

SECTION 32 01 13.63

SINGLE COURSE BITUMINOUS SLURRY

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The work covered by this specification includes the design, testing, construction, and quality control required for the proper application of an emulsified asphalt slurry seal surface (slurry seal).

- B. The slurry seal shall consist of a mixture of an approved emulsified asphalt, mineral aggregate, water and specified additives, proportioned, mixed and uniformly spread over a properly prepared surface as directed by the Owner. The completed slurry seal shall leave a homogeneous mat, adhere firmly to the prepared surface, and have a skid resistant surface texture.

1.2 MEASUREMENT AND PAYMENT

- A. The slurry seal will be measured and paid for at the contract unit price per square yard, complete in place.

1.3 LIMITATIONS

- A. WEATHER: The slurry seal shall not be applied if either the pavement or air temperature is below 55 degrees F (15 degrees C) and falling, but may be applied when both pavement and air temperature are above 45 degrees F (7 degrees C) and rising. No slurry seal shall be applied when there is danger the finished product will freeze before 24 hours. The mixture shall not be applied when weather conditions prolong opening to traffic beyond a reasonable time.

- B. OTHER: No slurry seal shall be applied before 8 A.M., and must be able to support traffic by 5 P.M. Weekend work is discouraged unless conditions warrant and is approved by the Engineer.

PART 2 – PRODUCTS

2.1 GENERAL

- A. The following specifications and test methods form a part of this specification.
 - AASHTO - American Association of State Highway and Transportation Officials.
 - ASTM - American Society for Testing and Materials
 - ISSA - International Slurry Seal Association

2.2 AGGREGATE AND MINERAL FILLER

AASHTO T2	ASTM D75	-	Sampling Mineral Aggregates
AASHTO T2	ASTM C136	-	Sieve Analysis of Aggregates
AASHTO T11	ASTM C117	-	Materials Finer than No. 200 in Mineral Aggregate
AASHTO T176	ASTM D2419	-	Sand Equivalent Value of Soils and Fine Aggregate
AASHTO T84	ASTM C128	-	Specific Gravity and Absorption of Fine Aggregate
AASHTO T19	ASTM C29	-	Unit Weight of Aggregate
AASHTO T96	ASTM C131	-	Resistance of Abrasion of Small Size Coarse Aggregate by use of the Los Angeles Machine
AASHTO T127	ASTM C183	-	Sampling Hydraulic Cement
AASHTO T37	ASTM D546	-	Sieve Analysis of Mineral Filler
AASHTO T104	ASTM C88	-	Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulphate
	ASTM D242	-	Mineral Filler for Bituminous Paving Mixtures

2.3 EMULSIFIED ASPHALT

AASHTO T40	ASTM D140	-	Sampling Bituminous Materials
AASHTO M140	ASTM D977	-	Specification for Emulsified Asphalt
AASHTO M208	ASTM D2397	-	Specification for Cationic Emulsified Asphalt
	ISSA T102	-	Mixing, Setting and Water Resistance Test to Identify "Quick-Set" Emulsified Asphalts

2.4 SLURRY SEAL

ISSA T101	-	Guide to Sampling Slurry Mix for Extraction Test
ISSA T106	-	Measurement of Slurry Seal Consistency
ISSA T111	-	Outline Guide Design Procedure for Slurry Seal
ISSA T114	-	Wet Stripping Test for Cured Slurry Seal Mixes
ISSA T115	-	Determination of Slurry Seal Compatibility
ASTM D3910	-	Design, Testing and Construction of Slurry Seal
ASTM D2172	-	Quantitative Extraction of Bitumen for Bituminous Paving Mixtures
ISSA T139	-	Test Method to Classify Emulsified Asphalt/Aggregate Mixture Systems by Modified Cohesive Tester Measurement of Set and Cure Characteristics

2.5 EMULSIFIED ASPHALT

The emulsified asphalt shall conform to CQS-1h or CSS-1h as specified in AASHTO M208. The cement mixing test is waived.

