



September 14, 2017

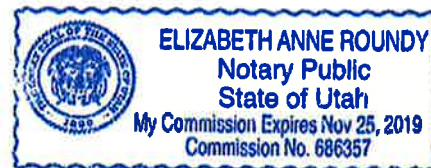
To Whom It May Concern:

This letter is to confirm that HA5, an asphalt preservation product, is a sole source product manufactured, sold, and distributed exclusively under the direction of IPS.

To date, HA5 is the only product meeting the rigorous specification of a High Density Mineral Bond as specified in the "Manual of Standard Specifications 2012" Section 32 01 13.68 produced by the American Public Works Association.

Sincerely,

Mark Beatty, SVP  
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# Special Specification XXXX

## High Density Mineral Bond (HDMB)



### 1. DESCRIPTION

Apply a mixture of asphalt binder and mineral aggregate as a pavement surface treatment and sealant.

### 2. MATERIALS

2.1. **General.** Furnish uncontaminated materials of uniform quality that meet the requirements of the plans and specifications. Notify the Engineer of all material sources. Notify the Engineer before changing any material source or formulation. Engineer may sample and test project materials at any time during the project to verify specification compliance.

2.2. **Asphalt Emulsion.** Provide non-ionic emulsified asphalt binder manufactured with an inorganic, non-carbon-based, emulsifier, and meeting the requirements of Table 1.

Table 1  
Emulsified Asphalt

Property	Test Method	Requirement	
		Minimum	Maximum
Viscosity, 77°F, 20 rpm, P	D 2196, Method A	110	200
pH	E 70	5.0	7.5
Density, 77°F, lb/gal	T 59	8.5	9.0
Residue by Evaporation, % by wt.	T 59	50	54
Ash Content, % by wt.	T 111	4.0	6.0
Tests on base asphalt before emulsification: Penetration, 77°F, 100 g, 5 sec.,	T 49	-	29

2.3. **Aggregate.** Furnish a mixture of slate, refined corundum, and sand meeting the requirements of Tables 2 and 3.

**Table 2**  
**Aggregate Properties**

Property	Test Method	Requirement
Tests on Slate Aggregate		
Specific Gravity	C 128	2.6 min
Compressive Strength, psi	C 170	11,000 min
Tests on Refined Corundum Aggregate		
Specific Gravity	C 128	3.9 min
Knoop Hardness Number	C 1326	2,000 min
Ball Mill Fiability	ANSI B74.8	50 (14 grit)

**Table 3**  
**Gradation Requirements for Combined Aggregate**

Sieve Size	% Passing by Weight or Volume
#10	95-100
#16	90-100
#30	87-93
#40	70-75
#50	53-58
#100	25-30
#200	15-20

- 2.4. **Complete Mixture.** Provide a completed mixture of asphalt and aggregates meeting the requirements of Table 4 prior to placement of material or loading into the distributor.

**Table 4**  
**HDMB Mixture Requirements**

Property	Test Method	Requirement	
		Minimum	Maximum
Non-volatile content, % by wt.	D 1644	55	63
Viscosity, 77°F, 20 rpm, P	D 2196, Method A	55	90
pH	E 70	5.0	7.5
Ash Content, % by wt.	C 2939	38	-
Asphalt Content <sup>1</sup> , % by wt.		17	20
Ash Content of Solids <sup>2</sup> , % by wt.		63	-
Total Inorganic Aggregate Content <sup>3</sup> , % by wt.		34	-
Density, 77°F, lb/gal	T 59	11.0	-
Sand Content		-	6.0
Volatile Organic Compounds, g/l	D 3960	-	5.0
Resistance to Water	D 2939	No Re-emulsification	
Wear Resistance, % loss, by wt.	D 2486 <sup>4</sup>	-	4.0

<sup>1</sup> Asphalt content is the non-volatile content less the ash content.

<sup>2</sup> Ash content of the mix expressed as a percentage of the non-volatile content.

<sup>3</sup> Ash content of the mix less the ash content of the emulsion.

<sup>4</sup> Use 48 mil wet drawdown. Dry for 3 days then Immerse in water for 24 hours at 77°F. Use 1 kg brush for 12,000 cycles. Report loss in weight.

