

B 2.

**CITY OF DALLAS SPECIFICATIONS
FOR
SLURRY SEAL**

For purposes of this specification, the term “Engineer” means the Program Manager engineer of the Department of Street Services or his duly authorized representative administering this contract and overseeing work performed under this contract.

SCOPE:

The work covered by this specification includes the design, testing, construction and quality control required for the proper application of slurry seal surface.

DESCRIPTION:

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

LABORATORY EVALUATION

GENERAL:

Before work commences, the contractor shall submit a signed original of a mix design containing the test results and proportioning of 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. This initial mix design will be done at the contractor’s expense. Upon receipt of the original mix design, an independent qualified laboratory selected by the City of Dallas will perform tests using the same materials as used in the initial mix design for verification of the results. This testing will be done at City of Dallas expense. No work will begin until all materials and/or mix design proportions have met the specifications as required. Once the materials are approved, no substitution will be permitted unless first tested and approved by the methods stated above.

APPLICABLE SPECIFICATION

GENERAL:

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

TEST METHODS FOR AGGREGATE AND MINERAL FILLER

AASHTO	T2	ASTM	D	75	Sampling Aggregates
AASHTO	T27	ASTM	C	136	Sieve Analysis of Aggregates
AASHTO	T11	ASTM	C	117	Materials Finer than No. 200 in Mineral Aggregate
AASHTO	T176	ASTM	D	2419	Sand Equivalent Value of Soils and Fine Aggregate
AASHTO	T84	ASTM	C	128	Specific Gravity and Absorption of Fine Aggregate
AASHTO	T19	ASTM	C	29	Unit Weight of Aggregate
AASHTO	T104	ASTM	C	88	Soundness of Aggregates by use of Sodium Sulfate or Magnesium Sulfate
AASHTO	T96	ASTM	C	131	Resistance to Degradation of small size Aggregate by use of the Los Angeles machine
		ASTM	D	1073	Specifications for Fine Aggregate for Bituminous Paving Mixtures
		ASTM	D	242	Mineral Filler for Bituminous Paving Mixtures
AASHTO	T37	ASTM	D	546	Sieve Analysis of Mineral Filler

TEST METHODS FOR EMULSIFIED ASPHALT

AASHTO	T40	ASTM	D	140	Sampling Bituminous Materials
AASHTO	M140	ASTM	D	977	Specification for Emulsified Asphalt
AASHTO	M208	ASTM	D	2397	Specification for Cationic Emulsified Asphalt
AASHTO	T59	ASTM	D	244	Testing Emulsified Asphalt
AASHTO	T59	ASTM	D	88	Test Method for Saybolt Furol Viscosity
AASHTO	T44	ASTM	D	113	Test Method for Ductility of Bituminous Materials
AASHTO	T44	ASTM	D	2042	Test Methods for Solubility of Asphalt Materials in Trichloroethylene
AASHTO	T49	ASTM	D	5	Test Methods for Penetration of Bituminous Materials
AASHTO		ASTM	D	2398	Test Method for Softening Point of Bitumen in Ethylene Glycol (Ring and Ball)

TEST METHODS FOR SLURRY SEAL

		ASTM	D	3910	Design, Testing and Construction of Slurry Seal
		ASTM	D	2172	Quantitative Extraction of Bitumen for Bituminous Paving Mixture
		ISSA	T	101	Guide for Sampling Slurry Mix for Extraction Test
		ISSA	T	102	Mixing, Setting and Water Resistance Test to Identify "Quick-Set" Emulsified Asphalt
		ISSA	T	106	Measurement of Slurry Seal Consistency
		ISSA	T	111	Outline Guide Design Procedure for Slurry Seal
		ISSA	T	113	Trail Mix Procedures for Slurry Seal Design
		ISSA	T	114	Wet Stripping Test for Cured Slurry Seal Mixes
		ISSA	T	115	Determination of Slurry Seal Compatibility

MATERIALS

AGGREGATE:

The mineral aggregate shall consist of a natural or manufactured crushed stone such as granite, slag, limestone or other high quality aggregates or a combination thereof that conforms to the quality requirement of ASTM Specification D1073 and shall be free of dirt, organic matter, clay balls, adherent films of clay, dust or other objectionable material. The aggregate shall contain no free water. Smooth textured sands of less than 1.25% water absorption shall not exceed 50% of the total aggregate blend. For heavy duty surface requirements, 100% crushed material is required.

