During compaction of asphalt concrete, the roller shall not pass over the end of freshly placed material except when a construction joint is to be formed. Edges shall be finished true and uniform.

Asphalt concrete SUPERPAVE pavement courses shall be placed in layers not exceeding 4.0 times the nominal maximum size aggregate in the asphalt mixture. The maximum thickness may be reduced if the mixture cannot be adequately placed in a single lift and compacted to required uniform density and smoothness. The minimum thickness for a pavement course shall be no less than 2.5 times the nominal maximum size aggregate in the asphalt mixture. Nominal maximum size aggregate for each mix shall be defined as one sieve size larger than the first sieve to retain more than 10 percent aggregate as shown in the design range specified in Section 211.03, Table II-13. Base courses to be placed in irregular shaped areas of pavement, such as transitions, turn lanes, crossovers, and entrances may be placed in a single lift.

Overlays in excess of 165 pounds per square yard or a milled depth greater than 1 ½ inches shall be squared up at the completion of each day's work.

The milled roadway areas that are to be opened to traffic, excluding curb and gutter sections, shall have drainage outlets cut through the shoulders at locations designated by the Engineer. The Contractor shall plan and prosecute the milling operation to avoid trapping of water on the roadway. Drainage outlets shall be restored to original grade, unless otherwise directed by the Engineer. The cost for cutting and restoring the drainage slots in the roadway shoulder shall be included in the price bid for other items of work.

The Contractor shall plan and prosecute a schedule of operations so that milled roadways will be overlaid with asphalt concrete as soon as possible, and, in no instance, shall the time lapse exceed 10 days after the milling operations, unless otherwise specified. The milled areas of the roadway shall be kept free of irregularities and obstructions that may create a hazard or annoyance to traffic in accordance with the requirements of Section 104.

A short ski or shoe shall be used to match the grade of the newly overlaid adjacent travel lane on all primary, interstate and designated secondary routes. Unless otherwise directed by the Engineer a nine 24 foot minimum automatic grade control ski shall be used on all asphalt mixtures on all divided highways, with the exception of less than full width overlays and the first course of asphalt base mixtures over aggregate subbases. Care shall be exercised when working along curb and gutter sections to ensure a uniformed grade and joint.

The Contractor shall construct the final riding surface to tie into the existing surface by an approved method, which shall include the cutting of a notch into the pavement. In addition to notching, the Contractor may use an asphalt design containing a fine graded mix to achieve a smooth transition from the new asphalt concrete overlay to the existing pavement, with the approval of the Engineer. The

material shall be of a type to insure that raveling will not occur. All cost for constructing tie-ins in the asphalt concrete overlay shall be included in the price bid for asphalt concrete.

- (d) **Compacting:** Immediately after the asphalt mixture is placed and struck off and surface irregularities are corrected, the mixture shall be thoroughly and uniformly compacted by rolling.

The surface shall be rolled when the mixture is in the proper condition. Rolling shall not cause undue displacement, cracking, or shoving.

The number, mass, and type of rollers furnished shall be sufficient to obtain the required compaction while the mixture is in a workable condition. The sequence of rolling operations and the selection of roller types shall provide the specified pavement density.

Immediately after the hot mixture is placed, it shall be sealed with rollers. Thereafter, rolling shall be a continuous process, insofar as practicable, and all parts of the pavement shall receive uniform compaction.

Rolling shall begin at the sides and proceed longitudinally parallel to the center of the pavement, each trip overlapping at least 6 inches, gradually progressing to the crown of the pavement. When abutting a previously placed lane, rolling shall begin at the outside unconfined side and proceed toward the previously placed lane. On superelevated curves, rolling shall begin at the low side and proceed to the high side by overlapping of longitudinal trips parallel with the centerline.

Displacements occurring as a result of reversing the direction of a roller, or from other causes, shall be corrected at once by the use of rakes or lutes and addition of fresh mixture when required. Care shall be taken in rolling not to displace the line and grade of the edges of the asphalt mixture.

To prevent adhesion of the mixture to the rollers, the wheels shall be kept properly moistened with water or water mixed with a very small quantity of detergent or other approved material. Excess liquid will not be permitted.

Along forms, curbs, headers, walls, and other places not accessible to rollers, the mixture shall be thoroughly compacted with hot hand tampers, smoothing irons, or mechanical tampers. On depressed areas, a trench roller may be used or cleated compression strips may be used under the roller to transmit compression to the depressed area.

Edges of asphalt pavement surfaces shall be true curves or tangents. Irregularities shall be corrected.

The surface of the compacted course shall be protected until the material has cooled sufficiently to support normal traffic without marring.

- (e) **Density:** Density shall be determined in accordance with the following:

1. The Contractor shall perform roller pattern and control strip density testing on surface, intermediate and base courses in accordance with the requirements of VTM-76. The contractor shall have a certified Asphalt Field Technician perform all density testing.

Density shall be determined by the backscatter method of testing using a thin-lift nuclear gage with printer, conforming to the requirements of VTM-81. All density test locations for control strips and test sections shall be marked and labeled in accordance with the requirements of VTM-76. The Contractor shall furnish and operate the nuclear gage, which shall have been calibrated within the previous 12 months by an approved calibration service. In addition, the Contractor shall maintain documentation of such calibration service for a 12 month period.

The required density of the compacted course shall be no less than 98.0 percent and not more than 102.0 percent of the target control strip density.

Nuclear density roller pattern and control strip density testing shall be performed on asphalt concrete overlays placed directly on surface treatment roadways and when overlays are placed at an application rate less than 125 pounds per square yard (based on 110 pounds per square yard per inch) on any surface. In these situations, sawed plugs or core samples will not be required and the minimum control strip densities as shown in Table III-3 will be waived. The required density of the compacted course shall not be less than 98.0 percent and not more than 102.0 percent of the target control strip.

**TABLE III-3
Density Requirements**

Mixture Type	Min. Control Strip Density (%)
SM-9.5A, 12.5A	92.5
SM-9.5D, 12.5D	92.2
SM-9.5E, 12.5E	92.2
IM-19.0A, IM-19.0D, IM-19.0E	92.2
BM-25.0A, BM-25.0D	92.2

Note: The control strip density requirement is the percentage of theoretical maximum density of the job-mix formula by Superpave Mix Design or as established by the Engineer based on two or more production maximum theoretical density tests.

The project will be divided into “control strips” and “test sections” by the Engineer for the purpose of defining areas represented by each series of tests.

- a. **Control Strip:** Construction of control strips shall be accomplished in accordance with the requirements of these specifications and VTM-76.

The term *control strip density* is defined as the average of 10 nuclear determinations selected at stratified random locations within the control strip.