2.6 AGGREGATE

- A. GENERAL - The mineral aggregate shall consist of natural or manufactured crushed stone such as granite, slag, limestone, or other high quality aggregates or a combination thereof. Smooth textured sands of less than 1.25% water absorption shall not exceed 50% of the total aggregate blend.
- B. QUALITY TESTS - When tested according to the following tests normal aggregates shall meet the following requirements:

TEST	QUALITY	SPEC
AASHTO T170 or ASTM 2149	Cleanness	55 min.
AASHTO T104 or ASTM C88	Soundness	15% max. using NA2SO4 or 20% max. using Mg SO4
AASHTO T96 or ASTM C131	Hardness	35% max.

- C. GRADING - When tested by AASHTO T27, ASTM C136 and ASTM C117, the aggregate (including mineral filler) shall meet the following gradation:

SIEVE SIZE	TYPE II PERCENT PASSING
3/8	100
No. 4	90-100
No. 8	65-90
No. 16	45-70
No. 30	30-50
No. 50	18-30
No. 100	10-21
No. 200	5-15

2.7 MINERAL FILLER

Portland Cement, hydrated lime, limestone dust, fly ash or other approved filler meeting the requirements of ASTM D242 shall be used if required by the mix design. They shall be considered as part of the dry aggregate.

2.8 WATER

All water shall be potable and compatible with the slurry mix. Compatibility must be insured by the Contractor.

2.9 ADDITIVES

Additives may be used to accelerate or retard the break-set of the slurry seal, or improve the resulting finished surface. The use of additives in the slurry mix (or individual materials) shall be made initially in quantities predetermined by the mix design with field adjustments if required, after approval by the Owner.

2.10 EQUIPMENT

- A. GENERAL - All equipment, tools and machines used in the performance of this work shall be maintained in satisfactory working order at all times.
- B. SLURRY MIXING EQUIPMENT - The slurry seal mixing equipment shall be a continuous flow mixing unit, either an individual unit that returns to the stockpile for reloading or a continuous run unit that is resupplied on the job. All units must have suitable means of accurately metering each individual material being fed into the mixer. All feeding mechanisms must be continuous feed and proportioning must remain constant at all times. The units shall be equipped with approved devices so that the machine can be accurately calibrated, and the quantities of materials used during any one period can be estimated. In the event these metering devices stop working, the slurry unit(s) will stop the application process until they are fixed.

The mixer shall thoroughly blend all materials to form a homogeneous mass before leaving the mixer.

- C. SLURRY SPREADING EQUIPMENT - The spreader box shall be equipped to prevent loss of slurry seal from all sides and with a flexible rear strike-off. It shall be capable of producing a uniform surface its full width. It shall have suitable means for side tracking to compensate for deviations in pavement geometry. Any type drag used shall be approved by the Owner and kept in a completely flexible condition at all times. The box shall be kept clean and build-up of asphalt and aggregate shall not be permitted.
- D. AUXILIARY EQUIPMENT - Suitable crack and surface cleaning equipment, barricading equipment, hand tools and any support equipment should be provided as necessary to perform the work.

2.11 MACHINE CALIBRATION AND VERIFICATION

- A. CALIBRATION - Each slurry mixing unit to be used in performance of the work shall be calibrated in the presence of the Owner prior to construction. No machine will be allowed to work on the project until the calibration has been completed and/or accepted.
- B. VERIFICATION - Test strips will be made by each machine after calibration and prior to construction. Test strips shall be a portion of the project. Samples of the slurry seal will be taken and verification made as to mix consistency and proportioning. Verification of rate of application will also be made. Upon failure to any of the tests, additional tests strips, at no cost to the Owner, will be required until each unit is authorized to work. Any unit failing to pass the tests after the third trial will not be permitted to work on the project. Test strips must be accepted or rejected within 24 hours after application.

