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**EMULSIFIED ASPHALT SLURRY SEAL****PART 1 - GENERAL****1.01 SECTION INCLUDES**

Emulsified Asphalt Slurry Seal

**1.02 DESCRIPTION OF WORK**

Includes the requirements for surface treatment of an existing pavement with an application of an emulsified asphalt slurry seal. In addition, the work may involve the following items:

- A. Slurry Leveling:** Use fine slurry mixtures to fill shallow depressions in the pavement and over cracks.
- B. Strip Slurry Treatment:** Applications of fine or coarse slurry mixtures as specified in the contract documents

**1.03 SUBMITTALS**

Comply with Division 1 - General Provisions and Covenants.

**1.04 SUBSTITUTIONS**

Comply with Division 1 - General Provisions and Covenants.

**1.05 DELIVERY, STORAGE, AND HANDLING**

Comply with Division 1 - General Provisions and Covenants, as well as the following:

Keep the various aggregate products separate, and make adequate provisions to prevent intermingling. Handle stockpiling and processing in a manner that will ensure uniform incorporation of the aggregate into the mix.

**1.06 SCHEDULING AND CONFLICTS**

Comply with Division 1 - General Provisions and Covenants.

**1.07 SPECIAL REQUIREMENTS**

None.

**1.08 MEASUREMENT AND PAYMENT****A. Emulsified Asphalt Slurry Seal by Area:**

- 1. Measurement:** Measurement will be in square yards for emulsified asphalt slurry seal.
- 2. Payment:** Payment will be at the unit price per square yard of emulsified asphalt slurry seal.
- 3. Includes:** Unit price includes, but is not limited to, surface preparation and furnishing and placing of materials, including fillets at intersecting streets, driveways, and turnouts.

**1.08 MEASUREMENT AND PAYMENT (Continued)****B. Emulsified Asphalt Slurry Seal by Units:****1. Aggregate:**

- a. Measurement:** Measurement will be in tons of aggregate.
- b. Payment:** Payment will be at the unit price per ton.
- c. Includes:** Unit price includes, but is not limited to, surface preparation and furnishing and placing of materials, including fillets at intersecting streets, driveways, and turnouts.

**2. Asphalt Emulsion:**

- a. Measurement:** Measurement will be in gallons of asphalt emulsion furnished and incorporated, including street surface, fillets, and turnouts.
- b. Payment:** Payment will be at the unit price per gallon of asphalt emulsion furnished and incorporated.
- c. Includes:** Unit price includes, but is not limited to, surface preparation and furnishing and placing of materials, including fillets at intersecting streets, driveways, and turnouts.

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**PART 2 - PRODUCTS****2.01 MATERIALS**

**A. Asphalt Emulsion:** Use a Grade CSS-1H (AASHTO M 208) or SS-1H (AASHTO M 140) emulsified asphalt meeting the requirements of Iowa DOT Section 4140.

**B. Aggregate:**

- Mineral aggregate consisting of natural or manufactured sand, slag, crusher fines, and others, or a combination thereof.
- Smooth-textured sand not exceeding 50% of the total combined aggregate.
- Clean and free from vegetable matter and other deleterious substances.
- When tested according to ASSHTO 96, shows a loss of no more than 40.
- When specified, use crushed aggregates meeting the requirements of Iowa DOT Section 4124

Mineral fillers such as portland cement, limestone dust, fly ash, and others are considered part of the blended aggregate; use in minimum required amounts. Only use fillers if needed to improve the workability of the mix or gradation of the aggregate.

**C. Mixture Gradation:** Use composite aggregate, excluding mineral filler that complies with the following gradation limits for the specified slurry mixture required:

1. **Fine Slurry Mixture:** Use aggregate meeting the requirements of Iowa DOT Article 4109.02, Gradation No. 22 of the Aggregate Gradation Table.
2. **Coarse Slurry Mixture:** Use aggregate meeting the requirements of Iowa DOT Article 4109.02, Gradation No. 23 of the Aggregate Gradation Table.

**D. Water:** Use water that is potable and free of harmful soluble salts in the slurry mixture.

**2.02 COMPOSITION OF THE SLURRY MIX**

**A.** Blend the amount of asphalt emulsion with the aggregate as specified in the contract documents and as adjusted in the field.

**B.** A minimum amount of water may be added as necessary to obtain a fluid and homogeneous mixture. Mix until the consistency is such that it “rolls” in the spreader box in a continuous mass.

**C.** Slurry that segregates in the spreader box, so that flowing of liquids (water and emulsion) is evident, is not acceptable.

**D.** Provide the Engineer with a copy of the certified gradations of aggregate proposed for use.

**E. Asphalt Binder Content:**

1. Estimated Asphalt Residue Content: 7% to 14% of the dry weight of the aggregate.
2. Mixture Design Film Thickness: 7.5 microns (target value) with a  $\pm 0.75$  microns permissible range.