One control strip shall be constructed at the beginning of work on each roadway and shoulder course and on each lift of each course. An additional control strip shall be constructed when a change is made in the type or source of materials, or whenever a significant change occurs in the composition of the materials being placed from the same source or when there is a failing control strip. During the evaluation of the initial control strip paving operations may continue. However, paving and production shall be discontinued during construction and evaluation of additional control strips. In the event that two consecutive control strips fail, subsequent paving operations shall cease until corrective action(s) has been made with the approval of the Engineer. If it is determined with the Engineer’s approval that the density cannot be obtained because of the condition of the existing pavement structure, the target control strip density shall be determined from the roller pattern that achieves the optimum density and shall be used on the remainder of the roadway that exhibits similar pavement conditions.

Either the Department or Contractor may initiate an additional control strip at any time.

The length of the control strip shall be approximately 300 feet regardless of the width of the course being placed. On the first day of construction or beginning of a new course, the control strip shall be started between 500 and 1000 feet from the beginning of the paving operation. The control strip shall be constructed using the same paving, rolling equipment, procedures and thickness as shall be used on the remainder of the course being placed.

One nuclear reading shall be taken at each of 10 stratified random locations. No determination shall be made within 12 inches of the edge of any application width for surface and intermediate mixes, nor within 18 inches of the edge of any application width for base mixes. The average of these 10 determinations shall be the Control Strip Density recorded to the nearest 0.1 pound per cubic foot. The minimum Control Strip Density shall be determined in accordance with the requirements of VTM-76.

The control strip shall be considered a lot. If the control strip density conforms to the requirements of Table III-3, the control strip will be acceptable and the control strip density shall become the target control strip density. If the density does not conform to the requirements of Table III-3, the tonnage placed in the control strip will be paid for in accordance with Table III-4 on the basis of the percentage of the Table III-3 value achieved. The Contractor shall take corrective action(s) to meet the density requirement specified in Table III-3.

TABLE III-4
Payment Schedule for Lot Densities

% of Target Control Strip Density	% of Payment
Greater than 102.0	95
98.0 to 102.0	100
97.0 to less than 98.0	95
96.0 to less than 97.0	90
Less than 96.0	75

- b. **Test section (lot):** For the purposes of acceptance, each day's production shall be divided into lots (test section). The standard size of a lot shall consist of 5,000 linear feet of any pass made by the paving train regardless of the width of the pass or the thickness of the course. Pavers traveling in echelon will be considered as two passes. Each lot shall be divided into five sublots of equal length. When a partial lot occurs at the end of a day's production or upon completion of the project, the lot size shall be redefined as follows: If the partial lot contains one or two sublots, the sublots will be added to the previous lot. If the partial lot contains three or four sublots, the partial lot will be redefined to be an entire lot. Each lot shall be tested for density by taking a nuclear density reading from two random locations selected by the Engineer within each subplot. Readings shall not be taken within 12 inches of the edge of any application width for surface or base mixes, nor within 18 inches of the edge of any application width for base mixes. The average of the subplot nuclear density readings will be compared to the target nuclear control strip density to determine the acceptability of the lot. Once the average nuclear density of the lot has been determined, the Contractor will not be permitted to provide additional compaction to raise the average. If two consecutive sublots produce nuclear density results less than 98 or greater than 102 percent of the target nuclear control strip density, the Contractor shall immediately notify the Engineer and institute corrective action. By the end of the day's operations, the Contractor shall furnish the test data developed during the day's paving to the Engineer.

The tonnage of each lot will be based on the lot's width and length and the mixture application rate as designated in the Contract or as revised by the Engineer. Payment will be made in accordance with the requirements of Table III-4.

The Engineer at any time on any project may perform Lot Density Verification testing. Lot Density Verification can be performed by either using a nuclear gage or plugs. The Contractor shall be responsible for taking plugs for testing. Testing of the plugs shall be done by or in the presence of the Department.

Surface, Intermediate, and Base mixes:

When a nuclear gage is used, the Department shall take 10 stratified random readings per lot. If, based on the average of the 10 readings, the density does not meet the requirement for 100 percent pay or the same pay percentage determined by the Contractor's testing for that lot, the Department will read the 10 Contractor sites then average all 20 sites together. If the density still does not conform to the requirements for 100 percent pay, payment for that lot shall be in accordance with Table III-4 on the basis of the Department's 20 test results. If the Contractor questions the payment for the lot, the Contractor can request the referee procedure.

The referee procedure shall consist of taking 5 plugs from the 5 sites closest to the average of the Department readings of the Contractor and Department sites. The density of the plugs shall be determined. If the average density of the plugs does not conform to the requirements for 100 percent pay for the lot in question, payment for that lot shall be in accordance with Table III-4 on the basis of the percentage of the Table III-3 value achieved.

When plugs are used for Lot Density Verification, 5 plugs shall be taken per lot. If the density of the plugs does not conform to the requirements for the lot in question, payment for that lot shall be in accordance with Table III-4 on the basis of the percentage of the Table III-3 value achieved.

- (e) **Surface, intermediate and base courses** not having a sufficient quantity of material to run a nuclear density roller pattern and control strip shall be compacted to a minimum density of 91.5 percent of the theoretical maximum density as determined in accordance with the requirements of VTM-22. The Contractor shall be responsible for cutting cores or plugs for testing by the Department. If the density is less than 91.5 percent, payment will be made in accordance with the requirements of Table III-5.

For asphalt patching, the minimum density of 91.5 percent maximum theoretical density will be determined in accordance with the requirements of VTM-22. The Contractor shall be responsible for cutting cores or sawing plugs. One set of plugs/cores shall be obtained within the first 20 tons of patching material and every 500 tons thereafter for testing by the Contractor or the Department. Core/plug locations shall be randomly selected. If the density is less than the 91.5 percent, payment will be made in accordance with the requirements of Table III-5.

Table III-5	
Payment Schedule for Surface, Intermediate and Base Courses (Not sufficient quantity to perform nuclear density roller pattern and control strip)	
% Theoretical Maximum Density	% of Payment
Greater than or equal to 91.5	100
90.2-91.4	95
88.3-90.1	90
Less than 88.2	75

Any section in which a mixture (i.e. SM-9.0) is being placed at an application rate of less than 125 pounds per square yard, based on 110 pounds per square yard per inch, that does not have a sufficient quantity of material for a nuclear density roller pattern and control strip shall be compacted by rolling a minimum of three passes with a minimum 8 ton roller. No density testing will be required.

- (f) **Joints:** Transverse joints shall be formed by cutting back on the previous run to expose the full depth of the course. A coat of asphalt shall be applied to contact surfaces of transverse joints just before additional mixture is placed against the previously rolled material.

Joints adjacent to curbs, gutters, or adjoining pavement shall be formed by hand placing sufficient mixture to fill any space left uncovered by the paver. The joint shall then be set up with rakes or lutes to a height sufficient to receive full compression under the rollers.

- (g) **Rumble strips:** This work shall consist of constructing rumble strips on mainline shoulders of highways by cutting 1/2 -inch-deep concave depressions into existing asphalt concrete surfaces as shown on the detail drawings and as directed by the Engineer.

Rumble strips shall be installed in accordance with detail drawings for rumble strips (asphalt shoulder). The depressions shall have a concave circular shape with minimum 1/2-inch depth at center and maximum 5/8-inch allowable depth at center. Depressions shall have as smooth finish with a maximum 1/16-inch variance between peaks and valleys of the depression.

