**401-9 Slurry Seal (Revised 10-10-19)**

1. SLURRY SEAL [401] (REVISED 10-10-19)

Description. This work is producing, furnishing, and placing slurry seal on an approved surface.

Materials. Provide slurry seal with the specified asphalt emulsion, mineral filler, and aggregate meeting the following requirements. Use additives as necessary.

It is recommended that the Contractor use generally recognized Statistical Quality Control methods and tests for quality control. Be responsible for all sampling, testing and control of aggregate and slurry seal. Furnish the Project Manager four copies of the quality control tests upon request.

Ensure that the aggregate, when combined at the job mix formula meets applicable subsection 701.03.1 requirements.

Aggregate. Furnish aggregate from sources meeting the applicable Section 106 requirements.

Meet the aggregate gradation requirements shown in Table of Gradation – Aggregate for Slurry seal below as tested by MT 202.

Furnish aggregate that is 100 percent manufactured crushed stone free from dirt, organic matter, clay balls, adherent films of clay, dust, or other detrimental materials.

Meet the following aggregate requirements at the job mix formula combined ratio:

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| --- | --- | --- |
| Description | Test Methods | Requirements |
| Wear | AASHTO T 96 | 30% max. |
| Sulfate Soundness | AASHTO T 104 | 15% max. with Sodium Sulfate25% max. with Magnesium Sulfate |
| Sand Equivalent | AASHTO T 176 | 60% min. |

Asphalt Emulsion. Furnish CQS-1h asphalt emulsion in accordance with AASHTO M 208. Asphalt emulsion will be sampled and tested in accordance with Section 702.

Mineral Filler. Furnish non air-entrained portland cement meeting the requirements of AASHTO M 85 and/or hydrated lime meeting the requirements of Subsection 713.02 as needed to improve mixture consistency, adjust breaking and curing properties, or to meet mix design requirements. Limit mineral fill to a maximum of 3 percent weight of aggregate.

Water. Furnish water that is free from harmful salts, reactive chemicals, and other contaminants. Verify water pH to ensure compliance with job-mix design prior to production and anytime the water source changes.

Additives. Furnish additives to accelerate or retard the break/set properties, improve the resulting finished surface, or increase adhesion. Ensure additives used are compatible with the other components of slurry seal.

Slurry seal Mix Design. Develop and submit for approval, a mix design meeting the contract requirements to the Project Manager at least 10 days prior to slurry seal placement. Perform mix design using the same materials and aggregate gradation to be used on the project. No material substitutions can be made following mix design approval unless authorized by the Project Manager.

Select aggregate target gradations within the following gradation bands. Ensure that the percent passing each sieve remains within the gradation band after the target gradation has been submitted. Do not include mineral filler within aggregate gradation.

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| Table Of Gradation – AggregateFor Slurry Seal |
| Percentage By Weight PassingSquare Mesh Sieves |
| Sieve Size | Percent Passing |
| #4 | 100 |
| #8 | 90-100 |
| #16 | 65-90 |
| #30 | 40-65 |
| #50 | 25-42 |
| #100 | 15-30 |
| #200 | 10-20 |

Determine additive quantities during the laboratory mix design. Provide manufacturer certifications and recommended dosage rates for each additive shipment used on the project. Use of additives not included in the laboratory mix design requires a new laboratory mix design unless determined otherwise by the Project Manager.

Ensure the slurry seal mix design includes the testing procedures and meets the properties shown in the table below. Restrict the residual asphalt cement to 13 ± 3 percent by total dry weight of aggregate.

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| ISSA SPECIFICATIONS |
| Issa Test No. | Description | Specification |
| ISSA TB-139 | Wet Cohesion@ 30 Minutes Minimum (Set)@ 60 Minutes Minimum (Traffic) | 12 kg-cm Minimum20 kg-cm or Near Spin minimum |
| ISSA TB-109 | Excess Asphalt by LWT Sand Abrasion | 50 g/ft2 Maximum(538 g/m2 Maximum) |
| ISSA TB-114 | Wet Stripping | Pass (90% Minimum) |
| ISSA TB-100 | Wet-Track Abrasion LossOne-hour Soak | 75 g/ft2 (807 g/m2) Maximum |
| ISSA TB-113 | Mix Time @ 77 degrees F | Controllable to 180 Seconds Minimum |
| ISSA TB-106 | Slurry Seal Consistency | 0.79-1.18 inches(2.0-3.0 cm) |

Construction.

