

Section 506. SLURRY SEAL

506.01. Description. This work consists of providing traffic control, preparing the surface, and applying a slurry seal mixture.

506.02. Materials. Provide material in accordance with the following:

Type I Portland Cement.....	<u>901</u>
Fine Aggregate, 2FA	<u>902</u>
Asphalt Emulsion, CSS-1h	<u>904</u>
Water	<u>911</u>

The Engineer will waive the cement mixing test for Asphalt Emulsions, CSS-1h.

A. **Mix Design Requirements.** Provide a slurry seal mix consisting of asphalt emulsion, fine aggregate, portland cement, water, and other additives. At least 10 working days before beginning production, submit to the Engineer a mix design prepared and certified by a Department-approved laboratory. The Contractor may use mix additives to provide additional control of the quick set properties and to increase adhesion. List additives as part of the mix design.

The Department will require a new mix design for any change in aggregate or asphalt emulsion sources.

Verify the compatibility and proportions of the fine aggregate, asphalt emulsion, portland cement, and additives.

From the mix design, develop a Job Mix Formula (JMF) showing the proportions of each material. Ensure the JMF complies with ASTM D 3910 for consistency, set time, cure time, and wet track abrasion.

Design a JMF with a residual asphalt binder content from 9.0 percent to 11.0 percent of the aggregate dry weight, and with a cement content from 0.5 percent to 3.0 percent of the aggregate dry weight.

- 1. **Mix Design Documentation.** Include all of the following in the mix design:
 - a. Sources of individual materials.
 - b. Aggregate properties including gradation, sand equivalence, and angularity index (A.I.).
 - c. Test results for the following parameters as tested in accordance with ASTM D 3910:
 - i. Consistency test,
 - ii. Set time,

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- iii. Cure time, and
- iv. Wet track abrasion.
- d. Interpretation of results and determination of a JMF including the following:
 - i. Cement (minimum and maximum), percent;
 - ii. Water, including aggregate moisture (minimum and maximum), percent;
 - iii. Additive (if required), percent;
 - iv. Emulsion in mix, percent;
 - v. Residual asphalt content of emulsion; and
 - vi. Residual asphalt content in mix, percent.
- e. Mix designer's signature and date.

506.03. Construction.

A. **Equipment.** Provide equipment, in accordance with section 107 and this section, capable of producing a specification product.

1. **Slurry Seal Mixer.** Provide a continuous-flow slurry seal mixing machine with automated controls, capable of delivering predetermined proportions of aggregate, water, and asphalt emulsion to the mixing chamber, and capable of continuously discharging the mixed product. Do not mix violently. Equip and operate each mixing machine as follows:
 - a. Easy to read metering devices that accurately measure the raw materials before they enter the pugmill.
 - b. A system to pre-wet the aggregate in the pugmill immediately before mixing with the emulsion.
 - c. A fines feeder with a metering device, or other approved means, to drop the required mineral filler quantity onto the aggregate before entering the mixing machine. Use the fines feeder if mineral filler is part of the aggregate blend.
 - d. A water pressure system and a fog-type spray bar to fog the surface immediately ahead of the spreading equipment. Apply water fog from 0.03 gallon per square yard to 0.06 gallon per square yard.
 - e. Capable of a speed of at least 60 feet per minute. Operate at less than 180 feet per minute.
 - f. Storage capacity to mix at least 7 tons of slurry seal.
 - g. A method of measuring materials in each slurry seal batch. Obtain the Engineer's approval of the measurement method and make available for observation.

- h. Check the slurry seal mixer weekly to ensure the condition of the equipment meets requirements.

The Engineer may use the recorders and measuring devices of the slurry seal unit to determine application rates, asphalt emulsion content, and mineral filler content of individual loads.

2. **Spreading Equipment.** Attach an adjustable, mechanical-type single squeegee distributor to the mixing machine. Equip the distributor with flexible material in contact with the road surface to prevent loss of slurry. Ensure a uniform application of slurry on varying grades and crowns. Provide a steerable distributor, adjustable in width with a flexible strike-off.

Ensure the spreader box does not leave grooves in the slurry. Keep the spreader box clean, and do not allow material build-up on the spreader.

Obtain the Engineer's approval of burlap, or other textile drag. Wet the drag with water at the beginning of each application. Clean or change the drag as directed by the Engineer.

3. **Calibration Requirements.** Before construction, calibrate each slurry seal mixer in accordance with the *Asphalt Institute Manual Series No. 19*, 2nd edition. Submit to the Engineer documentation of the calibration of each material metering device at various settings. Supply materials and equipment, including scales and containers, for calibration. After calibrating each mixing machine, demonstrate to the Engineer the ability of the machine to mix components together to simulate an end product. Repeat mixer calibration for changes in aggregate or asphalt emulsion source.
4. **Miscellaneous Equipment.** Provide hand squeegees, shovels, and other equipment to perform the work. Provide cleaning equipment including power brooms, air compressors, water flushing equipment, and hand brooms for surface preparation.
5. **Lights on Equipment.** Equip power brooms, distributors, and truck-mounted spreaders and mixers with at least one Department-approved, flashing, rotating, or oscillating amber light, visible in every direction. Equip continuous mixer and spreader units with one light on each side of the machine.