Prior to beginning production work on mainline shoulders, the Contractor shall demonstrate to the Engineer the ability to achieve the desired surface regarding alignment, consistency, and conformity with these specifications and the plans. The test site shall be approximately 25 feet longitudinally at a site mutually agreed upon by the Contractor and Engineer.

Following cutting and cleaning of the depressions of waste material, the entire rumble strip area shall be coated with liquid asphalt coating (emulsion) using a pressure distributor. For rumble strips installed on the shoulder, the approximate application rate shall be 0.1 gallon per square yard. For rumble strips installed in a new asphalt concrete surface (new construction or overlay) along the centerline, no sealing of the rumble strip area shall be performed. When the rumble strip is installed along the centerline in an existing asphalt concrete (i.e. more than one year since placement), the approximate application rate shall be 0.05 gallons per square yard. The application temperature shall be between 160 degrees F and 180 degrees F. For shoulder rumble strips only, overspray shall not extend more than 2 inches beyond the width of the cut depressions and/or shall not come in contact with pavement markings.

Rumble strips shall not be installed on shoulders of bridge decks, in acceleration /deceleration lanes, on surface drainage structures, or in other areas identified by the Engineer.

Waste material resulting from the operation shall be removed from the paved surface and shall not be disposed of where waterways may be at risk of contamination.

- (h) **Saw-cut Asphalt Pavement:** This work shall consist of saw-cutting the existing asphalt pavement to a depth shown on the plans and as directed by the Engineer.

315.06--Pavement Samples.

The Contractor shall cut samples from the compacted pavement for testing by the Department. Samples shall be taken for the full depth of the course at the locations selected by the Engineer. The removed pavement shall be replaced with new mixture and refinished. No additional compensation will be allowed for furnishing test samples and reconstructing areas from which they were taken.

315.07--Pavement Tolerances.

- (a) **Surface Tolerance:** The surface will be tested by using a 10-foot straight edge. The variation of the surface from the testing edge of the straightedge between any two contacts with the surface shall be not more than 1/4 inch. Humps and depressions exceeding the specified tolerance shall be corrected, or the defective work shall be removed and replaced with new material.
- (b) **Finished Grade Tolerance:** After placement of the final pavement layer, finished grade elevations shall be within ± 0.04 foot of the elevations indicated in the plans, unless otherwise specified, provided that the actual cross slope does not vary more than 0.20 percent from the design cross slope indicated in the plans and the pavement thickness conforms to the thickness tolerances specified herein.

If determined by the Engineer that either the finished grade elevations or cross slope exceed the tolerances specified, the Contractor shall submit to the Engineer for approval a plan of corrective action.

- (c) **Thickness Tolerance:** The thickness of the base course will be determined by the measurement of cores as described in VTM-32B.

Acceptance of asphalt concrete base for depth will be based on the mean result of measurements of samples taken from each lot of material placed. A *lot* of material is defined as the quantity being tested for acceptance except that the maximum lot size will be 1 mile of 24-foot-width base course.

A lot will be considered acceptable for depth if the mean result of the tests is within the following tolerance of the plan depth for the number of tests taken except that each individual test shall be within ± 0.60 inch of the plan depth: mean of two tests, ± 0.45 inch; mean of three tests, ± 0.35 inch; mean of four tests, ± 0.30 inch.

If an individual depth test exceeds the ± 0.60 -inch tolerance, that portion of the lot represented by the test will be excluded from the lot. If an individual test result indicates that the depth of material represented by the test is more than 0.60 inch, the Contractor will not be paid for that material in excess of the tolerance throughout the length and width represented by the test. If an individual test result indicates that the depth of the material represented by the test is deficient by more than 0.60 inch, correction of the base course represented by the test shall be made as specified hereinafter.

If the mean depth of a lot of material is excessive, the Contractor will not be paid for that material in excess of the tolerance throughout the length and width represented by the tests.

If the mean depth of a lot of material is deficient by more than the allowable tolerance, correction will not normally be required and the Contractor will be paid for the quantity of material that has been placed in the lot.

For excessive depth base courses, the rate of deduction from the tonnage allowed for payment as base course will be calculated at a weight of 115 pounds per square yard per inch of depth in excess of the tolerance. For sections of base course that are deficient in depth by more than 0.60 inch and less than 1.50 inch, the Contractor shall furnish and place material specified for the subsequent course to bring the base course depth within the tolerance. This material will be measured on the basis of tonnage actually placed, determined from weigh tickets, and paid for at the contract unit price for the base course material. Such material shall be placed in a separate course. If the deficiency is more than 1.50 inches, the Contractor shall furnish and place base course material to bring the base course thickness within the tolerance. Corrections for deficient base course depth shall be made in a manner to provide a finished pavement that is smooth and uniform.

When the Contract provides for the construction or reconstruction of the entire pavement structure, the surface and intermediate courses shall be placed at the rate of application shown on the plans within an allowable tolerance of ± 5 percent of the specified application rate for application rates of 100 pounds per square yard or greater and within 5 pounds per square yard for application rates of less than 100 pounds per square yard. The amount of material exceeding the allowable tolerance will be deducted from the pay quantities.

When the Contract provides for the placement of surface or intermediate courses over existing pavement, over pavements constructed between combination curb and gutter, or in the construction or reconstruction of shoulders, such courses shall be placed at the approximate rate of application shown on the plans. However, the specified rate of application shall be altered where necessary to produce the required riding quality.

315.08—Measurement and Payment

Asphalt concrete base will be measured in tons and paid for at the contract unit price per ton. This price shall include preparing and shaping the subgrade or subbase, constructing and finishing shoulders and ditches, and removing and replacing unstable subgrade or subbase.

Asphalt concrete will be measured in tons and paid for at the contract unit price per ton. Net weight information shall be furnished with each load of material delivered in accordance with the requirements of Section 211. Batch weights will not be permitted as a method of measurement unless the Contractor's plant is equipped in accordance with the requirements of Section 211, in which case the cumulative weight of the batches will be used for payment.

Asphalt used in the mixtures, when a pay item, will be measured in tons in accordance with the requirements of Section 109.01 except that transporting vehicles shall be tared prior to each load. The weight shall be adjusted in accordance with the percentage of asphalt indicated by laboratory extractions.

Tack coat shall be included in the price for other appropriate pay items.

Asphalt curb backup material will be measured in tons and will be paid for at the contract unit price per ton. This price shall include placing, tamping, and compacting.

Liquid asphalt cement, when a pay item, will be measured in tons and will be paid for at the contract unit price per ton.

Rumble strips will be measured and paid for in linear feet of shoulder where the rumble strips are actually placed and accepted, excluding the test site. This distance will be measured longitudinally along the edge of pavement with deductions for bridge decks, acceleration/deceleration lanes, surface drainage structures, and other sections where the rumble strips are not installed. This price shall be full compensation for application; disposal of waste material; and all labor, tools, equipment, and incidentals necessary to complete the work. The test site will not be measured for payment but shall be included in the unit price for rumble strip.

