

SECTION 00706 - EMULSIFIED ASPHALT SLURRY SEAL SURFACING

(Follow all instructions and make all edits with "Track Changes" turned on. If there are no instructions [purple text] above a subsection, paragraph, sentence, or bullet, then include it in the project. Delete all purple text before preparing the final document. All other modifications to this Section will require ODOT Technical Resource and State Specifications Engineer approval.)

Replace Section 00706 of the Standard Specifications except for the Section number and title with the following:

Description

00706.00 Scope - This Work consists of applying one or more layers of slurry seal consisting of Emulsified Asphalt, water, Aggregate, and additives on a prepared surface as shown or directed.

00706.02 Definitions:

Blast-furnace Slag - The nonmetallic product, consisting essentially of silicates and aluminosilicates of calcium and other bases that is developed in molten condition simultaneously with iron in a blast furnace.

Sublot Size - A sublot is 200 Tons of crushed Aggregate.

00706.03 Submittals - At least 14 Calendar Days prior to the slurry seal pre-placement conference, submit a signed slurry seal mix design for the specific Materials to be used on the Project. Show the percentages of each individual Material required on the mix design report. Provide a complete mix design made with the same Aggregate and Aggregate gradation that is used on the Project. After the mix design has been approved, no substitution is allowed unless approved in writing. Water is allowed to be used as a mix constituent during mix design development.

Submit a plan for preparation of surface according to 00706.41.

00706.04 Slurry Seal Pre-Placement Conference - At least 21 Calendar Days prior to beginning slurry seal placement, hold a pre-placement conference with all Contractor supervisory personnel, all Subcontractors who are to be involved in the slurry seal work, and the Engineer to discuss all phases of slurry seal work.

Materials

00706.10 Aggregate - Provide and stockpile Aggregate according to the following product compliance testing and the MFTP, section 4A:

(a) General - Provide clean, angular, durable, well graded, and uniform Aggregate consisting of broken stone, crushed Gravel, Blast-Furnace Slag or a combination of them.

(b) Fractured Faces - Crush Aggregate such that at least 90 percent by weight of the total Aggregate retained on the No. 8 and larger sieves is fractured on two faces, as determined according to AASHTO T 335.

(c) Unit Weight of Aggregate - Provide Aggregate with a minimum unit weight of 90 pounds per cubic foot according to AASHTO T 19.

(d) Soundness - Provide Coarse and Fine Aggregate with a weighted loss not exceeding 12 percent when subjected to five cycles of the soundness test using sodium sulfate solution according to AASHTO T 104.

(e) Durability - Provide Aggregate meeting the following durability requirements:

Test	Test Method ODOT	Test Method AASHTO	Maximum Values
Abrasion		T 96	30.0%
Degradation (Coarse Aggregate) Passing No. 20 Sieve	TM 208		30.0%
Sediment Height	TM 208		3.0 inches

(f) Harmful Substances - Provide Aggregate meeting the following harmful substances requirements:

Test	Test Method ODOT	Test Method AASHTO	Limits
Lightweight Pieces		T 113	1.0% maximum
Wood Particles	TM 225		0.1% maximum
Elongated Pieces (Coarse Aggregate at a ratio of 5:1)	TM 229		10.0% maximum
Sand Equivalent	T 176		60 minimum

(g) Grading - Perform sieve analysis according to AASHTO T 27 and AASHTO T 11. Provide grading for the slurry seal mix design for the specified type according to the following:

	TYPE I	TYPE II	TYPE III	
Sieve Size	Percent Passing	Percent Passing	Percent Passing	Stockpile Tolerance
3/8"	100	100	100	0
No. 4	100	90 - 100	70 - 90	± 5%
No. 8	90 - 100	65 - 90	45 - 70	± 5%

No. 16	65 - 90	45 - 70	28 - 50	± 5%
No. 30	40 - 65	30 - 50	19 - 34	± 5%
No. 50	25 - 42	18 - 30	12 - 25	± 4%
No. 100	15 - 30	10 - 21	7 - 18	± 3%
No. 200	10.0 - 20.0	5.0 - 15.0	5.0 - 15.0	± 2.0%

After the target gradation has been submitted the percent passing each sieve will not be allowed to vary by more than the stockpile tolerance. Do not exceed the percent passing limits.

