



**DEVELOPMENTAL SPECIFICATIONS
FOR
VOID REDUCING ASPHALT MEMBRANE**

**Effective Date
October 17, 2023**

THE STANDARD SPECIFICATIONS, SERIES 2023, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE DEVELOPMENTAL SPECIFICATIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

23041.01 DESCRIPTION.

- A. These specifications describe requirements for void reducing asphalt membrane (VRAM). Apply [Section 2303](#) of the Standard Specifications unless otherwise directed in these specifications. Do not use this specification in combination with Supplemental Specifications for Evaluation of Longitudinal Joint Quality for Flexible Paving Mixtures, Developmental Specifications for High Performance Thin Lift Overlay, or Developmental Specifications for Evaluation of Longitudinal Joint Quality for Flexible Paving Mixtures with Incentive/Disincentive.
- B. The VRAM is applied underneath the longitudinal construction joint(s) prior to paving the final lift of a flexible paving mixture.

23041.02 MATERIALS.

Provide VRAM material meeting the criteria in Table 23041.02-1. VRAM material shall consist of elastomers added to the base asphalt by an approved asphalt supplier. Styrene-butadiene diblock or triblock copolymer are acceptable elastomers.

Table 23041.02-1: Void Reducing Asphalt Membrane Criteria

| TEST | CRITERIA | TEST METHOD |
|--|--------------------------------------|---------------------|
| Dynamic shear @ 88°C (unaged), G*/sin δ | 1.00 kPa minimum | AASHTO T 315 |
| Creep stiffness @ -18°C (unaged) Stiffness (S) m-value | 300 MPa maximum 0.300 MPa minimum | AASHTO T 313 |
| Ash, % | 1.0% - 4.0% | AASHTO T 111 |
| Elastic Recovery, 100 mm elongation, cut immediately, 25°C | 70% minimum | ASTM D6084 Method A |
| Separation of Polymer, difference in ring and ball | 3°C maximum | ASTM D7173 |

23041.03 CONSTRUCTION.

- A. Equipment.

1. Distributor/Spray Applicator – Provide a distributor or spray applicator capable of applying material at the specified application rate and width. Apply the VRAM in a single pass. The distributor shall be equipped with a heating and recirculating system along with a functioning auger agitating system or vertical shaft mixer in the hauling tank to prevent localized overheating. The distributor shall be equipped with a guide or laser system to aid in proper placement and location of the VRAM.
2. Melter kettle – A melter kettle may be used if approved by the Engineer. Provide a melter kettle capable of applying VRAM material at the specified application rate and width. Apply the VRAM in a single pass. Material from the kettle may be dispensed through a pressure feed wand with an applicator shoe or with a spray bar. Use an oil jacketed double-boiler type with agitating and recirculating systems.

B. Material Handling.

Provide the Engineer with a copy of the manufacturer's recommendations for heating, re-heating, and applying the VRAM material at the pre-construction meeting.

C. Preparation of the Surface.

1. Prior to the application of the VRAM, ensure the area of the intended longitudinal asphalt pavement joint is thoroughly cleaned and free of debris. The area may be cleaned by sweeper/vacuum truck, power broom, air compressor or hand to the satisfaction of the Engineer. Ensure the existing surface is dry and free of moisture. Low speed roadways, less than 45 miles/hour, shall require the use of compressed air to clean the surface where the VRAM will be placed. Final cleaning will occur within 24 hours of the placement of VRAM and be performed to the Engineer's approval.
2. Milled surfaces may require the use of compressed air to remove dust and fine materials from the area where VRAM will be applied. When applying VRAM on a milled surface, apply the tack coat before VRAM placement.
3. If tack coat is applied prior to placement of the VRAM, the tack shall be fully cured. Tack coat may be placed over the VRAM at the Engineer's discretion. Do not use VRAM with or in proximity to cutback asphalts.
4. At the time of VRAM application, the pavement surface temperature and the ambient temperature shall be a minimum of 40°F and rising unless otherwise approved by the District Materials Engineer. Flexible paving mixture placement of the surface course lift is governed by [Article 2303.03, C, 4](#) of the Standard Specifications. Do not use VRAM when [Article 2303.03, F](#) of the Standard Specifications applies, unless approved by the District Materials Engineer.