Liquid asphalt coating (rumble strips) will be measured and paid for in square yards as described herein. This price shall be full compensation for cleaning rumble strips prior to application of the coating; furnishing and applying coating as specified herein; and all labor, tools, equipment, and incidentals necessary to complete the work.

Saw-cut asphalt concrete pavement will be measured in linear feet for the depth specified and will be paid for at the contract unit price per foot, which price shall be full compensation for saw-cutting the asphalt pavement to the depth specified.

Material Transfer Vehicle (MTV), when required in the contract, will not be measured for separate payment. The cost for furnishing and operating the MTV shall be included in the price bid for other appropriate items.

Warm Mix Asphalt (WMA) additive or process will not be measured for separate payment, the cost of which, shall be included in the price bid for other appropriate items.

These prices shall include heat stabilization additive, furnishing samples, and maintaining traffic.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Asphalt concrete base course (Type)	Ton
Asphalt concrete (Type) (Class)	Ton
Asphalt concrete curb backup material	Ton
Liquid asphalt cement	Ton
Rumble strip (Asphalt)	Linear foot
Liquid asphalt coating (Rumble strips)	Square yard
Saw-cut asphalt concrete (depth)	Linear foot

SECTION 317 - STONE MATRIX ASPHALT CONCRETE PAVEMENT (Oct. 2, 2008)

317.01—Description

This specification covers the furnishing, installation, and acceptance criteria for stone matrix asphalt (SMA) concrete pavement.

317.02—Materials

- (a) **Coarse aggregate** shall conform to the requirements of Section 248.02(a):
- (b) **Fine aggregate** shall conform to the requirements of Section 248.02(b).
- (c) **Asphalt binder** shall conform to the requirements of Section 248.02(c).
- (d) **Mineral filler** shall conform to the requirements of Section 248.02(d).
- (e) **Fiber additive** shall conform to the requirements of Section 248.02(e).

317.03—Composition of SMA Mixture

This section shall conform to the requirements of Section 248.

317.04—Acceptance

This section shall conform to the requirements of Section 248.

317.05—SMA Mixing Plant

- (a) **Mineral filler** handling shall be in accordance with the requirements of Section 248.05(a).
- (b) **Fiber addition** shall be in accordance with the requirements of Section 248.05(b).
- (c) **Hot-mixture** storage shall conform to the requirements of Section 248.05(c).
- (d) **Mixing temperatures** shall conform to the requirements of Section 248.05(d).

317.06—Weather Restrictions

SMA mixture shall be placed only when the ambient and surface temperatures are 50 degrees F or above.

317.07—Placing and Finishing

For mixtures containing PG 70-22, the mixture temperature shall not be less than 300 degrees F in the truck and less than 290 degrees F immediately behind the screed. For mixtures containing PG 76-22, the mixture in the truck and immediately behind the screed shall not be less than the minimum compaction temperature provided by the liquid supplier for mixtures.

A continuous paving operation that provides for constant steady movement of the paver shall be maintained. In the event that excessive stop and go of the paver is occurring, production and laydown of the mixture shall be stopped until the Contractor has made satisfactory changes in the production, hauling, and placement operations resulting in a constant steady movement of the paver.

A Material Transfer Vehicle (MTV) shall be used during the placement of SMA mixes. The paving operation shall have remixing capability in either the MTV or a paver-mounted hopper to produce uniform, nonsegregated mix with uniform temperature. The MTV and paver combination shall have a minimum storage capacity of 15 tons. In the event of a break down, paving shall be discontinued and no more material shall be shipped from the hot-mix plant.

317.08—Compaction

Immediately after the mixture has been spread and struck off, it shall be thoroughly and uniformly compacted by rolling. Rolling shall be accomplished with steel wheel roller(s) with a minimum weight of 10 tons. A minimum of three rollers shall be available at all times for compaction and/or finish rolling.

To minimize coarse aggregate fracture/breakage in the aggregate skeleton of SMA mixes, the use of vibratory rollers on SMA should be approached with caution. If a vibratory roller is used, the mat shall receive not more than three vibratory passes. The roller shall use only the highest frequency and lowest amplitude setting.

Rolling procedures shall be adjusted to provide the specified pavement density. Rollers shall move at a uniform speed not to exceed 3 mph with the drive wheel nearest the paver. Rolling shall be continued until all roller marks are eliminated and the minimum density has been obtained. The Contractor shall monitor density during the compaction process by use of nuclear density gages to ensure that the minimum required compaction is being obtained. During the trial section, The Department will randomly select 3 plugs or cores locations to determine the in-place density in accordance to VTM-22.

To prevent adhesion of the mixture to the rollers, the wheels shall be kept properly moistened with water that may be mixed with very small quantities of detergent or other approved material.

The Contractor shall perform acceptance testing for density for each day's production by obtaining one sawed specimen, 4 by 4 inch, or a 4-inch diameter core at five stratified random locations specified by the Engineer. The five cores or plugs shall be obtained and the in-place density determined in accordance with the requirements of VTM-22. Core locations shall be numbered sequentially per roadway, marked on the pavement, filled with SMA mixture, and compacted prior to completion of each day of production. The average density of the five cores as determined in accordance with the requirements of VTM-22 shall be 94 to 98 for 100 percent pay. Cores or plugs shall be bulked in the presence of the Department. The Department reserves the right to have the cores or plugs bulked on the project site. The payment for density will be in accordance with the following:

Payment Schedule	
% Density Achieved	% of Payment
More than 98.0	97
94.0 to 98.0	100
92.0 to 93.9	85
90.0 to 91.9	65
Less than 90.0	Remove and replace

317.09—Trial Section

A trial section(s), a maximum of 300 tons, shall be constructed at a site approved by the Engineer at least 1 week prior to, but not more than 30 days prior to, roadway construction to examine the mixing plant process control, mixture draindown characteristics, placement procedures, SMA surface appearance, and compaction patterns and to calibrate the nuclear density device. In addition, the percentage of flat and elongated particles will be calculated on the SMA material produced for the trial section in accordance with the requirements of VTM-121 and compared to the maximum limits specified in the Coarse Aggregate Table in Section 248.02(a). A passing F&E sample is required for acceptance of the trial section. Acceptance of trial section shall be in accordance to section 317.04.

The material placed in the trial sections shall be placed at the specified application rate using the same equipment that will be used during production.

317.10—Prepaving Conference

Prior to the start of production, the Department will hold a prepaving conference. Those attending shall include the Contractor’s production supervisor and laydown supervisor, a representative of the fiber supplier, and a representative of the asphalt binder supplier.

317.11—Measurement and Payment

Stone matrix asphalt will be measured in tons and paid for at the contract unit price per ton for the mix type specified, which price shall include all materials, additives, and equipment as described herein.