(h) Preproduced Aggregate - Provide sampling, testing, and quality control for preproduced Aggregate according to Section 00165.

00706.11 Emulsified Asphalt and Filler Material - Provide polymer-modified Emulsified Asphalt, additives, mineral fillers, and water according to the following:

(a) Emulsified Asphalt - Furnish CQS-1hP polymer-modified Emulsified Asphalt meeting the requirements of the latest version of ODOT's publication, *Standard Specifications for Asphalt Materials*.

Provide a polymer modifier that is either a solid synthetic rubber or latex material. Combine the polymer modifier with the base asphalt or asphalt Emulsified Asphalt, prior to loading at the manufacturing plant, at the minimum rate of 3 percent polymer solids by weight of asphalt. Provide a polymer modified Emulsified Asphalt that is compatible with the mix design developed for the slurry seal. For each shipment of Emulsified Asphalt, provide a certificate of analysis or certificate of compliance from the manufacturer.

Obtain samples of Emulsified Asphalt according to AASHTO R 66 at the frequency according to Section 00165. Samples are tested at the ODOT Materials Laboratory, or other laboratory as designated by the Agency. Test polymer-modified Emulsified Asphalt within 14 Calendar Days from the date it is sampled.

(b) Additives and Mineral Filler - The use of additives and mineral fillers are allowed only when their quantity can be metered. Provide additives and other individual materials in the slurry seal mix at the quantities predetermined by the mix design, or with field adjustments if required, after approval.

Provide portland cement, hydrated lime, limestone dust, fly ash or other approved filler required by the mix design that meet the requirements of AASHTO M 17. These Materials are considered part of the dry Aggregate.

(c) Water - Provide potable water that is compatible with the slurry mix and that meets the requirements of Section 02020.

00706.12 Job Mix Formula (JMF) Requirements - Do not begin production of slurry seal for use on the Project until the JMF is reviewed and written consent is provided to proceed.

(a) JMF Evaluation - Determine the proportions of component Materials and perform the tests described in 00706.12(b). Provide a final mix design meeting the limits described in 00706.12(b) and 00706.12(c) and meeting the grading requirements of 00706.10(b).

(b) Mix Design Tests:

Test	Description	Specification
ISSA TB-106	Slurry Seal Consistency	
ISSA TB-139 (For quick-traffic systems)	Wet Cohesion, 30 minutes set 60 minutes set	0.10 lb.-in. min. 0.17 lb.-in. min.
ISSA TB-109 (For heavy traffic areas only)	Excess Asphalt by LWT and Sand Adhesion	1 lb./sq. yd. max.
ISSA TB-114	Wet Stripping	Pass (90% minimum)
ISSA TB-100	Wet Track Abrasion Loss One hour soak	1.5 lb./sq. yd. max.
ISSA TB-113	Mix Time *	Controllable to 180 sec. minimum

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

Report the quantitative effects of moisture content on the unit weight of the Aggregate (bulking effect) according to AASHTO T 19. Provide a report that clearly shows the proportions of Aggregate, the minimum and maximum proportions of mineral filler and water, additive usage, and asphalt Emulsified Asphalt based on the dry weight of the Aggregate.

Provide component materials in the mix design testing that are representative of the materials proposed for use on the Project.

Show the percentages of each individual material required in the laboratory report. The Engineer will give final approval for all mix adjustments made based on the field conditions during construction.

(c) Component Materials – Furnish the component materials within the following limits:

- **Residual Asphalt:**
 - Type I: 10% - 16%
 - Type II: 7.5% - 13.5%
 - Type III: 6.5% - 12%
 - Based on dry weight of Aggregate
- **Mineral Filler:**
 - 0.5% - 3.0%
 - Based on dry weight of Aggregate
- **Additives** - As needed.