Aggregate Production. Produce and furnish material within the limits of Table of Gradation- Aggregate for Slurry Seal and is composed of 100 percent crushed material. Aggregate gradation testing will be performed according to MT 320, and the aggregate tested will be recovered by MT 319. Samples will be dried to a constant weight in oven before beginning MT 319. Be responsible for all sampling and testing to control gradation during aggregate production. Establish a process quality control plan addressing the following:

* Equipment Maintenance;
* Equipment Calibration;
* Stockpiling and materials handling; and
* Sampling and testing of component materials.

Aggregate Acceptance Sampling and Acceptance.

* + - 1. Sampling. The Project Manager will randomly select samples taken by the Contractor and witnessed by an inspector for gradation testing. Provide sampling apparatus and sample containers. Submit a sample consisting of well mixed slurry seal taken from the pugmill chute.

Each sample represents approximately 500 tons (mt). The Project Manager may require additional samples.

Five samples representing approximately 2500 tons (mt) constitutes a lot whenever production schedules and material continuity permits. The project manager may establish a lot of the quantity represented by 3 to 7 consecutive random samples when there are short production runs, significant material changes, or other unusual characteristics of the work.

* + - 1. Acceptance. Slurry seal is accepted on a lot by lot basis under Subsection 105.03.2 using price reduction factors for “Cover Material.”

Asphalt Emulsion Sampling and Acceptance.

Asphalt Emulsion will be sampled as specified in 402.03.2.

Asphalt Emulsion will be accepted as specified in 402.03.5.

Equipment. Use equipment specifically designed and manufactured to mix and place slurry seal.

Mix the material with an automatically sequenced, self-propelled or truck mounted slurry seal machine able to accurately deliver and proportion the aggregate, asphalt emulsion, mineral filler, additives, and water to a revolving multi-blade double shafted mixer capable of distributing the final product. Truck mounted slurry seal machines must have a capacity of at least 12 cubic yards (9.1 m3).

Slurry seal machine must have sufficient storage capacity for aggregate, asphalt emulsion, mineral filler, additive, and water to maintain an adequate supply to the proportioning controls. Use proportioning devices with individual volume or weight controls for proportioning each material added to the mix. Use proportioning devices with controls properly marked that can calibrate and determine material output at any time during production.

Use spreading equipment that spreads the mixture uniformly by means of a spreader box attached to the paver and mechanically equipped to agitate and spread the material evenly throughout the box. Provide a front seal that allows no loss of mixture at the road contact point. Provide an adjustable rear seal that acts as a final strike-off. Use a spreader box that provides a free flow of uniformly consistent materials to the rear strike-off and employs a suitable means to side shift the box to compensate for variations in the pavement geometry.

Calibrate each mixing unit in the presence of the Project Manager prior to using on the project, after repairs, or any time directed by the Project manager.

Do not use diesel fuel as a cleaning agent or as a release agent for any paving equipment or operations. Use a commercially manufactured release agent approved by the Project Manager.

Surface Conditions and Weather Limitations. Apply slurry seal when both the air and pavement temperature are 45ºF (7ºC) and rising. Stop slurry seal placement when the surface or air temperature is below 55°F (12ºC) and falling, the surface is wet, the roadbed is unstable, or the Project Manager determines adverse weather conditions prevent the proper handling or finishing of the mix. Do not apply slurry seal if the temperature is forecasted to be below 33°F within 24 hours of slurry seal placement.

Surface Preparation. Clean road surface of all dirt, sand, dust, oil, vegetation, and other detrimental materials prior to applying slurry seal material. Allow unsealed cracks to thoroughly dry prior to applying slurry seal material when water is used to clean the surface.

Cover manholes, valve boxes, drop inlets, and other service utility entrances in a manner that prevents slurry seal bonding prior to placement. Remove or block off areas with thermoplastic pavement markings and remove all epoxy pavement markings before placing slurry seal.

Wet existing surface immediately prior to slurry sealing, if necessary, to promote cohesion of slurry seal to the pavement surface, as directed by project manager. Adjust water application rate to suit temperature, surface texture, humidity and dryness of existing pavement.

Do not place slurry seal on pavement that has been crack sealed less than 2 weeks prior. For projects with both crack sealing and slurry seal activities, allow crack sealant to cure for at least two weeks before slurry seal. Do not apply slurry seal until surface preparation is approved by the Project Manager.

Test Strip. Place slurry seal material in a test strip of at least 500 feet (150 m) in length prior to full production. The test strip will become part of the slurry sealed roadway and measured if approved by the project manager.