The initial trial section will be paid for at the contract unit price for the mix type specified. Up to one additional trial section of the mix type specified will be paid for at the contract unit price. If additional trial sections are needed, the Department and the Contractor shall negotiate the price based on a reduced percentage of the contract unit price . No more than four trial sections will be paid for by the Department; any additional test sections will be provided solely at the Contractor’s expense.

Payment will be made under:

Pay Item	Pay Unit
Stone matrix asphalt, SMA-9.5 (70-22)	Ton

**VIRGINIA DEPARTMENT OF TRANSPORTATION
SPECIAL PROVISION FOR
TRENCH WIDENING ASPHALT MIXTURES
BM-25.0(T), IM-19.0D(T) or IM-19.0A(T)**

October 17, 2008c

SECTION 315—ASPHALT CONCRETE PAVEMENT of the Specifications is amended as follows:

Section 315.01—Description is amended to include the following:

Certain routes in the Contract are designated to use asphalt concrete type BM-25.0(T), IM-19.0A(T) or IM-19.0D(T). Those routes are referred to herein as trench widening routes.

Section 315.02—Materials is amended to add the following:

(e) Trench widening route materials shall conform to the requirements of Section 211 of the Specifications. IM-19.0A shall be used for IM-19.0A(T) and IM-19.0D shall be used for IM-19.0D(T). Where BM-25.0(T) is designated, either BM-25.0A or BM-25.0D shall be used by the Contractor.

Section 315.05(e)2 Surface, Intermediate and Base Courses is amended to include the following:

Trench Widening Routes — The minimum lift density as determined in accordance with the requirements of VTM-22 is based on the type of trench widening as defined below and specified in the Contract. Where trench widening is 2 foot in width compaction may be performed with small single drum walk-behind rollers or other mechanical means acceptable to the Engineer at the Contractor's discretion.

Type 1 — Paved Shoulder Only:

Trench widening routes where the widening will serve as a paved shoulder and will not be subjected to constant traffic: The painted edge line will not be on the trench widening. The minimum density requirement will not be enforced. Steel double drum rollers weighing no less than 8 tons shall perform compaction of the hot mix asphalt. No less than five passes shall be completed.

Type 2 — Widened Travel Lane and Paved Shoulder:

Trench widening routes where the widening will serve as a wider travel lane and paved shoulder that will be subjected to traffic: The widening will not include removal of existing travel lane pavement, i.e., inside the edge line marking. The painted edge line will be on the trench widening. The minimum density of 91.5 percent shall be enforced.

Type 3 — Repaired Travel Lane and Paved Shoulder:

Trench widening routes where the widening will include a portion of the existing travel lane, serve as a paved shoulder and will be subjected to traffic as a part of the travel lane: The widening will include removal of existing pavement (i.e. inside the edge line marking). The painted edge line will be on the trench widening. The minimum density of 91.5 percent will be enforced.

Where density requirements apply, the Contractor is responsible for cutting cores or sawing plugs for density testing. One set of plugs/cores per course of material shall be obtained within the first 500 linear feet and every 2,500 linear feet thereafter of the trench widening route for testing by the Contractor or the Department. Core/plug locations shall be randomly selected within each section. If the density achieved is less than 91.5 percent for the Type 2 or 3 trench widening routes, payment will be made on the theoretical tonnage within the 500 or 2,500 linear feet lot in accordance with the requirements of Table III-5 of the Specifications.

Section 315.05—Procedures is amended to include the following:

(i) Trench widening routes shall be widened by trenching on one or both sides of the existing roadway and placing BM-25.0(T), IM-19.0A(T) or IM-19.0D(T) commensurate with the required width and depth specified for that route.

Any remaining material, after final grading, shall be classified as excess material, and will be disposed of in accordance with the requirements of Section 106.04 of the Specifications or as directed by the Engineer.

The trench shall be shaped to have vertical sides, the width, depth and type as specified in the contract documents (2-foot minimum to 6-foot maximum width), be free of excess material, and shall be tacked against the existing pavement side before BM-25.0(T), IM-19.0D(T) or IM-19.0A(T) is placed.

The Contractor shall ensure that disruption to driveways, entrances, mail boxes and intersections are minimized and that precautions are taken to ensure that roadway drainage does not pond on the roadway surface.

Section 315.08 Measurement and Payment is amended to include the following:

Asphalt Concrete Type BM-25.0(T), IM-19.0A(T) or IM-19.0D(T) will be measured in tons and will be paid for at the contract unit price per ton, which price bid shall include furnishing and placing the BM-25.0(T), IM-19.0A(T) or IM-19.0D(T) mix, trenching, tack grading and disposal of excess material.

Payment will be made under:

Pay Item	Pay Unit
Asphalt Concrete Type BM-25.0(T)	Ton
Asphalt Concrete Type IM-19.0A(T)	Ton
Asphalt Concrete Type IM-19.0D(T)	Ton



COMMONWEALTH of VIRGINIA

DEPARTMENT OF TRANSPORTATION

1401 EAST BROAD STREET
RICHMOND, VA 23219-2000

PHILIP A. SHUCET
COMMISSIONER

June 21, 2005

To: District Administrators, Asset Management Director, District Construction Engineers, Resident Engineers, District Materials Engineers, District Maintenance Engineers, FHWA, Virginia Asphalt Association Members

From: Andrew Mergenmeier, P.E., State Materials Engineer, VDOT
Richard Schreck, Executive Director, Virginia Asphalt Association
Signatures on original copy of memorandum.

Subject: Quality Hot Mix Asphalt Construction
Longitudinal Joint Construction and Application of
Tack Coat for Plant Mix Schedules

The Virginia Department of Transportation (VDOT) and the hot mix asphalt industry represented by the Virginia Asphalt Association (VAA) are working together to enhance hot mix asphalt quality. We must choose appropriate and adequate maintenance strategies for our pavements; accomplish them with a high level of quality; and do so with minimal impact to the traveling public. Truly this can be a real challenge in today's traffic environment and limited resources. However, sometimes our focus on traffic safety, not inconveniencing the traveling public, speed of construction and other areas can sacrifice our pavement quality and performance.

VDOT and VAA have identified two of the most significant areas leading to premature distress in our asphalt pavements, low-density longitudinal joints and inadequate bond at the interface of new overlays and the existing pavement. VDOT and VAA have recognized these problem areas and have investigated different approaches to remedy these issues. Based on this effort, we have developed the attached guidance/procedures. By having VDOT and industry follow these procedures, we expect to see an improvement in asphalt pavement performance.

LONGITUDINAL JOINTS - The durability and performance of asphalt pavement longitudinal joints are becoming problems in an increasing number of locations across Virginia. For days after a rain or snow event, water or moisture is often observed at these

joints. After a short period of time under traffic, some of these joints are opening up and beginning to ravel. In some cases the raveling has been severe enough to completely erode the mix at the joint within a couple of years. When these types of premature failures occur it compromises the performance of even our best asphalt mixes and can result in sooner than scheduled resurfacing.