**F. Handling and Sampling Slurry Materials:**

1. Stockpiling of Aggregate:
  - a. Take precautions to prevent stockpile contamination with oversized rock, clay, silt, or moisture in excess of which would interfere with the amount of asphalt emulsion required in producing the desired homogeneous slurry mixture.

**2.02 COMPOSITION OF THE SLURRY MIX (Continued)**

- b. Place the stockpile in a well drained area. Do not allow the aggregate to become segregated.
  - c. Control the moisture in the aggregate to be within  $\pm 1.5\%$  of the moisture content of the aggregate at the time of calibration.
2. Storage:
    - a. Provide suitable storage facilities for the asphalt emulsion. Use a container equipped to prevent water from entering the emulsion.
    - b. Provide suitable and adequate heat to prevent freezing and to facilitate handling of the asphalt emulsion.
  3. Sampling: Furnish samples of materials during the process of the work as directed by the Engineer.

**2.03 MIX DESIGN**

**A. General:** Develop the mix design for the slurry mixture using the services of an independent testing laboratory that is certified by the International Slurry Surfacing Association (ISSA). Verify the functioning of the set regulating additives and present certified test results for the Engineer's approval prior to the work commencing. The Engineer will verify the laboratory tests required in ISSA A105 have been conducted.

**B. Proportions:** Meet following limits.

Mineral Aggregate, dry weight lb/sq yd	15 to 25
Emulsified Asphalt Residue, % by weight of aggregate	7.5 to 13.5%
Latex Base Modifier (if required)	As required with % by weight of binder, min. of 5.0
Mix Set Additive	As required
Mineral Filler, % by weight of aggregate	0.5 to 2.0% depending on weather conditions

**C. Compatibility:** Verify the compatibility of the aggregate, emulsified asphalt, mineral filler, and other additives with the mix design. Meet the following requirements for ISSA A105:

ISSA Test No.	Description	Specifications
ISSA TB-139	Wet Cohesion @ 30 minutes min. (set) @ 60 minutes min. (traffic)	12 kg-cm min. 20 kg-cm min. or Near Spin min.
ISSA TB-109	Excess Asphalt by LWT Sand Adhesion	50 gm/sq ft max.
ISSA TB-114	Wet Stripping	Pass (90% min.)
ISSA TB-100	Wet-Track Abrasion Loss One-hour Soak	75 gm/sq ft max.
ISSA TB-113	Mix Time @ 77°F	Controllable to 180 seconds, min.
ISSA TB 106	Consistency	0.79-1.18 inches
ISSA TB 113	Mix Time at 77°F	Controllable to 180 seconds, min.

Check the mixing test and set time test at the highest temperatures expected during construction.

**2.03 MIX DESIGN (Continued)**

- D. Submittal:** In the mix design, report the quantitative effects of moisture content on the unit weight of the aggregate (bulking effect). Clearly show the proportions of aggregate, mineral filler (minimum and maximum), water (minimum and maximum), additive usage, and asphalt emulsion based on the dry weight of the aggregate.

For the aggregate blend in the mix design, provide the test results for AASHTO T 176 with the mix information to the Engineer. The Engineer's review and approval will be required for aggregate test values below 45.

- E. Approval:** Show the percentages of each individual material required in the laboratory report. Obtain approval from the Engineer for the mix design prior to its use. After approval, substitutions will not be allowed unless approved by the Engineer. Maintain continuous control of the emulsified asphalt to dry aggregate proportioning to conform to the approved mix design within a tolerance of  $\pm 2$  gal/ton.