PART 3 – EXECUTION**3.1 EXAMINATION/QUALITY CONTROL**

- A. **MATERIALS** - The Contractor will permit the Owner to take samples of the aggregate and asphalt and asphalt emulsion used in the project at the Owner's discretion. Gradation and sand equivalent tests may be run on the aggregate and residual asphalt content tests on the emulsion. Test results will be compared to specifications. Tests will be run at the expense of the Owner. The Owner must notify the Contractor immediately if any test fails to meet the specifications.
- B. **SLURRY SEAL** - Samples of the slurry seal will be taken directly from the slurry units(s). Consistency and residual asphalt content tests may be made on the samples and compared to the specifications. Tests will be run at the expense of the Owner. The Owner must notify the Contractor immediately if any test fails to meet specifications.

The Owner may use the recorders and measuring facilities of the slurry seal unit to determine application rates, asphalt emulsion content, mineral filler and additives(s) content for an individual load.

It is the responsibility of the Contractor to check stockpile moisture content and to set the machine accordingly to account for aggregate bulking.

- C. **NON-COMPLIANCE** - If any two successive tests fail on the stockpile material, the job shall be stopped. It is the responsibility of the Contractor, at his own expense, to prove to the Owner that the conditions have been corrected. If any two successive tests on the mix from the same machine fail, the use of the machine shall be suspended. It will be the responsibility of the Contractor, at his own expense, to prove to the Owner that the problems have been corrected and that the machine is working properly.

3.2 LABORATORY EVALUATION

- A. **GENERAL** - Before work commences, the Contractor shall submit a signed original of a mix design covering the specific materials to be used on the project. This design must have been performed by a qualified laboratory. Previous lab reports covering the exact materials to be used may be accepted provided they were made during the calendar year. Once the materials are approved, no substitution will be permitted unless first tested and approved by the laboratory preparing the mix design.
- B. **LABORATORY REPORT** - The laboratory report will show the results of tests performed on the individual materials, comparing their values to those required by this specification. The report will provide the following information on the slurry seal mixture.

TEST PURPOSE	METHOD	SPEC
Slurry Seal Consistency	ISSA T106	2 - 3 cm
Wet Stripping Test	ISSA T114	Pass
Compatibility	ISSA T115	* Pass
Quick Set Emulsion	ISSA T102	** Pass
Wet Track Abrasion	ASTM D3919-Modified	50 gms/sq ft. max. (6 days soak)
Cohesive Test	ISSA T139	12 kg-cm, 30 min. 16 kg-cm, 60 min.

* Mixing tests must pass at the maximum expected air temperature

** Using job aggregate

The laboratory shall further report the quantitative effects of moisture content on the unit weight of the aggregate (bulking effect). The laboratory report must clearly show the proportions of aggregate, mineral filler (min and max), water (min and max), additive(s) (usage) and asphalt based on the dry aggregate weight.

3.3 COMPOSITION, RATE OF APPLICATION AND TOLERANCES

- A. COMPOSITION - The percentage of each individual material shall be as required by the laboratory report. Adjustments may be required during construction, based on field conditions. The Owner will give final approval for all such adjustments.
- B. RATE OF APPLICATION - The slurry seal mixture shall be of proper consistency at all times so as to provide the amount of mixture required by the surface condition. The average application rate as measured by the Owner shall be a minimum of 12 to maximum of 14 lbs. per s.y. based on dry aggregate weight.

The application rate must be a minimum of 10 lbs. per s.y. based on dry aggregate weight when tested in Place Paper Test or other approved test methods satisfactory to the Engineer.

- C. TOLERANCES - Tolerances for individual materials as well as the slurry seal mixture are as follows:
1. After the designed residual asphalt content is determined, a plus or minus one percentage point variation will be permitted.
 2. The percentage of aggregate passing each sieve shall not vary more than $\pm 4.0\%$ from the job mix formula.
 3. The percent of aggregate passing shall not go from the high end to the low of the specified range of any two successive sieves.
 4. The slurry consistency shall not vary more than ± 0.5 cm from the job mix formula after field adjustments.