- **Water** - As needed to achieve proper mix consistency. Do not allow total mix liquids to exceed the loose Aggregate voids. Use ISSA T106 to check optimum liquids.

00706.13 Tolerances and Limits - Tolerances for individual materials and the slurry seal mixture during production are as follows:

- Residual asphalt content: JMF +/- 0.5%.
- For the percentage of Aggregate passing each sieve, adhere to the stockpile tolerance range as stated in 00706.10(g).
- Cement content: JMF +/- 0.5%.
- The rate of application according to 00706.43. Once determined by the Engineer, do not vary the rate of application more than +/- 2 pound per square yard while remaining within the design application rate range.
- Do not exceed the limits of 00706.12(c) for any component material.
- Do not allow the percentage of Aggregate passing to go from the high end to the low end of the specified range of any two successive sieves.
- Do not vary the slurry consistency more than plus or minus 0.2 inch from the job mix formula after field adjustments.

00706.14 Aggregate Production Quality Control - Provide quality control during production of Aggregate and statistically evaluate according to Section 00165.

Compliance of Aggregates produced and stockpiled before the Award of this Contract are determined according to Section 00165.

00706.15 Acceptance of Aggregate - The Contractor's quality control tests are used for acceptance, if verified by the MFTP Quality Assurance Program.

00706.16 Slurry seal Production Quality Control - Provide quality control testing during production of slurry seal material according to the following:

- Determine Emulsified Asphalt content from calibrated meter readings for each Day's total production run.
- Determine moisture content of Aggregates during Equipment calibration, daily prior to each shift of placement, and as directed.
- Determine cement content from uncalibrated meter reading and the total number of bags or cement tickets for each Day's total production run.
- Determine the Aggregate spread rate from calibrated meter readings and the total estimated surface area placed for each Day's total. Provide an application rate meeting the requirements of 00706.43. The Engineer will accept the spread rate visually when filling ruts.

00706.17 Slurry Seal Production Quality Assurance - The Agency will perform verification of quality control testing as follows:

- Verify moisture content of the Aggregates during the Equipment calibration process. A maximum 1% moisture difference is allowed between QC and QA.

Equipment

00706.20 Mixing Equipment - Provide self-propelled, twin-shaft pug mill mixers that are specifically designed and manufactured to accurately deliver and proportion the Aggregate, Emulsified Asphalt, mineral filler, control setting additive and water to a revolving blade mixer that discharges the thoroughly mixed product on a continuous flow basis. Provide a slurry seal machine with a minimum capacity of 7 cubic yards. Truck-mounted mixers are not allowed.

Equip the mixing machine with an approved fine 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. Use the fine feeder whenever added mineral filler is a part of the Aggregate blend.

Equip the mixing machine, or separate piece of Equipment, with a water pressure system and fog type spray bar adequate for complete fogging of the surface preceding spreading Equipment.

(a) Proportioning Devices - Provide and properly mark individual volume or weight controls, such as revolution counters or similar devices, for proportioning each Material to be added to the mix (for example; Aggregate, mineral filler, additive, Emulsified Asphalt and water). Provide proportioning devices in working order prior to commencing proportioning and mixing operations that are visible when standing near the mixing machine. Instruct the Engineer on how to calculate the application rate per square yard utilizing the Contractor's proportioning devices.

(b) Calibration - Calibrate, in the presence of the Engineer, the Emulsified Asphalt pump and the Aggregate feeder on each mixing unit used on the Project prior to construction. Notify the Engineer at least 1 Calendar Day prior to performing the calibration. Provide the Engineer with access to the Equipment during the calibration process. Previous calibration documentation covering the exact Materials to be used are accepted at the discretion of the Engineer provided the calibration was performed within the previous 60 Calendar Days. Provide documentation that includes an individual calibration of each Material at minimum three settings, that can be related to the machines metering devices. Include in the calibration settings at least one setting above and below the target setting. A machine will not be allowed to work on the Project until the calibration has been completed and accepted. A new calibration test is required when there is a change in Material sources or a change in Equipment components that deliver slurry seal materials to the pugmill mixer.