Remove and replace the test strip at no expense to the Department if it fails to meet contract requirements. Make necessary adjustments if the test strip fails and obtain Project Manager approval prior to repeating the test strip process. Provide a revised mix design if the test strip failure indicates a mix design or ingredient related problem.

Application Rate. Apply slurry seal at the application rates identified in the contract. Application rates may be changed if directed or approved by the Project Manager.

Slurry Seal Application. Place slurry seal meeting the mix design criteria. If disparities between placement and mix design requirements are observed, the Project Manager will request submittal of a new mix design.

Maintain at least one lane open to traffic during all slurry seal operations. Schedule slurry seal operations to ensure all lanes are opened to traffic a minimum of 30 minutes prior to sunset of the same working day. Ensure all lanes are open to traffic during non-working hours.

Control ingredient proportions by using the metering or measuring devices on the slurry seal equipment to ensure mix design compliance.

Limit any increase or decrease in the amount of mineral filler added during production to ±1 percent of the approved mix design.

Pass the mineral aggregate over a scalping screen prior to transfer to the slurry seal mixing machine to remove oversize material.

Carry a sufficient amount of slurry seal in all parts of the spreader box to ensure full width and complete coverage with no streaks, narrow spots, or mix segregation. Do not overload the spreader. Do not manually add water to the slurry seal within the spreader box or on the roadway surface.

Remove and replace the slurry seal at no expense to the Department if any of the following occurs:

* Lumping, balling, or unmixed aggregates.
* Course aggregate separates from the emulsion and fines.
* Excessive breaking of emulsion inside the spreader box.
* Excessive streaking. Excessive streaking is defined as longitudinal steaks greater than 0.15 inches (3.8 mm) in depth when measured by placing a 10 foot (3 m) straight edge over the surface or drag marks greater than 0.5 inches (12.5 mm) wide and 4 inches (100 mm) long, or 1-inch (25 mm) wide and 3 inches (75 mm) long.
* Transverse ripples 0.25 inches (6 mm) in depth when measured by placing a 10-foot (3 m) straight edge over the surface.
* Flushing or excessively rich areas appearing in slurry seal after eight hours from time of placement.
* Any measurable rutting, shoving, or other evidence of premature deformation when exposed to traffic.

Compaction. Do not roll or compact slurry seal material.

Joints. Construct longitudinal and transverse joints without any buildups, uncovered areas or unsightly appearance.

Place longitudinal joints with less than 6 inches (150 mm) overlap on adjacent passes and no more than ¼-inch (6 mm) difference in elevation between the adjacent passes. Do not allow longitudinal edge lines to vary horizontally by more than ± 2 inches (50 mm) within any 100-foot (30 m) length. Place longitudinal joints on lane lines unless directed otherwise by the Project Manager.

Place slurry seal adjacent to concrete pavements or concrete curb and gutter with a straight longitudinal edge.

Construct transverse joints with no more than 1/8-inch (3 mm) difference in elevation across the joint. Use construction paper, or comparable product, so all beginning and ending edge lines from each construction pass are straight.

Handwork. Complete all handwork prior to mainline slurry seal placement. Use hand squeegees to spread slurry seal in areas that cannot be reached with slurry seal machine. Provide a complete and uniform coverage. Finish hand worked areas in a manner that provides uniform finish when compared to material placed by the slurry seal machine. Dampen existing pavement before handwork in accordance with section C.6) above.

Clean up. Remove slurry seal from all utility access areas and concrete surfaces. Remove any debris or excess slurry seal materials associated with work on a daily basis.

Opening to Traffic. Prior to opening to traffic, allow the slurry seal to sufficiently cure to ensure it will not deform or be picked up under traffic conditions. Do not allow traffic on slurry seal less than four hours after placement. Opening of slurry sealed areas to traffic does not constitute Department acceptance of work.

Method of Measurement. Slurry seal aggregate is measured by the dry ton in accordance with Section 109. Slurry seal emulsion is measured by the ton in accordance with Section 109. Additives, mineral filler, test strip, mix design, surface preparation, and water are to be included in the cost of the aggregate and emulsion and no additional measurements or payments will be made.

Basis of Payment. Payment for completed and accepted quantities is made under the following:

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| --- | --- |
| Pay Item | Pay Item |
| Slurry Seal Aggregate | Square Yard (m2) |
| Slurry Seal Emulsion | Ton |

Repair slurry seal material not meeting contract requirements at no additional cost to the Department. Repair damage to the slurry seal due to premature opening to traffic at no additional cost to the Department.

Payment at the contract unit price is full compensation for all necessary resources to complete the item of work under the contract.