D. Application of VRAM.

1. Apply the VRAM in a single pass placed by any application method listed in Article 23041.03, A. Use a stringline or paint mark as a guide for the application to maintain a uniform edge alignment.
2. Apply the VRAM centered within 2 inches of the project's established centerline or established lane edge. If the VRAM material flows more than 2 inches from the initial placement width, stop VRAM application and take remedial action subject to the Engineer's approval. Figure 1 provides an example illustration of VRAM application at the center line.

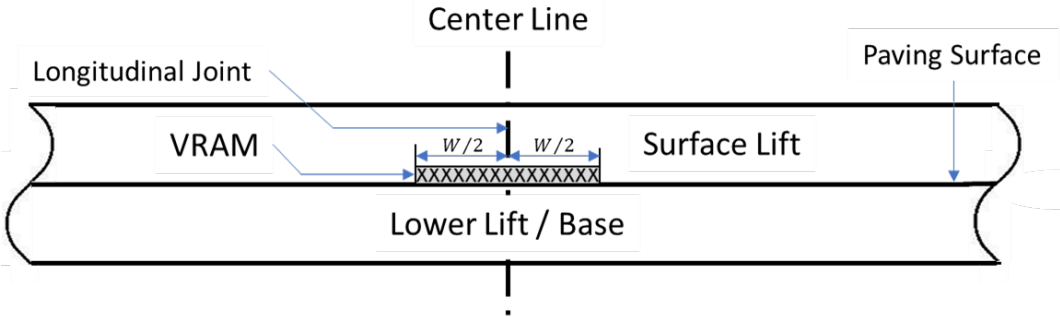


Figure 1: Example to illustrate VRAM application. Drawing not to scale. Cross sections will vary. Refer to plans.

- When a notched-wedge joint is placed over VRAM, ensure the VRAM material is under the joint area. Figure 2 provides an example illustration of notched wedge joint placement over VRAM. Before paving the adjacent lanes over the notched wedge joint, apply tack coat to fully cover the wedge and coat the vertical face of the notch.

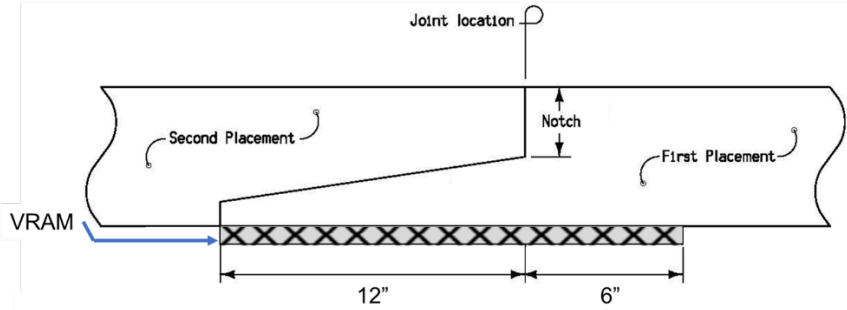


Figure 2: Example illustration of VRAM with a compacted notched-wedge joint. Drawing not to scale. Cross sections will vary. Refer to plans.

- When resuming placement of VRAM or re-applying VRAM to localized areas (e.g. where application rates were verified per Article 23041.03, E), place release paper (such as 30 pound roofing felt) over the previous application of VRAM to prevent double application of VRAM materials. Ensure release paper does not adhere to the previously placed VRAM material.
- The application rate of VRAM shall be determined from the JMF of the mixture to be paved over the VRAM material. From the JMF, determine the mixture size and categorize the mixture as “Coarse-Graded” or “Fine-Graded” based on Table 23041.03-1.

Table 23041.03-1: Definition of Fine and Coarse-Graded HMA Mixtures

| Mixture Size per IM 510 Appendix A | Coarse-Graded | Fine-Graded |
|------------------------------------|------------------|------------------|
| 3/4 inch | < 35% Passing #8 | ≥ 35% Passing #8 |
| 1/2 inch | < 40% Passing #8 | ≥ 40% Passing #8 |
| 3/8 inch | < 45% Passing #8 | ≥ 45% Passing #8 |

- The VRAM, meeting the requirements specified herein, shall be applied to the existing surface at the width and target application rate as specified in Table 23041.03-2.