(1) Aggregate Belt Rate Determinations - Pre-weigh a loaded truck and run a minimum of 3 Tons of Aggregate from the truck mounted hopper, over the belt, and through the pugmill. Register the number of counts on the aggregate belt feeder revolution counter. Re-weigh the truck after the test run, divide the net mass change by the revolutions counted and reduce the results by the moisture content of the Aggregate being used for the calibration to obtain a dry weight of Aggregate per revolution.

This calculation provides the dry weight of Aggregate delivered to the pugmill per unit of the aggregate belt-feeder revolution counter. The type of count does not matter as long as it relates to aggregate belt-feeder movement. The important final product of this

calibration is the ability to determine the ratio of pounds of dry Aggregate to the pounds of Emulsified Asphalt, corrected for temperature, while operational.

Continue this operation for a total of three runs at the approximate gate setting to be used during the production of slurry seal. None of these three runs should deviate from their combined mathematical average by more than 1.0 percent.

After using the above procedure to establish belt-feeder delivery consistency, do two more runs that bracket the initial delivery rate. These two runs and the average of the first three runs should produce a straight line plot.

(2) Emulsified Asphalt Pump Rate Determination - Pre-weigh a mixer-spreader truck empty of Aggregate but loaded with Emulsified Asphalt to be used for the Project. Run at least 320 gallons from the truck mounted Emulsified Asphalt storage through the Emulsified Asphalt pump and into a separate tank. Run the Aggregate belt-feeder in an empty mode in order to make the aggregate belt-feeder revolution counter functional. Register the number of counts on the counter. Re-weigh the mixer-spreader truck after the test run. Divide the net mass change by the revolutions counted and reduce the results for any temperature correction to obtain corrected pounds of Emulsified Asphalt per unit of the aggregate belt-feeder revolution counter.

Continue this operation for a total of three runs at the approximate Emulsified Asphalt rate to be used during the production of slurry seal. None of these three runs should deviate from their combined mathematical average by more than 2.0 percent. Use the average of the results produced by the three test runs for the Emulsified Asphalt pump rate determination for use in operational calculations.

If the Contractor elects to use a variable rate Emulsified Asphalt pump, use the following procedure. After using the initial three test runs to establish the Emulsified Asphalt pump delivery consistency, do two more runs that bracket the initial delivery rate. The results of these two runs and the average of the first three runs should produce a straight line plot.

Check that the Emulsified Asphalt pump and all plumbing are free of leaks. Check the thermometer in the Emulsified Asphalt storage tank with a standardized thermometer.

(3) Report - At the conclusion of a successful calibration of proportioning devices, record the span adjustment settings and provide the quantity charts and supporting data to the Engineer.

00706.22 Spreading Equipment - Spreader Box - Provide a spreader box with twin-shafted paddles or spiral augers that is capable of uniformly spreading the slurry seal mixture. Provide a spreader box that is adjustable in width, capable of spreading a Traffic Lane width up to 14 feet, and that has strips of flexible rubber belting or similar material on each side of the spreader box in contact with the Pavement to positively prevent loss of slurry seal from the ends of the box. Provide a spreader box with suitable means to side shift the box to compensate for variations in the Pavement geometry. Maintain spreader box skids in such a manner as to prevent chatter (wash boarding) in the finished mat.

Provide a spreader box with a strike-off blade at the rear of the box that makes close contact with the Pavement and is capable of being adjusted to the various crown shapes, so as to apply a uniform slurry seal coat with a uniform texture free of streaking.

Flexible fabric drags attached to the rear of the spreader box are not allowed in travel lanes. Flexible fabric drags outside of travel lanes are only allowed with Engineer's approval. Clean or change strike-off blades (rubber) daily if problems with cleanliness and longitudinal scouring occur.

Provide a slurry seal spreader box clean and free of slurry seal and Emulsified Asphalt at the start of each work shift and prior to the beginning of each application.

