HIGH DENSITY MINERAL BOND.
(REV 1-22-19)

The following new Section is added after Section 300.

SECTION 318
HIGH DENSITY MINERAL BOND

318-1 Description.

High Density Mineral Bond (HDMB) is a mixture of fine aggregates blended with non-ionic, thixotropic asphalt emulsion utilizing inorganic emulsifiers and other additives. Ensure all ingredients are accurately proportioned, mixed, and spread on the paved surface in accordance with this Section.

318-2 Materials.

318-2.1 Asphalt Emulsion: Ensure the emulsified asphalt is a non-ionic emulsion at 77°F, meeting the requirements of Table 318-1.

Table 318-1
Requirements for Asphalt Emulsion (Non-ionic, Inorganic*)

Criteria	Test Method	Specification	Unit
Brookfield Viscosity at 77°F (Spindle RV-5, 20 rpm)	AASHTO T316	11,000 - 20,000	cPs
pH	ASTM E70	5.0 - 7.5	pH
Density	AASHTO T59	8.5 - 9.0	lbs/gal
Solids Content	AASHTO T59	50.0 - 54.0	%, by weight
Ash Content	AASHTO T111	4.0 - 6.0	%, by weight

* Inorganic is defined as a non-carbon-based emulsifier.

318-2.2 Aggregates: Use fine aggregates free from excessive polishing meeting the requirements of Tables 318-2 and 318-3.

Table 318-2
Slate Aggregate

Criteria	Test Method	Specification
Specific Gravity	AASHTO T84	> 2.6
Compression	ASTM C170	≥ 11,000 psi

Table 318-3
Refined Corundum Aggregate

Criteria	Test Method	Specification
Specific Gravity	AASHTO T84	> 3.9
Knoop 100 Hardness	ASTM C1326	> 2,000
Ball Mill Friability	ANSI B74.8	50 (14 grit)

Ensure the aggregates are premixed with the base emulsion at the emulsion manufacturer facility or at an emulsion manufacturer-approved mixing facility prior to arriving at the jobsite.

318-2.3 Water: Use potable water free from any contaminants detrimental to the HDMB mixture.

318-3 Composition of the Mixture.

318-3.1 HDMB Mixture: Proportion the emulsion and aggregate materials to ensure the HDMB mixture meets the requirements of Table 318-4.

Table 318-4
HDMB Job Mix Formula (JMF)

Criteria	Test Method	Specification	Unit
Asphalt Content	AASHTO T164	17.0 – 20.0	%, by weight
Solids Content	ASTM D1644	55.0 – 63.0	%, by weight
Initial Brookfield Viscosity at 77°F (Spindle RV-5, 20 rpm)	AASHTO T316	5,500 – 15,000	cPs
Ash Content	AASHTO T111	38.0 Min.	%, by weight
Ash Content of Solids	AASHTO T111(1)	65.0 Min.	%, by weight
Density	AASHTO T59	11.0 Min.	lbs/gal
pH	ASTM E70	6.0 – 8.0	-
Total Inorganic Aggregate Content	AASHTO T111(2)	37.0 Min.	%, by weight
Total Sand Content	-	6.0 Max.	%, by weight
Maximum VOC	ASTM D3960	5.0 Max.	g/l
Resistance to Re-emulsification	ASTM D2939	No Re-emulsification	-
Wear Resistance	ASTM D2486(3)	4.0 % Max.	% loss, by weight

(1) Ash content as a percentage of solid content.
(2) Ash content of completed HDMB minus ash content of HDMB base non-ionic emulsion. Total inorganic aggregate content defined as slate, refined corundum, and sand.
(3) ASTM D2486 (Modified): Prepare samples at 48 wet mils on glass panel. Dry at 77°F for 3 days. Immerse in water for 24 hours at 77°F. Test scrub resistance with 1,000 gram brass brush for 12,000 cycles. Report % of dry film lost.

318-3.2 Mixture Design: Submit a job mix formula (JMF) for the HDMB to the Engineer at least three weeks prior to beginning HDMB work. Ensure all test results along with representative samples of each ingredient are suitable to be used in the HDMB mixture. List all source information relative to materials, including certified test reports on individual materials. Include the Project Financial Project ID on the JMF.

318-4 Equipment.