MINERAL FILLER:

Shall be a recognized brand of Type I or II Portland cement having no entrained air that meets the requirements of ASTM D242 if required by the mix design. 0.5% to 2% by dry weight of aggregate will be the range of mineral filler in the mix design. The mineral filler shall be considered as part of the dry aggregate.

WATER:

All water shall be potable and compatible with the slurry mix. Compatibility must be insured by the contractor. The percent of water in the mix design will be as required to produce proper mix consistency.

MATERIALS

EMULSIFIED ASPHALT:

The asphalt emulsion shall be homogeneous and show no separation after mixing. As directed by the Engineer, one of the following two grades of emulsion will be selected.

1. Grade SS-1h - Conforming to the requirements specified in ASTM D 977 for Emulsified Asphalt.
2. Grade CQS-1h - Conforming to the requirements specified in ASTM D 2397 for Cationic Emulsions. (Quick Set)

Any emulsion used will be with a latex modifier which shall be milled into the emulsion or blended into the asphalt cement prior to the emulsification process. It shall pass all applicable storage and settlement tests. The cement mixing test shall be waived.

Asphalt emulsion, type CQS-1h (Quick Set) shall be specified on streets where the amount of time the street can be closed is restricted.

LATEX MODIFIER:

A 3% latex content based on bitumen weight, certified by the emulsion supplier, shall be milled into the asphalt emulsion.

ADDITIVES:

Any additive used to accelerate or retard the break-set of the slurry seal shall be approved by the mix design laboratory as part of the mix design. The amount and type of additive (if needed) will be shown in the mix design.

TEST AND DESIGN

MIX DESIGN:

All materials which first meet all quality test specifications shall be shown in the mix design by type of material and recommended proportions of said material.

MATERIAL

Dry Weight, Proportion %

Aggregate

Mineral Filler (Portland Cement)

Emulsion

Water

Additive (if required)

TEST AND DESIGN**TEST ON AGGREGATE:**

TEST	METHOD			SPECIFICATION
1. Gradation Analysis	ASTM	C	136	See Gradation Chart
	AASHTO	T	27	
2. Sand Equivalent	ASTM	C	2419	45 Min.
	AASHTO	T	176	
3. Soundness	ASTM	C	88	15% Max. Loss by Sodium Sulfate (4 Cycles)
	AASHTO	T	104	
4. Hardness	ASTM	C	88	20% Max. Loss by Magnesium Sulfate (5 Cycles)
	AASHTO	T	104	
5. Unit Weight of Aggregate	ASTM	C	131	35% Max.
	AASHTO	T	96	
5. Unit Weight of Aggregate	ASTM	C	29	Informational lb. cu. ft. (for bulking effect)
	AASHTO	T	19	

BULKING EFFECT

Moisture Content	Moist. Wt. Per One Lb. Can	Moist. Wt. Per Volume	Wt. Of Dry Aggregate Per Volume of Moist Aggregate
Percent		Lbs./Cu. Ft.	Lbs./Cu. Ft.
0			
1.0			
2.0			
3.0			
4.0			
5.0			
6.0			

TEST AND DESIGN
AGGREGATE GRADATION CHART

SIEVE SIZE	TYPE IIA
3/8	100
No. 4	85-100
No. 8	55-80
No. 16	35-60
No. 30	25-45
No. 50	18-30
No. 100	10-21
No. 200	5-15
Residual Asphalt Content, % Weight of Dry Aggregate	8% to 12%
Application Rate Lb. Sq. Yd. Based on Weight of Total Mix	15 lbs. to 21 lbs.

The aggregate shall meet the above gradations and shall not vary from the low limit on one sieve to the high limit on the adjacent sieves or vice versa. The gradation type to be used will be as designated by the Engineer.