- 2.5. **Acceptance of Materials.** Provide independent laboratory test reports for the emulsified asphalt and aggregates showing that they meet the requirements in Tables 1 and 2. Supply a sample of the emulsified asphalt and aggregate mixture to the Engineer prior to the start of placement. Provide a test report showing the results of a wear resistance test conducted within one calendar year of the start of placement. Provide a mix design report for the proposed HDMB material at least 10 days prior to placement.

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### 3. STAFFING REQUIREMENTS

The manufacturer of the HDMB is required to have a representative at the pre-construction or pre-paving meeting and at the construction site to provide technical assistance to the Engineer and Contractor personnel before placement of HDMB and as necessary during the surface preparation, material placement and during any necessary corrective actions.

The representative must be available throughout construction to provide recommendations as deemed necessary to the Engineer and Contractor personnel.

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### 4. EQUIPMENT

Use equipment for surface cleaning operations where applicable, in accordance with Item 738, "Cleaning and Sweeping Highways."

- 4.1. **Distributor.** Furnish a distributor that will apply the HDMB mix uniformly at the specified rate, and which has continuous mixing to keep the mixture in suspension.

- 4.1.1. **Calibration of Tank Volume.** Furnish a volumetric calibration and strap stick for the distributor tank in accordance with Tex-922-K, Part I. Provide documentation of distributor calibration performed not more than 5 yr. before the date first used on the project. The Engineer may verify calibration accuracy in accordance with Tex-922-K, Part II.

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### 5. CONSTRUCTION

- 5.1. **General.** Apply the material when the air temperature and the surface temperature are 45°F and rising. Measure the temperatures in the shade away from artificial heat. The Engineer will determine when weather conditions are suitable for application.

- 5.2. **Quality Assurance.** The Engineer may require that Contractor has successfully completed at least five projects of similar size and nature, using the same mix design as described in the materials section and have demonstrated a five-year minimum proven performance on a bituminous surface. Acceptable performance after five-year period is no less than 70% residual coverage in the treated area.

- 5.3. **Surface Preparation.** Remove dirt, dust, or other harmful material before application. When shown on the plans, remove vegetation and blade pavement edges.

Protect utilities, drainage structures, curbs, and any other structure within or adjacent to the treatment location against the application of the HDMB materials. Adequately cover expansion joints and deck drains. Remove covering from all areas covered before opening to traffic..

Cover and protect existing pavement markings that are adjacent to the application surfaces as directed. Remove existing or temporary pavement markings that are within the surface application area in accordance with Item 677, "Eliminating Existing Pavement Markings and Markers," except for Measurement and Payment.

- 5.4. **Control Strip.** When directed by the Engineer, construct a control strip of HDMB before starting any production work. The control strip is required to meet the following:

- Included in the measurement and payment per requirements in Sections 7 and 8; and
- Constructed using the same equipment as the anticipated production work.

Replicate field conditions, including ambient and surface temperatures, anticipated for the production work. Demonstrate surface preparation requirements.

- 5.5. **Application.** Apply the material in two coats. Apply the second coat after the first coat is thoroughly dry and free of any damp areas. Apply the first coat at a rate of 0.2 gal/SY and the second at 0.16 gal/SY, for a total rate of at least 0.36 gal/SY, unless otherwise directed.
- 5.5.1. **Nonuniform Application.** Stop application if it is not uniform due to streaking, ridging, puddling, or flowing off the roadway surface. Verify equipment condition, operating procedures, application temperature, and material properties. Determine and correct the cause of nonuniform application. If the cause is high or low emulsion viscosity, replace emulsion with material that corrects the problem. Repair any areas of nonuniformity as directed.
- 5.5.2. **Test Strips.** The Engineer may stop asphalt application and require construction of test strips at the Contractor's expense if any of the following occurs:
- nonuniformity of application continues after corrective action;
  - on 3 consecutive shots, application rate differs by more than 0.03 gal. per square yard from the rate directed; or
  - any shot differs by more than 0.05 gal. per square yard from the rate directed.
- The Engineer will approve the test strip location. The Engineer may require additional test strips until HDMB application meets specification requirements.
- 5.6. **Curing.** Cure the HDMB in accordance with the manufacturer's recommendation. Protect treated surface from traffic until the area has cured.
- 5.7. **Cleanup.** Remove all covers and protections that were installed near the project. Clean any adjacent items or markings that were contaminated during application.