TACK APPLICATION – Approximately fifteen years ago the application of tack materials was an individual pay item. Misuse and over application became a problem to the point some pavements flushed, failed skid, and had to be overlaid within three years. As a result of these problems VDOT removed tack as a pay item from asphalt contracts and made it incidental to the cost of the hot mix asphalt. Today, we are often experiencing the opposite problem, not enough tack causing delamination, potholes, and other premature pavement failures.

In an effort to address these two important asphalt pavement quality issues we have put together the attached documents on Best Practices for Constructing Longitudinal Joints and Tack Coat Application. The attached procedures have application to all hot mix asphalt operations, but were developed specifically for the work performed in plant mix schedules.

Please ensure that all your employees involved in the placement of hot mix asphalt receive a copy of this memorandum and its attachments. We believe that with all parties having the same expectations for longitudinal joint construction and tack coat application, we will increase the quality and life of our hot mix asphalt pavements.

Attachments

Longitudinal Joint Construction Focus Areas

Longitudinal joints in asphalt are unavoidable. However, insufficient mix and/or poor joint construction and compaction create a point of weakness in the mat compromising long-term pavement performance. The following is a brief overview of 5 key focus areas of good longitudinal joints.

5 Key Focus Areas of Good Longitudinal Joints

- 1. Joint Location**
- 2. Proper Paver Mix Placement During the Second Paver Pass at a Longitudinal Joint**
- 3. Adequate Depth of Compacted Second Paver Pass**
- 4. Joint Handwork and Tacking**
- 5. Proper and Effective Joint Compaction**

1. Joint Location

Even the best longitudinal joints will have lower density than the surrounding mat, typically 1-2% lower. These lower densities can result in reduced performance and higher maintenance costs. Joint location is also important. Generally, longitudinal joints in wearing courses are placed to coincide with the centerline striping, between lane line striping, and edge line striping. It is preferred to have the longitudinal joint offset no more than 6" from the striping. This will allow for future crack sealing operations without damaging the striping. When practical, longitudinal joints in successive layers should be offset by at least 6".

2. Proper Paver Mix Placement During the Second Paver Pass at a Longitudinal Joint

The proper depth of uncompacted mix placed by a paver at the longitudinal joint during the second pass of the joint can best be illustrated by the following example:

$$D2 = D1 + 25\%$$

Where D1 is the *compacted mat thickness of the first paver pass at the joint*, D2 is the uncompacted mat thickness behind the paver screed at the same joint, and 25% is the mix roll down.

If the mat is being placed with access to both sides (both lanes closed) the paver overlap should be 1"- 2". However, much of our paving has only one lane closed and traffic using the adjacent lane. Under these conditions the paver overlap may have to be reduced to within 1/2" of the cold side of the joint.

3. Adequate Depth of Compacted Second Paver Pass

The "Toe Drag Test" (TDT) to determine if both sides of the joint are even or "smooth" is the most common test used by inspection, paving and management personnel to assess the quality of longitudinal joints. It is a false test. In fact, it almost guarantees that at least one side of the joint will have poor density. *When compacted, the second placed side of a longitudinal joint should always be slightly higher than the first placed side (typically 1/16" – 1/4").*

4. Joint Handwork and Tacking

Improper "bumping" of the joint is one of the most common mistakes made in constructing longitudinal joints. In an effort to meet TDT the 1"- 2" overlap placed by the paver is kicked away leaving both the compacted side and uncompacted side even. When the roller(s) go over this area there is little or no additional compaction of the hot mat at the joint.

VDOT specifications require that tack be applied at the longitudinal joint because the extra liquid asphalt fills some of the voids and makes the mix at the joint less permeable. Too often, the longitudinal joint is not tacked adequately. This can be from concerns that tack overspray may be carried on to the open lanes and the traveling public or the tack material may blemish new pavement markings. There are even cases of the distributor bars nozzle closest to the longitudinal joint being closed off to prevent applying tack too near the open lane. These failures to adequately tack/bond the new mat to the existing pavement have severe impact on the performance of the new pavement.

5. Proper and Effective Joint Compaction

The number of unsupported edges on the first lane/pass of the paver (figure 2) can be none (full inlay), one (curb & gutter or unmilled pavement on one side) or two (not touching anything on either side). How this first paver pass should be rolled depends on how many uncompacted edges there are. The type and location of the roller are critical to obtaining density at the unsupported edge (figures 3, 4, 5). Failure to roll the first pass correctly can result in poor densities at the edges, cracking along the edge or both.

Roller overlap and compaction technique, when compacting the second mat or hot side of a longitudinal joint, are also critical to maximizing joint density. For most applications, rollers should roll from the outside (side away from longitudinal joint) toward the longitudinal joint (figure 6). The movement of the roller over the hot mat will cause some lateral movement of the mix. Therefore rolling from the outside in will push mix

laterally into the joint. Roller overlap at the joint should be 2"- 6" (6" if work zone permits) over the cold side of the mat (figures 7, 8). An alternative method is to stay off the joint about 6" leaving an area of uncompacted mix to be compacted on a subsequent pass that includes a 2"- 6" roller overlap (figure 9). Regardless of method used, if proper placement and compaction procedures have been followed, the second paver pass or "hot" side of the longitudinal joint will have a higher density than the first or "cold" side (assuming it was unconfined).

It should be noted that longitudinal joints between inlays and the existing pavement are always treated as the "hot side" of the joint.

The above identification of focus areas and their brief discussion are intended to make you aware of these important aspects of asphalt pavement performance. If you have any questions, please contact the Central Materials Division, District Materials Section, and/or the Virginia Asphalt Association.