- B. **Pre-Production Meeting.** Before beginning work, conduct an on-site pre-paving meeting with the Engineer to discuss the following:

1. Contractor's detailed work schedule;
2. Traffic control plan;

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3. Equipment calibration;
4. Mix design previously submitted to the Engineer;
5. Equipment inspection, including transport units;
6. Surface preparation and pre-treatment;
7. Permit to Place (Form 1125); and
8. Availability of materials.

C. Surface Preparation. Remove loose material, vegetation, dirt, mud, and other deleterious materials, and wash animal remains from the surface before placing the slurry seal.

Before placing slurry seal, treat visible cracks with overband crack fill in accordance with section 502.

If a bond coat is required, use one part CSS-1h emulsified asphalt to three parts water, and apply at a rate of 0.05 gallons per square yard. Allow the bond coat to cure before placing the slurry seal.

D. Application. Apply a single course of slurry seal over the area shown on the plans at a rate of at least 16 pounds per square yard, based on the weight of dry aggregate.

E. Surface Quality. Provide a finished surface, free of scratch marks, rippling, and other surface irregularities. Do not leave tear marks greater than ½ inch wide and 4 inches long, or other marks greater than 1 inch wide and 1 inch long.

F. Cure Time and Repair. Do not allow traffic on the new surface until it cures, to prevent pickup by vehicle tires. Repair traffic damage to the new slurry seal surface at no additional cost to the Department.

G. Weather and Seasonal Limitations.

1. **Weather Limitations.** Place the slurry seal when pavement and ambient air temperatures are at least 45 °F and are rising. Do not place mix in rain or inclement weather, or if temperatures are forecast below 32 °F within 24 hours of application.
2. **Seasonal Limitations.** Place slurry seal in accordance with the following seasonal limitations:
 - a. From June 1 to September 15, in the Upper Peninsula; or
 - b. From May 1 to October 1, in the Lower Peninsula.

H. Quality Control. If the Engineer identifies conditions that cause an unsatisfactory slurry seal, immediately stop production and begin corrective action, at no additional cost to the Department. Maintain QC measures until the Engineer accepts the work.

Produce a mix that meets the JMF and the QC tolerances specified in Table 506-1. Notify the Engineer immediately and stop mix production if the QC test results exceed the tolerance specified in Table 506-1. Identify the cause of the deviation and determine the corrective action necessary to bring the mix into compliance. Obtain the Engineer's approval before resuming work.

1. **Sampling and Testing.** Conduct QC sampling and testing at the following minimum frequency:
 - a. Randomly sample fine aggregate from the mixer and test for gradation at a rate of one test per 500 ton of aggregate. Conduct at least one test per day of mix production.
 - b. Randomly, at least three times per day, calculate the percent asphalt content of the mixture using the equipment counter readings.

Table 506-1	
Slurry Seal Quality Control Tolerances	
Sieve Size	Tolerance (±)
No. 4	5.0%
No. 8	5.0%
No. 16	5.0%
No. 30	5.0%
No. 50	4.0%
No. 100	3.0%
No. 200	2.0%
General Quality Control Tolerances (±)	
Parameter	Tolerance
Asphalt Cement Content Single Test	0.5% from JMF
Asphalt Cement Content Daily Average	0.2% from JMF

2. **Documentation.** Within 1 working day of mix production and placement, provide a daily report to the Engineer with the following information:
 - a. Control section;
 - b. Project number;
 - c. County;
 - d. Route;
 - e. Engineer;
 - f. Date;
 - g. Air temperature;
 - h. Control settings;
 - i. Calibration values;
 - j. Unit weight of emulsion (pounds per gallon);
 - k. Percent residue in emulsion;
 - l. Beginning and ending stations;

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- m. Counter readings (beginning, ending, and total difference);
- n. Aggregates placed;
- o. Gallons of emulsion placed;
- p. Percent of each material;
- q. Percent of asphalt cement;
- r. Application rate;
- s. JMF (percent portland cement, percent emulsion, gradation, percent AC);
- t. Contractor's authorized signature;
- u. Calibration forms;
- v. Aggregate gradations;
- w. Aggregate certification or Shipment of Tested Stock Report (Form 1922); and
- x. Asphalt emulsion load ticket and Shipment of Tested Stock Report (Form 1922).

If using truck mounted machines, prepare a separate daily report for each machine.

I. **Acceptance.**

1. **Field Inspection Acceptance.** Upon completion of work, schedule an inspection with the Engineer. The Engineer will note deficiencies, including areas exhibiting adhesion or cohesion failure, or other factors the Engineer determines unacceptable. Correct work identified by the Engineer as unacceptable.
2. **Delayed Acceptance.** At least 30 days after completion of the slurry seal, the Engineer will inspect the project for surface flushing and loss of material. If the Engineer finds these deficiencies, correct the work as approved by the Engineer within 7 working days of the inspection, or other date, as agreed by the Engineer, and at no additional cost to the Department.

506.04. Measurement and Payment.

Pay Item	Pay Unit
Seal, Slurry	Square Yard

The unit price for **Seal, Slurry** includes the cost of cleaning existing pavement surface, applying a bond coat, placing the mix, and traffic control, including traffic control to complete corrective action.

The Department will pay separately for overband crack fill pre-treatment, in accordance with subsection 502.04.