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**6. MEASUREMENT**

High Density Mineral Bond will be measured by the square yard of completed and accepted work. No deduction will be made for the areas occupied by manholes, inlets, drainage structures, pavement markings, or by any public utility appurtenances within the area.

This is a plans quantity item. The quantity to be paid is the quantity shown in the proposal, unless modified by Article 9.2, "Plans Quantity Measurement." Additional measurements or calculations will be made if adjustments of quantities are required.

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**7. PAYMENT**

The work performed and materials furnished in accordance with this item and measured as provided under "Measurement" will be paid for at the unit price bid for "High Density Mineral Bond." This price is full compensation for surface preparation, furnishing, preparing, hauling and placing materials, removing existing pavement markings, and for labor, tools, equipment, and incidentals.

# **HIGH DENSITY MINERAL BOND**

## **Part 1        GENERAL**

### **1.1    SECTION INCLUDES**

- A.    Mineral aggregate and asphalt binder surface treatment installed as a High Density Mineral Bond over a roadway surface.

### **1.2    REFERENCES**

- A.    AASHTO R 9: Standard Recommended Practice for Acceptance Sampling Plans for Highway Construction
- B.    ANSI B74.8: Procedure to Ball Mill Test for Friability of Abrasive Grain
- C.    ASTM C 128: Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate
- D.    ASTM C 170: Standard Test Method for Compressive Strength of Dimension Stone
- E.    ASTM C 1326: Standard Test Method for Knoop Indentation Hardness of Advanced Ceramics
- F.    ASTM D 1644: Standard Test Method for Nonvolatile Content (Solids by Weight)
- G.    ASTM D 2172: Standard Test Methods for Quantitative Extraction of Bitumen From Bituminous Paving Mixtures
- H.    ASTM D 2196: Standard Test Method for Rheological Properties of Non-Newtonian materials by Rotational (Brookfield type) Viscometer
- I.    ASTM D 2486: Standard Test Method for determining wear resistance in cycles
- J.    ASTM D 2939: Standard Test Method for Emulsified Bitumens used as Protective Coatings
- K.    ASTM D 3960: Standard Practice for Determining Volatile Organic Compound Content of Paints and Related Coatings
- L.    ASTM E 70: Standard Test Method for pH of Aqueous solutions with the Glass Electrode
- M.    AASHTO T 59: Standard Test Method for Testing Emulsified Asphalts

- N. AASHTO T 111: Standard Test Method for Mineral Matter or Ash in Asphalt Materials

### **1.3 DEFINITIONS**

- A. Lot – The number of tons of High Density Mineral Bond placed in a Production Day.

### **1.4 SUBMITTALS**

- A. Results of wear resistance test current within one calendar year.
- B. Traffic control and notification plan.
- C. Mix Design: 10 days prior to use.
- D. Equipment: List of construction equipment to be used.
- E. Certification from emulsion manufacturer stating the base emulsion meets the requirements of the High Density Mineral Bond base emulsion in section 2.1 of this specification.
- F. Certification from the manufacturer stating the completed High Density Mineral Bond meets the requirements of section 2.3 of this specification.
- G. Warranty.

### **1.5 QUALITY ASSURANCE**

- A. Contractor has successfully completed at least five (5) projects of similar size and nature, using the same mix design as described in section 2. Provide a list of five (5) projects which used the mix design in section 2 and have demonstrated a five year minimum proven performance on a bituminous surface. Acceptable performance after five year period is no less than 70% residual coverage in the treated surface area.
- B. Foreman of the crew has completed at least three (3) projects of similar size and nature.
- C. Do not change the source of the emulsified asphalt or aggregate without supporting changes in the mix design.
- D. Reject asphalt emulsion that does not meet requirements of this section.
- E. Remove product found defective after installation and install acceptable product at no additional cost to the department.