3.4 NOTIFICATION AND TRAFFIC CONTROL

- A. NOTIFICATION - All homeowners and businesses affected by the construction shall be notified one day in advance of the surfacing. Should the work not occur on the specified day, new notification will be distributed when required. The Contractor must supply the Engineer with a tentative schedule at least 10 days in advance of placement, along with weekly schedules.
- B. TRAFFIC CONTROL - Suitable methods shall be used by the Contractor to protect the slurry seal from all type of vehicular traffic until the new surface will support the traffic without damage. Opening to traffic does not constitute acceptance of the work. The Owner shall be notified of the methods to be used.

Traffic control measures shall be in accordance with the "Texas Manual on Uniform Traffic Control Devices for Streets and Highways".

3.5 PREPARATION OF THE SURFACE

- A. GENERAL - Immediately prior to applying the slurry seal, the surface shall be cleared of all loose material, silt spots, vegetation, oil spots and other objectionable material. Any standard cleaning method will be acceptable. If water is used, cracks will be allowed to dry thoroughly before slurry sealing. Manholes, valve boxes, drop inlets and other service entrances will be protected from the slurry seal by a suitable method. The Owner shall approve the surface preparation prior to sealing.

The Contractor shall remove and properly dispose of all debris, including any accumulations in the gutter lines.

3.6 APPLICATION

- A. GENERAL - The surface should be pre-wetted by fogging ahead of the slurry box when required by local conditions. Water used in pre-wetting the surface shall be applied such that the entire surface is damp with no apparent flowing water in front of the slurry box. The rate of application of the fog spray shall be adjusted during the day to suit temperatures, surface texture, humidity and dryness of the pavement surface.

The slurry mixture shall be of the desired consistency upon leaving the mixer and no additional materials shall be added. A sufficient amount of slurry shall be carried in all parts of the spreader at all times so that a complete coverage is obtained. Overloading of the spreader shall be avoided. No lumping, balling or unmixed aggregate shall be permitted.

No streaks, such as those caused by oversized aggregate, will be left in the finished surface. If excess oversize develops, the job will be stopped until the Contractor proves to Owner that the situation has been corrected.

- B. JOINTS - No excessive buildup, uncovered areas or unsightly appearance shall be permitted on longitudinal or transverse joints. An excessive overlap will not be permitted on longitudinal joints. The Contractor shall provide suitable width spreading equipment to produce a minimum number of longitudinal joints throughout the project. When possible, longitudinal joints shall be placed on lane lines. Half passes and odd width passes will be used only in minimum amounts. If half passes are used, they shall not be the last pass of any paved area.

- C. MIX STABILITY - The slurry mixture shall possess sufficient stability so that premature breaking of the slurry seal in the spreader box does not occur. The mixture shall be homogeneous during and following mixing and spreading, it shall be free of excess water or emulsion and free of segregation of the emulsion and aggregate fines from the coarser aggregate.

- D. HAND WORK - Areas which cannot be reached with the slurry seal machine shall be surfaced using hand squeegees to provide complete and uniform slurry seal coverage. The area to be hand worked shall be lightly dampened prior to mix placement and the slurry worked immediately. Care shall be exercised to leave no unsightly appearance from handwork. The same type finish as applied by the spreader box shall be required. Handwork shall be completed during the machine applying process.

- E. LINES - Care shall be taken to insure straight lines along curbs and shoulders. No runoff on these areas will be permitted. Lines at intersections will be kept straight to provide a good appearance.

- F. OPEN TO TRAFFIC - The surface shall be suitable to open to rolling traffic within a period of 2 hours after placement. Pneumatic rolling will be required on all slurry prior to opening to traffic.

- G. CLEAN-UP - All areas, such as manways, gutters and intersections, shall have the slurry seal removed as specified by the Owner. The Contractor shall remove any debris associated with the performance of the work, on a daily basis.

END OF SECTION