Figure 1

Constructing and Compacting Longitudinal Joints

Virginia Department of Transportation
&
The Virginia Asphalt Association

Figure 2

Unconfined Edges



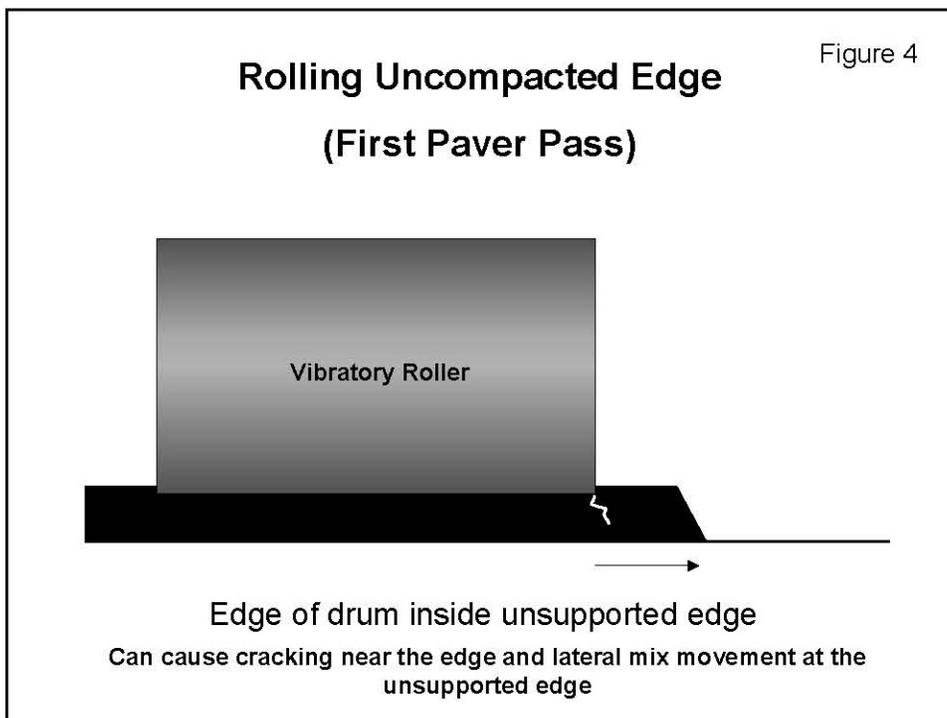
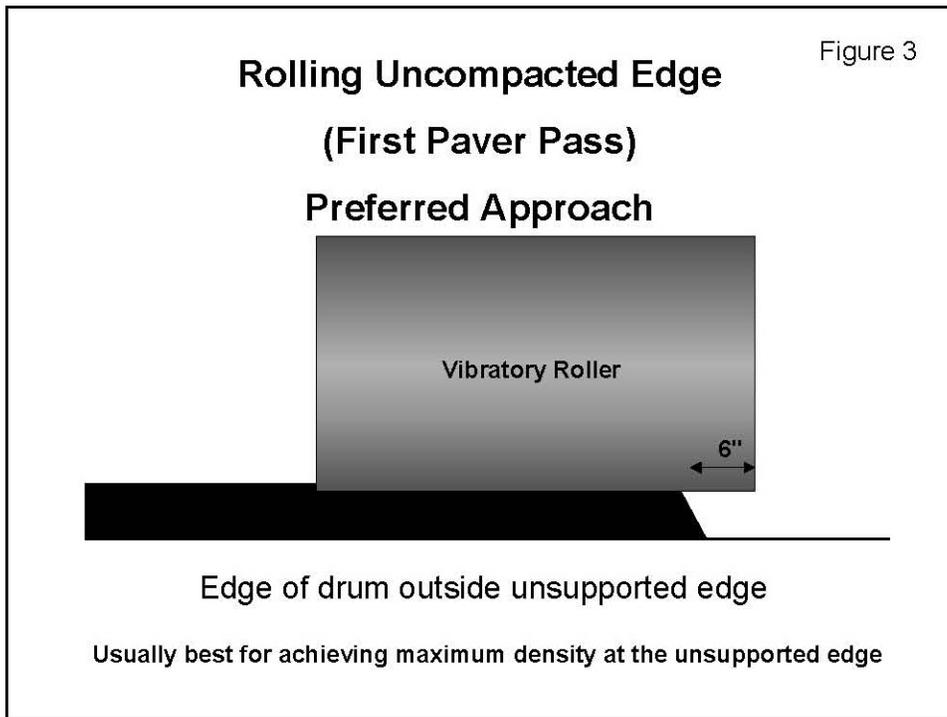
No Unconfined Edges



One Unconfined Edge



Two Unconfined Edges



Rolling Uncompacted Edge (First Paver Pass)

Figure 5



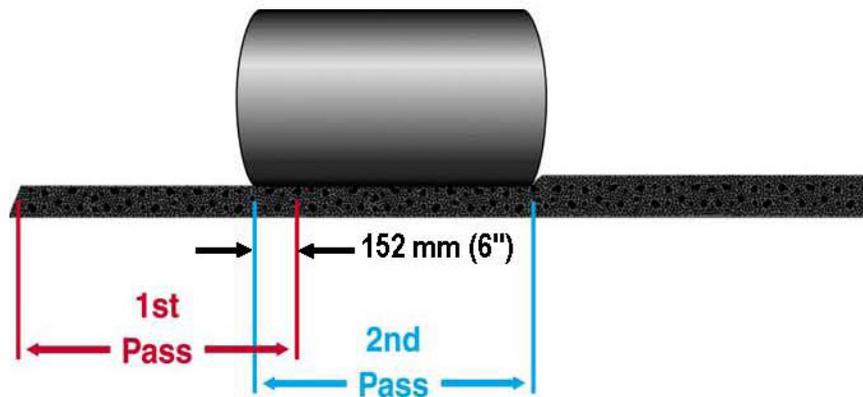
Edge of drum on the unsupported edge

Can cause lateral mix movement at the unsupported edge

Mat Compaction

Figure 6

Mat should be rolled from the unconfined/outside edge to the longitudinal joint (number of passes to cover the mat depends on roller widths).