**PART 3 - EXECUTION****3.01 EQUIPMENT****A. Slurry Mixing Equipment:**

1. Use a continuous flow mixing unit capable of accurately delivering a predetermined proportion of aggregate, water, control additives, and asphalt emulsion to the mixing chamber, and discharging the thoroughly mixed product on a continuous basis.
2. Pre-wet the aggregate immediately prior to mixing with the emulsion. Use a pugmill capable of thoroughly blending all ingredients together.
3. When required, use a mixing machine equipped with an approved fines feeder that provides an accurate metering device, or method, to introduce a predetermined proportion of mineral filler into the mixer at the same time and location that the aggregate is fed.
4. Use an aggregate feed to the mixer equipped with a revolution counter or similar device so the amount of aggregate used may be determined at any time.
5. Use a positive displacement type emulsion pump equipped with a revolution counter or similar device so that the amount of emulsion used may be determined at any time.
6. For adding water to the mixer, use a pump equipped with a valve to establish the required water flow.
7. Mechanically tie all controls to ensure accurate proportioning of all materials at all times, including starts and stops. On some machines, this can be a simultaneous start and stop of all materials. On other machines, depending on where the materials are introduced into the mixing chamber, the feeds must be properly synchronized.
8. Use a one-lever or one-button operation with no means for the operator to adjust the mix proportions, except for the water.
9. Use revolution counters that count 0.1 revolutions on mechanisms that turn less than 100 rpm.
10. Attach a metering device to the slurry machine for the addition of additive to the mixture or any component material. Use a device that has positive, quick-acting controls, is easily calibrated, and maintains accurate and uniform flow.
11. Provide a means for calibrating the mixer. Calibrate and properly mark the controls for proportioning each material to be added to the mix. Use equipment with controls placed so they are readily accessible for calibration and so the Engineer may determine the amount of each material being used at any time. A minimum of three aggregate gate settings will be required for calibration and, if changes in emulsion delivery are necessary, a minimum of three pump changes will be required.
12. Use a mixing machine that:
  - Is equipped with a water pressure system and fog type spray bar adequate for complete fogging of the surface preceding spreading equipment,
  - Is controllable to an application range of 0.05 gallon per square yard, and
  - Provides sufficient machine storage capacity to properly mix and apply a minimum of 5 tons of the slurry, except when the mixing machine is operated in a continuous manner and is supplied by separate nurse type equipment.

**3.01 EQUIPMENT (Continued)****B. Slurry Spreading Equipment:****1. Full Width, Slurry Wedge, Strip Slurry Treatment:**

- a. Use a mixer machine with an attached mechanical type squeegee distributor equipped with flexible material in contact with the surface to prevent loss of slurry from the distributor. Maintain the squeegee to prevent loss of slurry on varying grades and crown. Include a steering device and a flexible strike off.
- b. Use a spreader box capable of placing the slurry mixture to the width specified in the contract documents. Use a spreader box equipped with vertical adjustment devices attached to horizontal support devices (such as runners) located a minimum of 6 inches inside both ends at the side of the box. This is to ensure uniform distribution on varying grades and crowns. Use vertical adjustment devices of sufficient weight (mass) to keep the horizontal support devices in contact with the roadway surface during operation. Use flexible strike off material of sufficient stiffness to produce the desired texture and rate of application.
- c. Keep the spreader box clean. Do not allow build up of asphalt and aggregate on the box.

2. **Slurry Leveling:** Use metal lutes of varying widths for spreading the slurry mixture in the depressed areas. Ensure the face of each lute is indented (arched) slightly (1/8 inch to 3/16 inch) to aid in controlling the spread.

**C. Cleaning Equipment:** Use power brooms, power blowers, air compressors, water flushing equipment, or hand brooms for cleaning the surface and cracks.

**D. Auxiliary Equipment:** Furnish hand squeegees, shovels, and other equipment as necessary to perform the work.

**E. Screening Unit:** Use a screening unit to remove objectionable oversize and foreign material that may be encountered. Screen material before loading the slurry machine and/or weighing for payment.

**3.02 SURFACE PREPARATION**

- A. If specified, complete pavement patches and joint or crack filling per Section 7040.
- B. Immediately prior to applying the slurry, clean the surface of all loose material, mud spots, vegetation, and other objectionable material.
- C. Any standard cleaning method used to clean pavements such as power brooms, compressed air, high-pressure water, and hand tools will be acceptable, except water flushing will not be allowed in areas where considerable cracks are present in the pavement surface. The surface preparation is subject to approval of the Engineer prior to placement of the slurry material.
- D. Use a suitable covering to protect the items below from being soiled by bitumen. Leave the protective covering in place until the bitumen has set.
  - Pavements adjacent to the beginning and end of placement.
  - Manholes and Utility accesses.
  - Intakes.
  - Water and gas valves.
  - Railroad flange ways.
  - Other installations requiring protection.