318-4.1 General Requirements: Provide equipment, tools, and machines necessary for the successful application of the HDMB. The Engineer may stop work if sufficient equipment and tools are not in use to place the materials satisfactorily.

318-4.2 Installation Equipment: Provide a paver with a continuous flow mixing unit meeting the following requirements.

1. Capable of applying at least 15,000 square yards of material each day.

2. Equipped with a full sweep helical mixer to ensure proper suspension of the fine aggregates.

3. Equipped with two separate filters with two mesh sizes to ensure proper mixing and removal of any solid masses that may cause non-uniform application.

4. Equipped with a means of determining the application rate to the nearest gallon.

318-4.3 Equipment Calibration: Calibrate the paver to the correct application rate prior to the start of the project and at least once during each day of production. Provide documentation of the calibration to the Engineer prior to beginning the work. Calibration of the equipment must cover the range required in the two applications of the HDMB mixture. Do not work on the project until the machine calibration has been completed and accepted. The Engineer may require additional calibrations.

318-5 Construction.

318-5.1 Weather Limitations: Place the HDMB surface treatment material when ambient air and roadbed temperatures in the shade are 45°F and rising. Stop paving a minimum of four hours prior to expected rain and 48 hours prior to expected freezing temperatures.

318-5.2 Surface Preparation: Prior to application, sweep or broom the entire surface to remove any loose material, soil, sand, dust, oil, vegetation, and other objectionable material. Do not flush water over cracks or apply pressurized water to cracked pavement. Apply a tack coat to severely raveled or porous pavements unless otherwise approved by the Engineer. Patch any holes, raveled areas, or low areas with asphalt mixture prior to placement.

318-5.3 Application: Apply the HDMB in two separate layers. Ensure the first layer is thoroughly dry and free from any damp areas prior to the second layer being placed. Ensure the machine settings match the application rates shown in Table 318-5.

Table 318-5
Application Rates

Layer	Placement Rate (gal/yd^2)
1	0.20 minimum
2	0.16 minimum

Apply the HDMB with uniform coverage over the entire surface without streaking. Ensure applications along gutters and shoulders are straight, uniform, and at the appropriate rate. Adjust the second application as necessary to ensure the final product meets the total application rate. Do not vary any single application rate more than 0.05 gallons per square yard from the rates shown in Table 318-5.

318-5.4 Opening to Traffic: Ensure the newly applied HDMB material is protected from traffic until it has cured. Curing of each layer must be completed within 60 minutes of initial placement. Maintain traffic control as necessary to prevent damage to the mixture. Repair any damage done by traffic or construction equipment to the finished HDMB mixture at no additional cost to the Department.

Ensure work is completed early enough each day to permit traffic to safely travel over the completed surface prior to removing traffic control. In the event HDMB material requires more than 60 minutes to cure, discontinue placement operations until approved to the satisfaction of the Engineer.

318-6 Qualifications.

Provide supervisory personnel who have successfully completed at least five projects of similar size and nature using an acceptable JMF as provided in Table 318-4. Provide a list to the Engineer of at least five completed projects.

An alternative to the Contractor required experience, provide a HDMB supplier representative for the entire duration of the project. The supplier representative must have the same experience required of the Contractor with five projects of similar size and nature using the mix design specified in Table 318-4.

318-7 Acceptance of Mixture.

A LOT is defined as the quantity of HDMB placed in a production day. For each LOT, provide a LOT sheet containing the following information.

1. LOT number, project financial ID, and route.
2. Date and air temperature.
3. Beginning and ending stations for each paved lane.
4. Length, width, and total area in square yards of HDMB placed.
5. Gallons placed and recorded application rate for each layer.
6. Calibration forms.
7. Contractor's authorized signature.

Ensure any mat defects are corrected to the satisfaction of the Engineer. Remove and replace non-compliant material at no additional expense to the Department. Reinspect any applications exceeding 0.40 gallons per square yards combined for both layers to ensure bleeding has not occurred or corrective work is not needed.

318-8 Method of Measurement.

Payment will be made at the Contract unit price per square yard of HDMB completed and accepted.

318-9 Basis of Payment.

Price and payment will be full compensation for all work specified in this Section, including furnishing all labor, materials, equipment, and incidentals necessary to complete the work.

Payment will be made under:

Item No. 919-318- High Density Mineral Bond – per square yard.