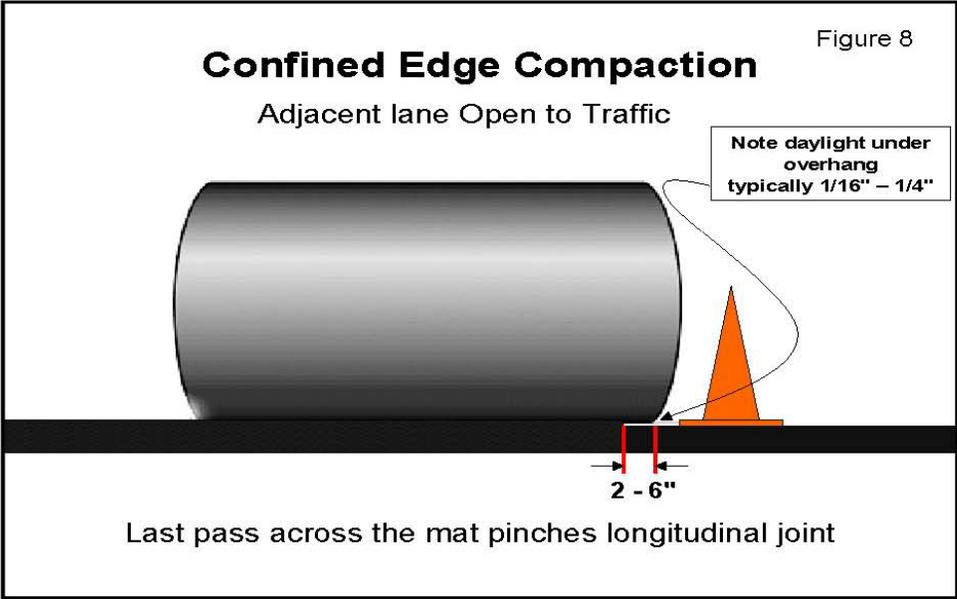
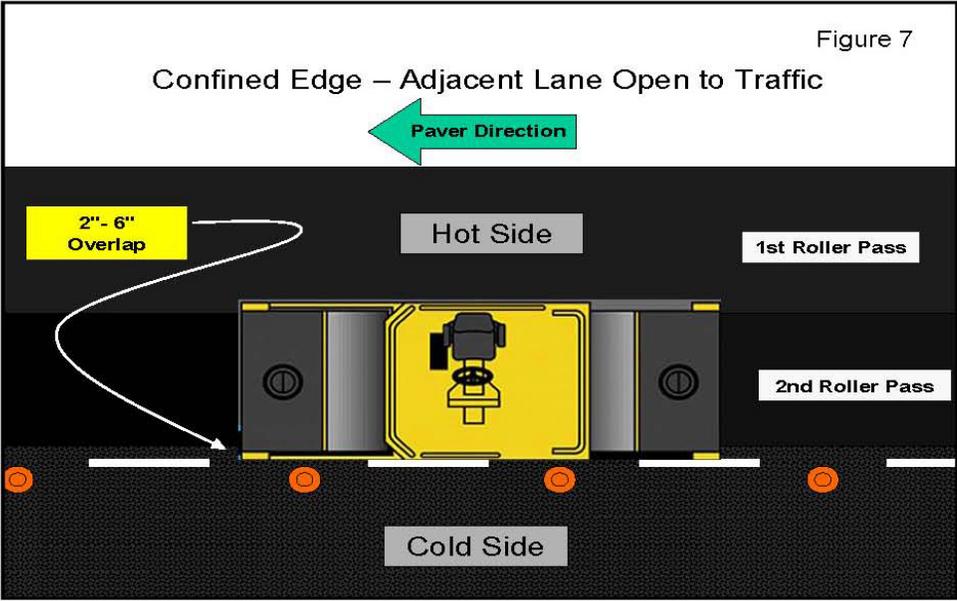
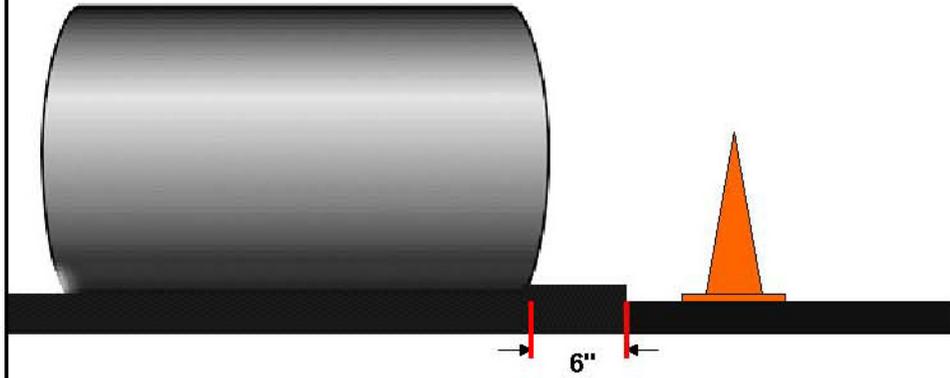


Figure 9

Confined Edge Compaction - Alternate

Adjacent lane Open to Traffic



Next to last pass across the mat leaves 6" uncompactd at joint. Last pass pinches longitudinal joint.

High Performance Tack Application Focus Areas

A tack coat is a pressurized spray application of liquefied asphalt, typically an asphalt emulsion, to a pavement to ensure a bond between the existing pavement surface and the new asphalt overlay. Too little tack can cause slippage problems and delamination of pavement layers. Excessive tack, or tacking areas that do not need tack can lead to pavement bleeding, loss of skid characteristics and rutting. The following 5 Focus Areas are key to achieving the proper and effective application of tack materials.

5 Tack Application Focus Areas

- 1. Application Rate, Temperature, Pressure, and Timing**
- 2. Start and End of Tack Application**
- 3. Tacking Longitudinal and Transverse Joints**
- 4. Proper Use of Hand Wands**
- 5. Tacking Milled Surfaces**

1. Application Rate, Temperature, Pressure, and Timing

Uniformity of application and use of the proper application rates are key to the success of the tack coat. The tack coat should be applied with a pressure distributor with all nozzles open and angled to spray at approximately 30 degrees (see distributor manufacturers recommendations). The distributor bar should also be at the proper height to ensure that double or triple lap of the material is achieved. Too little pressure or low temperatures will cause clogging of nozzles and/or tack “stripes” on the pavement. The proper tack coat application will leave a residual asphalt binder content of approximately 0.04 to 0.06 gal/sy on the roadway. If the correct application rate is used some of the existing surface will show through the tack coat. Finally, timing the application of the tack coat is critical to minimize tracking. Tack coat should be applied in advance of the paving operation to allow the emulsion to break and reduce sticking to tires.

2. Start and End of Tack Application

On a truck mounted distributor the application rate is controlled by metering equipment synchronized with the axles of the vehicle. When starting from a dead stop this can result in too heavy of an application on the first 25-100 feet of the spray application. Shutting the tack spray off at the exact end of the area to be paved can also be very challenging. Therefore, extra care must be taken at start up and ending areas. Startup and application end areas should not be located at intersections or there will be an even greater risk of

pavement slippage, loss of skid and/or rutting due to the higher pavement stresses associated with braking traffic.

3. Tacking Longitudinal and Transverse Joints

Longitudinal joints are the weakest area of an asphalt mat and are, therefore, to be minimized. It is extremely important that there be a good bond between the existing or underlying surface and the new layer of asphalt at the joints. Tack coats at longitudinal joints have several functions. First, they form the bond between the underlying pavement and the new asphalt layer. Secondly, by using a hand wand to spray extra tack on the vertical face of the exposed side of the longitudinal joint, a tighter, less permeable seal is obtained between the two sides of the joint. And thirdly, the additional tack in the area of the joint aids in achieving better compaction at the joint. Longitudinal joints should not be located in the wheel paths or traffic areas so this additional asphalt will not result in slippage, loss of skid, flushing or rutting like it would if the wheel paths were tacked this heavy.

4. Proper Use of Hand Wands

A hand wand is a hand-held section of piping with a single distributor nozzle on the end connected to the distributor tank by a hose. Hot, pressurized tack is sprayed through the nozzle in a controlled and operator directed manner. Low pressure and/or temperature can result in heavy, dribbling applications. Holding the hand wand too high above the pavement will result in a wide, fan like spray of tack material and loss of application control.

5. Tacking Milled Surfaces

Most pavements require some degree of surface preparation prior to tack application. This may include sweeping/dirt removal, patching, crack sealing, or leveling courses. Milled surfaces present unique challenges due to their pre-tack surface preparation needs. Milled surfaces ideally should be left open to traffic and the environment for a period of time to be swept and washed clean. However, scabbing, loose aggregates, drainage issues and safety considerations may prevent this. Milled surfaces should be swept clean with a power broom and/or vacuum truck. A heavier than normal tack application rate is typically used due to the irregular and uneven surface texture of milled pavements. When the pavement surface is not cleaned properly, the tack material will bond to the dirt/dust and then stick to the tires of the paving equipment.

The above identification of focus areas and their brief discussion are intended to make you aware of these important aspects of asphalt pavement performance. If you have any questions, please contact the Central Materials Division, District Materials Section, and/or the Virginia Asphalt Association.