## **1.6 WEATHER**

- A. Temperature:
  - 1. Apply surface treatment material when air and roadbed temperatures in the shade are 45° Fahrenheit (°F) and rising.
  - 2. Do not apply surface treatment material if pavement or air temperature is below 45° Fahrenheit (°F) and falling or if the finished product will freeze before 48 hours.
- B. Moisture: Do not apply surface treatment material during rain or unsuitable weather.

## **1.7 NOTICE**

- A. Follow Laws and Regulations concerning when and to whom notices are to be given. Give written notices at least 2 days prior to applying surface treatment material.
- B. Indicate application time and when the surface can be used. Include a map signifying the specific area to be closed providing detailed directions.
- C. Provide a minimum of two contacts that represent the Contractor with phone numbers which can be reached at any time during the project.
- D. Should work not occur on specified day, send a new notice before the end of the day.

## **1.8 ACCEPTANCE**

- A. General:
  - 1. Acceptance is by Lot.
  - 2. If non-complying material has been installed and no price for the material is specified, apply price adjustment against cost of work requiring complying material as part of its installation.
  - 3. Opening HDMB to vehicular traffic does not constitute acceptance.
  - 4. Observation of Contractor's field quality control testing does not constitute acceptance. Such testing; however, may be used by Engineer for acceptance.
- B. Surface Treatment Material:
  - 1. Paving Asphalt: Acceptance is not specified in this Section.
  - 2. Aggregate Source: Verify suitability of aggregated source.
  - 3. Mixture, Ready to Install: Lot size is the number of tons of High Density Mineral Bond placed in one day. Collect samples randomly and test for density, AASHTO T59
- C. Placement
  - 1. Lot size is 1 lane mile. Sub-lot size is 0.1 lane mile.
  - 2. Mat Appearance:
    - a. No runoff onto concrete curbs and shoulders



- b. No streaking
- c. No Light spots
- d. No de-bonding due to road contaminants

- D. Price Adjustment: Mat appearance defects may be accepted if a 2.5 percent price reduction is applied against the Lot for each condition not met. Maximum price reduction for the Lot is 5 percent. Engineer may waive price adjustment if Contractor corrects deficiencies at no additional cost to the department.

## 1.9 WARRANTY

- A. The surface treatment material must carry a warranty from both the Contractor and the manufacturer for a period of five (5) years when applied to pavement in appropriate condition. Acceptable performance after 5 years is defined as, no less than 70% residual inter-aggregate coverage in the treated surface area. The warranty includes coverage for peeling and delamination. Mechanical disturbances by snow plow chatter, studded tires, etc. are excluded from warranty.

## PART 2 MATERIAL

### 2.1 HIGH DENSITY MINERAL BOND BASE EMULSIFIED ASPHALT

- A. Non-ionic base emulsion used in High Density Mineral Bond, at 77 Deg. F., must meet the requirements of Table 1 below.

Table 1

Non-Ionic Emulsion – Emulsifier Type: Inorganic*			
Criteria	ASTM/AASHTO METHOD	Specification	Unit
Initial Brookfield Viscosity at 77 °F (RV-5, 20 rpm)	D2196	11,000 – 20,000	cPs
pH	E70	5.0 – 7.5	pH
Density	T59	8.5 – 9.0	lbs/gal
Solids Content	T59	50.0 - 54.0	%, by weight
Ash Content of emulsion	T111	4.0 – 6.0	%, by weight
*Inorganic is defined as a non-carbon-based emulsifier			

## 2.2 AGGREGATE

### A. Slate:

Table 2

Slate			
Criteria	ASTM Method	Specification	Unit
Specific gravity	C128	>2.6	--
Compression	C170	11,000 min	psi

### B. Refined Corundum

Table 3

Refined Corundum		
Criteria	ASTM Method	Specification
Specific Gravity	C128	> 3.9
Knoop 100 Hardness	C1326	> 2,000
Ball Mill Fiability	ANSI B74.8	50 (14 grit)

## 2.3 COMPLETED HIGH DENSITY MINERAL BOND MIX DESIGN

- A. Completed High Density Mineral Bond material, prior to being loaded for install must meet the requirements in Table 6 below:

Table 6

Criterion	ASTM/AASHTO Method	Specification	Unit
Asphalt Content	D2172 <sup>1</sup>	17.0 – 20.0	%, by weight
Solids Content	D1644	55.0 – 63.0	%, by weight
Initial Brookfield Viscosity at 77°F (RV-4, 20 rpm)	D2196	5,500 – 9,000	cPs
Ash Content of wet mix	C2939	> 38.0	%, by weight
Ash Content of Solids	T111 <sup>2</sup>	> 63.0	%, by weight
Density	T59	> 11.0	lbs/gal
pH	E70	6.0 – 8.0	
Total Inorganic Aggregate Content	T111 <sup>3</sup>	> 34.0	%, by weight
Total Sand Content		< 6.0	%, by weight
Maximum VOC	D3960	< 5.0	g/l
Resistance to Re-emulsification	D2939	No Re-emulsification	--
Wear Resistance	D2486 Modified <sup>4</sup>	< 4.0 %	% loss, by weight

- Report Asphalt Content of Mixture prior to being loaded for install as % Solids minus % Ash.
- Ash Content as a percentage of Solids Content.
- 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.
- 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.

### **3.1    CONSTRUCTION EQUIPMENT**

- A.    Paver: Continuous flow mixing unit.
  - 1.    Capable of applying at least 15,000 square yards of material per day.
  - 2.    Equipped with full sweep helical mixer to assure proper suspension of fine aggregates.

### **3.2    PREPARATION**

- A.    General:
  - 1.    Severely raveled or porous pavements may require tack coat.
  - 2.    Asphalt concrete inlay may be required in rut deformations.
- B.    Surface Repair: Patch any holes, raveled areas, and low areas with asphalt concrete.
- C.    Cleaning:
  - 1.    Remove loose material, mud spots, sand, dust, oil, vegetation and other objectionable material.
  - 2.    Do not flush water over cracks or apply pressurized water to cracked pavement.
  - 3.    Clean the surface prior to installation.

### **3.3    PROTECTION**

- A.    Implement the traffic control plan requirements. Provide safe passage for pedestrians and vehicles. Do not proceed without flaggers.
- B.    Protect trees, plants, and other ground cover from damage.
- C.    Prune trees to allow equipment passage underneath. Repair tree damage at no additional cost to the Department.
- D.    Install invert covers.

- E. Mask off end of streets and intersection to provide straight lines:
  - 1. Make straight lines along lip of gutters and shoulders. Keep same thickness in these areas. No runoff on these areas will be permitted.
- F. Protect curb, gutter, and sidewalks from spatter, mar, or overcoat.
- G. Protect surface treatment materials from traffic until it has cured.

### **3.4 APPLICATION**

- A. Application Rate: Two separate application coats are required. The first application must be thoroughly dry and free of any damp areas before the second application begins. Machine settings must match the following application rates.
  - 1. 0.20 gallons per square yard minimum.
  - 2. 0.16 gallons per square yard minimum.
- B. Spreading:
  - 1. Keep constant delivery rate of material per square yard of surface.
  - 2. Do not reduce application rate along edges or around manhole covers.
  - 3. Apply both applications right to the edge of the pavement. Do not back away from curbs, manhole covers, and edges on either application.

### **3.5 AFTER APPLICATION**

- A. Leave no streaks caused by plugged nozzle or improper spray bar height.
- B. Leave no holes, bare spots, or cracks.
- C. Expose and clean Manholes, valve boxes, inlets and other service entrances and Street Fixtures.
- D. Raise reflective tabs that were covered over.
- E. Do not permit traffic on product until surface has cured.

### **3.6 FIELD QUALITY CONTROL**

- A. Testing: If density tests (AASHTO T59) show non-compliance, remove the product and halt operations until new material arrives and is shown to be in compliance. Measure the total amounts of material installed, and verify it meets the application rate.
- B. Protect surface treatment material from traffic until it has cured.

### **3.7 REPAIR**

- A. Remove spatter and mar from curb and gutter, sidewalk, guard rails and guide posts at no additional cost to the Department.
- B. Remove surface treatment material from Street Fixtures
- C. Make correction lines straight. Provide good appearance.
- D. Leave no streaks, holes, bare spots, or cracks through which liquids or foreign matter could penetrate to the underlying pavement.
- E. Repair collateral damage caused by construction.

END OF SECTION