Labor

00706.30 Personnel Qualifications - Provide a resume of work experience for the person signing the mix design, documenting the following minimum work experience:

- Minimum 5 years' experience in slurry seal mix design or construction
- List of minimum 5 successful slurry seal projects person worked on including project name, project location, year of completion, and owner of project.

00706.31 Quality Control Personnel - Provide a technician with CAgT certification.

Construction

00706.40 Weather Limitations - Do not apply the slurry seal if either the Pavement or air temperature is below 50 °F and falling. Apply slurry seal when both the Pavement and air temperature are above 45 °F and rising. Do not apply if there is a danger of freezing within 24 hours of application. Do not apply when weather conditions prolong opening to traffic beyond a reasonable time. Do not apply in the rain. Replace slurry surface damaged by rain after application according to the Specifications, and as determined by Engineer, at no additional cost to the Agency. Clean the street of all remaining slurry seal Materials prior to re-application.

00706.41 Preparation of Surface - At least 7 Calendar Days prior to the slurry seal pre-placement conference submit details of the proposed street cleaning.

Remove organic Materials in cracks or joints.

Prepare the Pavement by flushing and sweeping. Complete flushing, as needed, prior to sweeping. Finish sweeping with a vacuum sweeper no more than 24 hours prior to application of the slurry seal.

Prepare the Pavement where the slurry seal is to be placed as follows and as directed.

(a) Asphalt Concrete Pavement Repairs - When shown, remove and replace Existing Surfacing according to Section 00748, or as determined.

(b) Crack Sealing - A minimum of 30 Days prior to the application of slurry seal, clean and fill cracks 1/4 inch wide and larger inside the proposed slurry seal area according to Section 00746.

(c) Tack Coat - When shown, apply tack coat according to Section 00730 prior to placing the slurry seal. Allow the tack coat to cure thoroughly prior to the application of the slurry seal.

(d) Street Equipment and Procedure - Immediately prior to applying the slurry seal, clear the surface of all loose material, Silt spots, vegetation, oil spots and other objectionable material. If water is used, allow cracks to dry thoroughly before placing slurry seal. The Engineer will approve the surface preparation prior to slurry seal placement.

(e) Utility Covers - Protect manholes, valve boxes, drop inlets and other service entrances from the slurry seal by a suitable method. Clean these covers as quickly as possible after the application of the slurry seal and prior to the final set. If necessary, clean mixture residual from the interior of the Utility covers.

(f) Pavement Markings - Cover, or remove, all reflector buttons before slurry seal is applied to any area, as determined. Remove all thermoplastic and paint Pavement markings prior to applying slurry seal according to 00225.45.

00706.42 General - If required by local conditions, wet the surface by misting ahead of the spreader box. Apply water at such a rate that the entire surface is damp with no apparent flowing water in front of the spreader box. Adjust the rate of application of the misting during the day to suit temperatures, surface texture, humidity, and dryness of Pavement surface. Do not spray additional water into the spreader box.

Provide a slurry seal mixture of proper consistency at all times so as to uniformly spread on the existing surface within the application rate specified in 00706.43. Do not allow lumping, balling or unmixed Aggregate in the spreader box. Do not allow segregation of the Emulsified Asphalt and Aggregate fines from the Coarse Aggregates. If the Coarse Aggregate settles to the bottom of the mix, remove the slurry seal mixture from the Pavement. Do not allow excessive breaking of the Emulsified Asphalt in the spreader box. Do not exceed four minutes mixing time in the pug mill.

Do not leave streaks in the finished surface, such as those caused by oversized Aggregate, mixture build-up, or improper installation of secondary strike-off blades. If excess streaking develops, stop the application until corrected to the satisfaction of the Engineer. Excessive streaking is defined as more than four drag marks greater than 1/2 inch wide by 4 inches long, or 1 inch wide by 3 inches long, in any area of 30 square yards. No transverse ripples or longitudinal streaks of 1/4 inch in depth is permitted when measured by placing a 10 foot straight edge over the surface.