Type IIA is a modification of ISSA Type II gradation to provide a coarser mix.

BULKING EFFECT FORMULA

1. Determine Weight of Aggregate Delivered from Slurry Machine.
 - a. Set aggregate metering gate at know position above belt.
 - b. Drive belt to establish uniform flow. (use water to help flow)
 - c. Stop flow, set counter to 0, flush all aggregate out of mixer, and weight machine. (using truck scale) Note: Do not use any water remaining in the machine from this point on.
 - d. Start aggregate belt using an auxiliary water source to speed aggregate through the mixer.
 - e. Stop belt after a predetermined number of revolutions of its drive roller.
 - f. Flush mixer free of aggregate with water from an auxiliary source and reweigh the machine.
 - g. Divide the pounds of aggregate per revolution.

2. Determine Volume of Aggregate Delivered from Slurry Machine.
 - a. Weigh aggregate to determine moisture content as provided on mix design under “Bulking Effect”.
 - b. Obtain weight of aggregate with moisture content as provided in mix design. (Moist Weight per Volume Column).
 - c. $\text{Volume of aggregate delivered per revolution} = \text{weight delivered per revolution divided by weight per cubic foot at moisture content.}$ (Chart gate setting and cu. ft. delivered) See Chart I.

3. Determine Weight of Emulsion Delivered from Slurry Machine.
 - a. Load known amount (gals.) of emulsion, set revolution counter to zero, run a predetermined number to revolutions and weigh. (Most emulsions used in Slurry weigh 8.35 to 8.40 lbs. per gal.)
 - b. $\text{Weight of emulsion divided by number of revolutions} = \text{weight of emulsion per revolution.}$

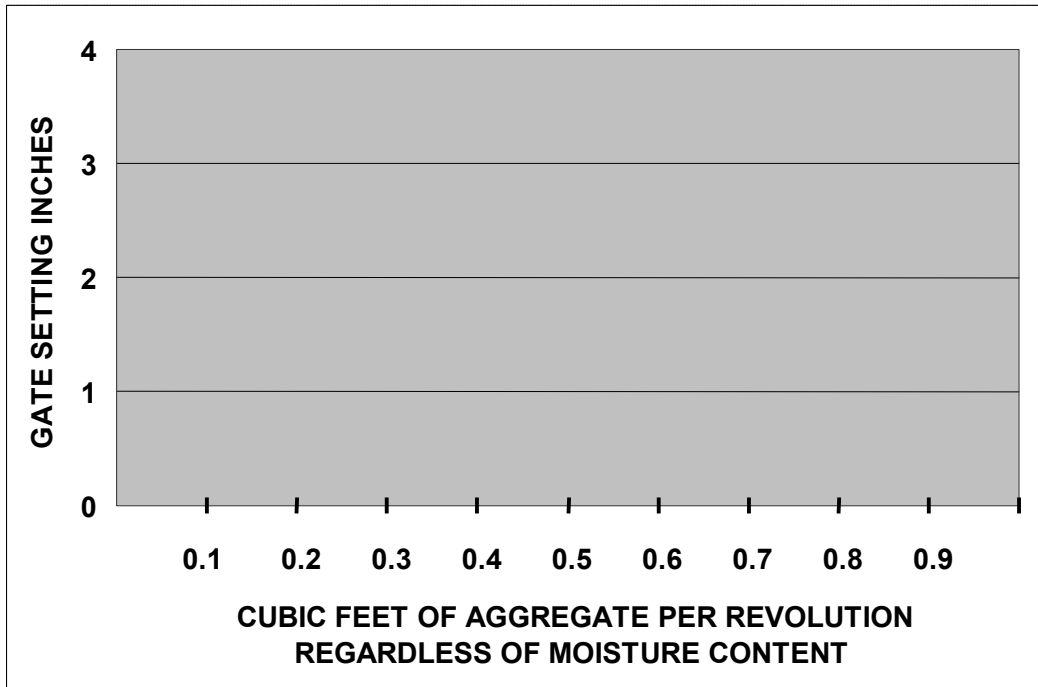
BULKING EFFECT FORMULA

4. Determine Weight of Fines (cement) Delivered from Slurry Machine.
 - a. Load cement, set counter to zero.
 - b. Run a predetermined number of revolutions and weigh.
 - c. Weigh and divide by number of revolutions = weight per revolution.