Table 23041.03-2: VRAM Width and Application Rate based on Intended Surface Thickness and Mixture Gradation

| VRAM Application Table ¹ | | |
|--|---------------------|--------------------------|
| Intended Surface Thickness, in. | VRAM Width (W), in. | Application Rate, lb/ft. |
| Coarse-Graded HMA Mixtures | | |
| 1 | 18 | 1.15 |
| 1 1/4 | 18 | 1.31 |
| 1 1/2 | 18 | 1.47 |
| 1 3/4 | 18 | 1.63 |
| ≥ 2 | 18 | 1.80 |
| Fine-Graded HMA Mixtures | | |
| 1 | 18 | 0.80 |
| 1 1/4 | 18 | 0.88 |
| ≥ 1 1/2 | 18 | 0.95 |
| 1. Each application rate has a surface demand for liquid included. Therefore, do not increase the VRAM application rate when a required overlay thickness is greater than the values shown here. | | |

7. When only one-half of the joint is exposed, such as a mill and inlay project, apply the VRAM one-half the prescribed width and rate, adjacent to the center of the joint, and coat the vertical face of the cold joint left in place.
8. VRAM application temperature shall not exceed 350°F. Determine the application rate of VRAM based on the nominal maximum aggregate size of the mixture. Apply the VRAM at the application rate and width listed in Table 23041.03-2. Ensure the applied width of VRAM is within ±1.5 inches of the width application required in Table 23041.03-2.
9. Exclude the area 1.0 foot on either side of the longitudinal joint from density measurement and density-related pay adjustment.
10. The VRAM shall be suitable for construction traffic to drive on without pick up or tracking of the VRAM within 30 minutes of placement. If pick up or tracking occurs, stop placement of VRAM and take remedial action subject to the Engineer's approval.
11. Prior to paving over VRAM, ensure the paver end plate and grade control devices are not in contact with the VRAM. If flushing or bleeding is noted in the asphalt surface, immediately stop placement of asphalt mixture and VRAM until the issue is corrected.
12. Asphalt mixture placed over VRAM must have a minimum laydown temperature of 250°F and a minimum plant mix production temperature of 260°F unless otherwise approved by the District Materials Engineer.

E. Quality Assurance/Quality Control of VRAM Material.

1. Acceptance of the VRAM is based on the certification by the manufacturer that the material meets the requirements listed in Table 23041.02-1. Field sampling will be used to verify that the delivered VRAM meets the requirements of the specification. Notify the Engineer prior to sampling. The Contractor shall take a sample in the presence of the Engineer. Sample from the sample valve, spray bar, or applicator shoe during the first 20 minutes of placing VRAM on the project. After the first sample is taken, sample for every 25,000 gallons of material used on the project. Each sample shall consist of a one-quart aluminum or steel sample container. Refer to [Materials I.M. 323](#) Method of Sampling Asphaltic Materials. Label the sample container with the project number, date, time, location, manufacturer, and bill of lading number of the VRAM material.
2. The Contractor will check the application rate of VRAM within the first 1000 linear feet of the day's application length and every 12,000 linear feet the remainder of the day. Check the rate twice for projects less than 12,000 linear feet in length. Check the rate by weight per foot. Place

a paper or pan (such as 30 pound roofing felt or oil drip tray/pan) of known weight and dimension at a random location in the path of the VRAM application. Pick up and weigh the paper or pan after application of the VRAM. Calculate the weight per foot. Replace the VRAM in the area where the application rate was checked. The tolerance for the target application rate per foot from Table 23041.03-2 is $\pm 10\%$. Notify the Engineer if the application rate falls outside of the tolerance.

23041.04 METHOD OF MEASUREMENT.

The Engineer will measure the VRAM by the linear foot, for both full width and half width applications.

23041.05 BASIS OF PAYMENT.

Payment per contract unit price for VRAM, in both full width and half width, shall be full compensation for equipment, materials, surface preparation, and labor required to complete the work.