00706.43 Application Rate - Apply the slurry seal mixture within the following range of rates based upon the slurry type:

Slurry Type	Application Rate*
TYPE I	8 - 12 lbs./sq. yd.

TYPE II	14 - 18 lbs./sq. yd.
TYPE III	18 - 24 lbs./sq. yd.

*Application rates are based upon the dry Aggregate weight in the mixture.

The exact rate is determined by the Engineer depending on the surface demand of the Pavement, the size of the largest particles of Aggregate and using the specific weight of the Aggregate determined in the mix design.

00706.44 Applying Slurry Seal Test Strip - Furnish a test strip consisting of two panels approximately 250 feet long, placed side by side to form a typical joint between them. Apply each panel at the width shown. Place the strip at least 24 hours prior to the beginning of the Work. Use the strip to calculate and monitor the rate of application in relation to weight of Material per area, and to define the speed of the Equipment related to the rate of application. If the Engineer determines on the basis of this test strip that there are deficiencies in the mix design, method of application, or rate of application, revise the mix design or repair or modify the Equipment or application at the Engineers discretion. After all changes are made, place a new test strip.

00706.45 Joints - Construct a uniform line along the edge and a good seal at curb lines. Construct the flow line at curbs to allow storm drainage flow to catch basins without bonding along the curb line. In the case of a concrete gutter, cover the gutter line joint with the slurry seal, but do not overlap onto the gutter. Remove any overlap, as determined, at no additional cost to the Agency.

Provide joints and Panels that are straight, neat and uniform and follow the contour of the existing curb or concrete gutter. Keep lines straight at intersections.

00706.46 Mix Stability - Provide a slurry seal mixture that is stable and does not break prematurely in the spreader box, that is uniform and homogeneous during mixing and spreading, is free of excess water and emulsion, and is free of segregation.

00706.47 Handwork - Use approved squeegees to spread Material in areas not accessible to the slurry mixer.

Limit handwork at the beginning and end of the Panels to prevent segregation of the Aggregate from the emulsion and to minimize drag marks or defects in the finished product.

Apply the same finish as applied by the spreader box. Complete handwork prior to curing of the Material.

00706.48 Curing - Produce and place slurry seal Material that is capable of curing at a rate such that a Traveled Way may be opened to traffic after application without tracking or damage to the surface. Protect the area for the full curing period with suitable barricades or markers. If the slurry seal does not cure in a timely manner and remains trackable overnight, apply a covering of 1/4 inch minus Material to prevent tracking and related property damage prior to permitting traffic on the street at no additional cost to the Agency.

The Agency will not be responsible for any damage to the slurry seal prior to opening the area. Repair all damage to the slurry, to the satisfaction of the Engineer, at no additional cost to the Agency.

00706.49 Cleanup - Remove all debris associated with the performance of the Work on a daily basis.

Maintenance

00706.60 Correction of Defects - Correct all defects that occur within 15 Days of placing the slurry seal, as directed, at no additional cost to the Agency. Defects include bleeding, raveling, separation, segregation of Materials, non-uniform texture and fouled surfaces preventing full bond between Lifts of mixture. No adjustment in Contract time will be made for corrective work.

Measurement

00706.80 Measurement - The quantities of Work performed under this Section will be measured according to the following:

The quantities of slurry seal will be measured on the area basis, measurement will be limited to the Neat Lines shown or directed.

The quantities of Emulsified Asphalt in slurry seal will be measured on the weight basis.

Payment

00706.90 Payment - The accepted quantities of Work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) Slurry Seal	Square Yard
(b) Emulsified Asphalt in Slurry Seal	Ton

Item (a) includes all components of the mix and the placement of slurry seal except for Emulsified Asphalt.

Payment will be payment in full for furnishing and placing all Materials, and for providing all Equipment, labor, and Incidentals necessary to complete the Work as specified.

Emulsified Asphalt for tack coat will be paid for according to 00730.90.

Crack sealing will be paid for according to 00746.90.

Asphalt concrete pavement repairs will be paid for according to 00748.90.

Stripe removal will be paid for according to 00225.90.