5. Application of Calibration Data (constant speed emulsion pump)
 - a. Lbs. of emulsion delivered per revolution divided by mix design recommended % emulsion = lbs. of total dry aggregate required per revolution.
 - b. Subtract mix design recommended cement content % from total percent of aggregate and cement.
 - c. To obtain weight of dry aggregate which must be delivered per revolution through the aggregate metering gate, multiply % of aggregate minus cement content by lbs. of total dry aggregate which must be delivered per revolution.
 - d. Divide lbs. obtained in Step "C" by the weight supplied in mix design of dry aggregate in one cu. ft. of moist material to obtain cu. ft. moist aggregate.
 - e. Refer to metering gate Calibration Chart (Chart I) for the correct gate setting for cu. ft. per revolution of aggregate delivered.
 - f. To obtain gate setting for percent of moisture, see the following formula.

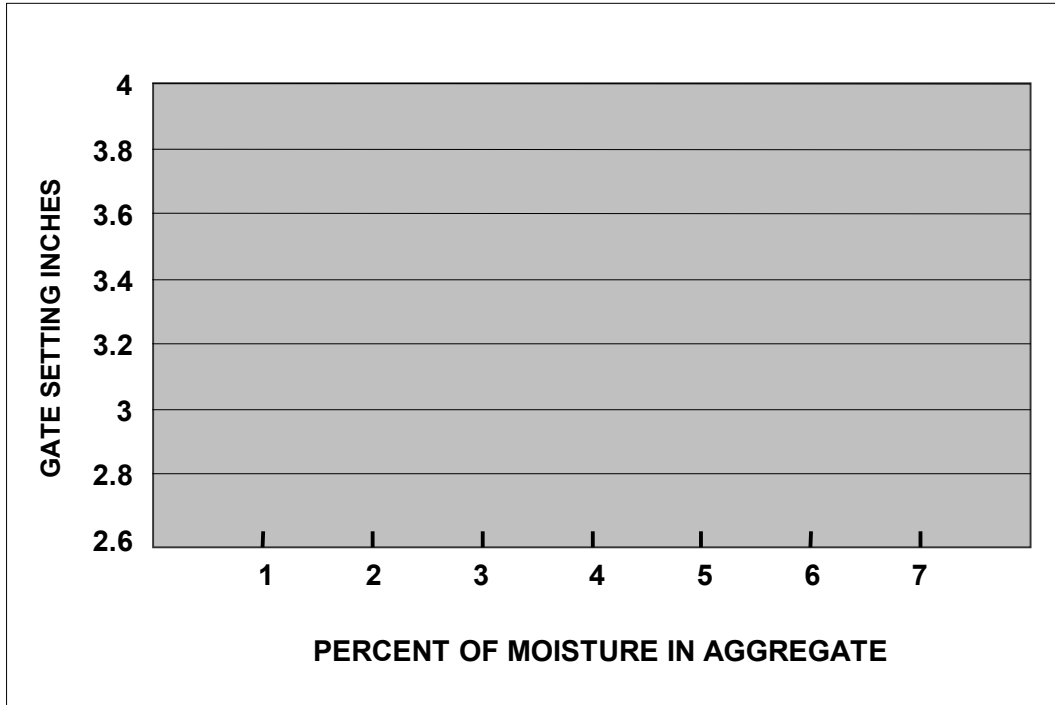
Gate setting in inches divided by volume per revolution times cu. ft. of moist aggregate = gate setting in inches. See Chart II.