**3.03 APPLYING SLURRY MATERIAL**

- A. When directed by the Engineer, fog the surface of the pavement with water immediately preceding the pass of the spreader. Apply the water fog at such a rate that the entire surface is damp (approximately 0.05 gallon per square yard) with no apparent flowing water in front of the slurry box.
- B. Ensure the slurry mixture is of the desired consistency such that it “rolls” in the spreader in a continuous mass prior to deposit on the surface. Do not exceed 4 minutes for the total time of mixing.
- C. Ensure a sufficient amount of slurry is carried in all parts of the spreader at all times so complete coverage is obtained. Avoid overloading of the spreader. Apply the slurry seal at a rate of 10 to 18 pounds per square yard for fine aggregate and 15 to 22 pounds per square yard for coarse aggregate or as specified in the contract documents. Spread the paving mixture to fill minor cracks and shallow potholes and leave a uniform surface. Verify the application rate from daily readings taken from the proportioning devices during the progress of the work.
- D. No lumping, balling, or unmixed aggregate is allowed. No segregation of the emulsion and aggregate fines from the coarse aggregate is allowed. If the coarse aggregate settles to the bottom of the mix, remove the slurry from the pavement.
- E. Avoid buildup on longitudinal or transverse joints.
- F. Apply a burlap drag to the surface when specified in the contract documents.
- G. Apply strip slurry treatment parallel to the centerline, edge line, or other reference using a guide extending at least 3 feet ahead of the application equipment.
- H. A mechanical device, such as an auger, may be used to distribute the slurry in the spreader box. The use of a mechanical device in the slurry distribution box for strip slurry treatment and slurry wedge application will generally not be required.
- I. Ensure the finished product is uniform in color and composition. Do not leave streaks, such as those caused by oversized aggregate, in the finished surface. If excess streaking develops, the job will be stopped until the Contractor proves to the Engineer that the situation has been corrected. Excessive streaking is defined as more than four drag marks greater than 1/2 inch wide and 4 inch long, or 1 inch wide and 3 inches long, in any 30 square yard area. No transverse ripples or longitudinal streaks of 0.25 inch in depth will be allowed, when measured by placing a 10 feet straightedge over the surface.
- J. Ensure the slurry seal possesses sufficient stability so that premature breaking of the material in the spreader box does not occur. Ensure the mixture is homogeneous during and following mixing and spreading. It must be free of excess water or emulsified asphalt and free of segregation of the emulsified asphalt and aggregate fines from the coarser aggregate. Do not spray water directly into the laydown box while placing slurry seal material.
- K. Provide a smooth, neat seam where two passes meet. Immediately remove excess material from the ends of each run. Repair any damage to, or irregularities in, the slurry seal, as directed by the Engineer. Make all repairs with a paver box, except areas designated as hand work areas.



**3.03 APPLYING SLURRY MATERIAL (Continued)**

- L. Those areas inaccessible to the spreader box and approved by the Engineer may be designated as hand work areas. Use approved squeegees to spread slurry in areas inaccessible to the slurry machine. Adjustments to the additive will be allowed to provide a slower setting time when hand spreading is needed. If hand spreading is necessary, pour the mixture in a small windrow along one edge of the surface to be covered and then spread uniformly by a hand squeegee or lute. Ensure hand work areas have an appearance consistent with the areas placed with a spreader box.
- M. Remove the slurry seal mix from all areas, such as manholes, gutters, and intersections, as directed by the Engineer. On a daily basis, remove any debris associated with the performance of the work.
- N. Check the yield of the application after the first 1,000 feet and throughout each day's paving, with a minimum of three tests per day. Furnish the yield check results to the Engineer daily.
- O. Submit a daily "run sheet" for each day's work as soon as all the data is available. On the run sheet, provide a breakdown of the actual meter numbers and quantities of all materials actually used each day, as well as the respective locations.

**3.04 SLURRY LEVELING**

- A. Ensure the surface to which the slurry leveling is to be applied is moist and clean of dust and foreign material. Scraping and sweeping may be necessary.
- B. Spread the slurry leveling mixture in depressions at and over cracks in the pavement. Spread to the full width of the depression. Level the slurry with a metal lute of the proper width to provide a smooth riding surface. Ensure the slurry leveling is neat in appearance. Do not allow spillage around and between leveled areas. Keep excess material at the pavement edge to a minimum. Scatter excess material across the adjacent shoulder.
- C. Allow the slurry leveling to cure until the area may be open to traffic without pick up or raveling of the leveling mixture.
- D. Ensure the cured slurry has a homogeneous appearance and a uniform texture, fills all cracks in the application area, and adheres to the surface.

**3.05 LIMITATIONS**

- A. Schedule slurry placement to ensure the traffic lanes are opened to traffic 30 minutes before sundown of the same working day. When traffic is maintained, keep the entire roadbed free of construction equipment during non-working hours.
- B. Place slurry mixture between May 1 and October 15, when the temperature is at least 50°F and rising, and the forecast for the next 24 hours is above 40°F.
- C. When this work is done in conjunction with crack cleaning and filling, clean and fill cracks before performing slurry work. The application of slurry and the crack cleaning and filling activity may be done as one coordinated operation.
- D. When placing a strip slurry treatment, both edges of the slurry box must run on the pavement surface.
- E. When the installation of strip slurry treatment is required at a pavement centerline or lane line, the Engineer may require such placement in two separate applications.

**3.06 CURING AND OPENING TO TRAFFIC**

Allow the treated area to cure until it may be opened to traffic without pick up or raveling of the slurry mixture. Repair or replace any damaged caused to the slurry surface by premature opening to traffic at no additional cost to the Contracting Authority.

END OF SECTION