**BULKING EFFECTS FORMULA
CHART I
METERING GATE CALIBRATION CHART**



**BULKING EFFECTS FORMULA
CHART II**

GATE SETTING CHART



WATER CONTENT, %

- 0
- 1
- 2
- 3
- 4
- 5
- 6

GATE SETTING, INCHES

TEST AND DESIGN**TEST ON EMULSION**

TEST	METHOD			SPECIFICATION
1. Particle Charge	ASTM	D	244	Informational (Pos. or Neg.)
2. Residue from Distillation, Weight %	ASTM	D	244	57% Min.
	AASHTO	T	59	
3. Saybolt Furol Viscosity @ 77 degrees F. SSF, Seconds	ASTM	D	88	15-50
	AASHTO	T	59	
4. Sieve Test, % Retained on 20 Mesh Sieve	ASTM	D	244	0.1% Max.
	AASHTO	T	59	
5. 24 hr. Storage Stability, %	ASTM	D	244	1% Max.
	AASHTO	T	59	
5 Day Settlement Test, %	ASTM	D	244	5% Max.
	AASHTO	T	59	

TEST ON RESIDUE FROM DISTILLATION

1. Penetration @ 77 degrees F., 100 grams, 5 seconds	ASTM	D	243	40-90
	AASHTO	T	49	
2. Solubility in Trichloroethylene, %	ASTM	D	2042	97.5% Min.
	AASHTO	T	44	
3. Ductility, 77 degrees F., Cm	ASTM	D	113	40 Min.
	AASHTO	T	44	
4. Softening Point, Degrees F. (Ring and Ball)	ASTM	D	2398	140-Degrees F. Min.

TESTS AND DESIGN**TEST ON SLURRY SEAL JOB MIXTURE**

TEST	METHOD			SPECIFICATION
1. Consistency Test, cm Flow	ASTM	D	3910	2-3
2. Set Time, Hours	ASTM	D	3910	12 hrs. Max.
3. Cure Time, Hours	ASTM	D	3910	24 hrs. Max.
4. Wet stripping test, % coating	ISSA	TB	114	80% Min.
5. Wet track abrasion test, Grams per square foot	ASTM	D	3910	75 Max.

EQUIPMENT

GENERAL:

All methods and equipment employed in performing the work shall be subject to the approval of the Engineer before work is started and whenever found unsatisfactory they shall be changed and improved as required. All equipment must be maintained in a satisfactory condition.

MIXING EQUIPMENT:

The slurry seal mixing equipment shall be a continuous flow mixing unit as to give a uniform and complete circulation of the batch in the mixer, so as not to segregate the aggregates, but will provide a thorough and uniform free flowing mix with the asphalt and water. The units shall be equipped with approved devices so that the machine can be accurately calibrated and the quantities of material used can be determined. The mixing machine shall be equipped with a water pressure system and nozzle type spray bar adequate for completely fogging the surface with 0.05 to 0.15 gallons per square yard immediately ahead of the spreader box.

SPREADING EQUIPMENT:

The spreader box shall be equipped to prevent loss of slurry seal from all sides and with a flexible rear strike-off capable of being adjusted. It shall have suitable means for side tracking to compensate for deviations in pavement geometry. The box shall be kept free of built-up asphalt and aggregate. The strike-off drag shall be kept completely flexible at all times

AUXILIARY EQUIPMENT:

Suitable crack and pavement cleaning equipment, hand tools and any support equipment will be provided by the Contractor as necessary to perform the work.

EQUIPMENT

CALIBRATION:

Each Slurry unit to be used shall be calibrated in the presence of the Engineer prior to construction. Previous calibration documentation covering the exact materials to be used may be accepted provided they were made during the calendar year. No machine will be allowed to work on the project until the calibrations have been completed and/or accepted.

VERIFICATION:

The strips will be laid (location to be determined by the Engineer) before construction begins. The Engineer will observe the test strip for verification or rejection according to the specifications. Upon failure of any of the test, additional test strips will be laid at no cost to the City. The square yards of the first test strip will be measured and paid for at the contract unit price.

(Keeping proper consistency is a major concern. A wet mix will cause an asphalt rich surface. Consistency can be checked in the field by making a line through the slurry surface immediately behind the spreader box. If the line stays, the slurry is at a proper consistency level. If the line fills up, the slurry is too wet.)

LIMITATIONS

WEATHER:

All Slurry Seal will be applied between March 1 and December 1.

The Slurry shall be applied only if the air and pavement temperature is 50 degrees F and rising.

No Slurry shall be applied:

1. In the period following precipitation with water remaining on the surface to be coated.
2. In foggy conditions.
3. If there is a threat of rain before the Slurry Seal can fully cure.
4. If there is danger that the finished product will freeze within 24 hours after application.
5. If weather conditions prolongs opening to traffic beyond the time specified by the Engineer.

The Slurry Seal will be placed on the location and within the time limits as specified by the Engineer.

PURPOSE OF SLURRY SEAL APPLICATION:

TYPE IIA. This blend is used to give maximum skid resistance and an improved wearing surface. An example would be on pavements which have highly textured surfaces and require this size aggregate to fill in the voids and provides an improved wearing surface.

Rate of application: 15 to 21 pounds per square yard.

LIMITATIONS

CONDITION AND TYPE PAVEMENT TO BE TREATED:

Any base failures, severe pavement defects, or similar conditions which are present will be properly repaired by the city to insure correct application and performance of the slurry. Slurry normally adheres to asphalt pavement more readily than concrete, especially worn or polished areas. Heavy traffic areas, especially those on concrete, require greater care in selection of type of coarseness of slurry allowing the surface to fully cure before opening to traffic, and the placing of either a tack coat or a second coat of slurry for greater adhesion and wear purposes.

NOTIFICATION:

It shall be the Contractor's duty to notify all homeowners and businesses affected by the construction a minimum of 24 hours in advance of the surfacing. Should the work not occur on the specified day, new notification will be distributed as required. Suitable no parking signs will be properly posted on streets, 24 hours prior to starting work, where parked vehicles would interfere with the surfacing.

TRAFFIC CONTROL:

It shall be the Contractor's responsibility to provide adequate traffic control measures, such as barricades, cones, advance warning signs, flag person, etc. to protect the uncured slurry from all types of traffic and provide traffic safety in the construction area. These measures shall be in accordance with the Section 6 "Texas Manual on Uniform Traffic Control Devices for Streets and Highways". Opening to traffic does not constitute acceptance of the work. Any damage to the uncured slurry will be the responsibility of the Contractor and will be repaired as directed by the Engineer. Approved temporary lane marking will be provided by the Contractor for placement as directed by the Engineer.

STORAGE AND STOCKPILING

STOCKPILING OF AGGREGATE:

Precautions shall be taken to insure the aggregate does not become contaminated with over-sized rock, clay, silt or excessive amounts of moisture. The stockpile shall be kept in areas that have good drainage. Segregation of aggregates proposed for use and as supplied to the mixing plant shall be uniform.

STORAGE SITE:

The Contractor shall provide a suitable storage facility for all equipment and materials needed to perform the work. This site should be located as close as possible to the area of work being done to reduce turn around time and insure an acceptable rate of work. Any site selected shall be subjected to final approval by the Engineer. Erosion control measures shall be implemented as needed to comply with the law and City of Dallas ordinances.

SURFACE PREPARATION

GENERAL:

Immediately prior to applying the slurry seal, the pavement shall be thoroughly cleaned of all loose materials, vegetation, soil and other objectionable material. Any breakdowns, base failures, or other defects will be properly repaired by the city before application of the slurry seal. Manholes, valve boxes, raised pavement markers and other designated objects will be covered by the Contractor to insure their integrity. After completion of slurry placement, the contractor shall remove said covers so the objects protected will remain fully functional. Any objects damaged by the Contractor shall be repaired or replaced at no cost to the City.

TACK COAT:

If required, the Contractor shall apply a tack coat or a second coverage of slurry seal on brick, concrete, or other highly absorbent or polished pavements. If a tack coat is required, a 1-part emulsion, 3-part water tack coat of the same asphalt emulsion type and grade as specified for the slurry is required.

Rate of application, 0.05 to 0.10 gallons per square yard. All debris and unused material shall be removed.

APPLICATION

GENERAL:

If conditions require, the pavement shall be pre-wetted by fogging ahead of the spreader box. Water used in fogging the surface shall be applied so that the entire surface is damp with no flowing water in front of the box.

Rate of spray: 0.05 to 0.15 gal/sq. yd. (or as directed by the Engineer); no streaks, lumps, balls or unmixed aggregated shall be permitted.

RATE OF APPLICATION:

The slurry shall be sufficiently stable during the spreading period so that the emulsion does not break, there is no segregation of the fines from the coarser aggregate and the liquid of the mix does not float to the surface.

JOINTS:

No excessive buildup or unsightly appearance shall be permitted on longitudinal or transverse joint. 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. Longitudinal joints shall be placed on lane lines when possible. If half passes are used, they shall not be the last pass of any paved area.

HAND WORK:

In areas where the spreader box cannot be used, the slurry shall be applied by hand squeegees to provide complete and uniform coverage. Any joint or cracks not filled by the slurry shall be corrected by use of hand squeegees. Hand work shall be completed during the machine applying process

LINES:

Straight lines along curb gutters and shoulder will be required. No runoff on these areas will be permitted. Lines at intersections must be kept straight to provide a good appearance. Slurry shall be placed at the lip of the gutter or at a distance from the face of the curb as directed by the Engineer.

APPLICATION

ROLLING:

If required, specified areas shall be rolled by a self-propelled 10 tons pneumatic roller with tire pressure of 50 PSI and equipped with a water spray system. The slurried pavement shall be subjected to a minimum of 5 full coverages by the roller. Rolling should not commence until the slurry has cured enough so that it will not pick up on the tires. (Rolling is normally not required). In areas of high traffic volume and subject to slow turning, e.g. major intersections, rolling may be feasible.

CURING:

All traffic shall be kept off the slurry until it has cured to a firm condition that will prevent damage to the slurry. Any uncured slurry damaged will be repaired to the satisfaction of the Engineer at the Contractor's expense.

CLEAN-UP:

All objects not to have been covered (manhole covers, valve covers, raised traffic markers, etc) will be restored to their original integrity. The Contractor shall remove all unused material and debris from the site prior to final acceptance.

MEASUREMENT AND PAYMENT

METHODS OF MEASUREMENT:

AGGREGATE:

The quantity of aggregate used in the accepted portions of the work shall be measured by net ticket weight of the individual loads of aggregate shipped to the project and used.

LATEX MODIFIED ASPHALT EMULSION:

The quantity of latex modified asphalt emulsion used in the accepted portion of the work shall be measured by gallons of emulsion shipped and used. Mineral filler, modifier, water and all other additives shall be considered subsidiary items and shall not be paid for separately from the bid item.

BASIS OF PAYMENT:

The treated area on each street authorized and approved by the Engineer shall be field measured and calculated in square yards. The gallons of latex modified asphalt emulsion and pounds of aggregate applied shall be calculated. Payment for authorized work shall be approved if the amount of emulsion and aggregate fall within the specified range per square yard. Dry weight of aggregate should be between 15 to 21 lbs. per square yard for Type IIA slurry. Payment per square yard shall be considered full compensation for grass removal, cleaning the existing pavement, all material (including mineral filler, water modifiers and additives) labor, tools, equipment, maintenance of traffic and incidentals necessary to complete the work. **No payment shall be made for work not authorized and approved by the Engineer.**

SURFACE TREATMENT INSPECTION PROCEDURES

1. All locations will be selected and subject to final approval by the Engineer. Non-compliance will result in nonpayment.
2. No work will commence on any location until approval by the Engineer. Non-compliance will result in nonpayment.
3. All pavement cleaning (sweeping, vegetation removal, etc.), and covering of appurtenances to be performed by the contractor as directed in the Slurry Seal Specification will be subject to the final approval and acceptance of the Engineer. Non-compliance will result in nonpayment.
4. All locations will be subjected to final approval in regards to appearance by the Engineer. Any work directed by the Engineer to correct any appearance defect will be subject to the final approval of the Engineer. Non-compliance will result in nonpayment.
5. No location will be opened to traffic without the approval of the Engineer. Any locations damaged due to non-compliance will be repaired as directed by the Engineer, at the Contractor's expense.