100 TIRE RUBBER MODIFIED SLURRY SEAL.

100-1 GENERAL. Tire rubber modified asphalt slurry seal shall be a stable mixture of emulsified asphalt, mineral aggregate, water, and retardant and is herein referred to as slurry.

100-2 Materials. (Greenbook) 203.52 The ingredients of the slurry shall conform to the following:

100-2.1 Tire rubber modified emulsified asphalt shall be cationic quick-set type CQS-1h TR and contain 2 ½ % latex solids based on mass of asphalt (asphalt residual) within the emulsion.

(Greenbook) 203.5.2

1) The quick-set type shall be cationic unless otherwise specified and shall conform to the requirements of CQS-1h of 203-1.3, Test Reports and Certification, to the following specifications when tested according to appropriate ASTM Methods:

TABLE 203-5.2 (A) – updated for QUICK SET EMULSION CQS-1h TR [1]

TESTS	ASTM Test Method	REQUIREMENTS Min.	Max.
Furol Viscosity at 25°C (77°F), sec.	D244	20	100
Residue from distillation, % by weight	D244	62 Min.	
Sieve Test (% retained on 850 µm [No. 20])	D244		0.30 Max.
Particle Charge Test (Cationic)	D244	Positive	
Storage Stability; 1-Day Settlement	D244		1% Max.
Residue from Evaporation	**CTM 331**		
Penetration 0.1 mm	D 5	35	70
Solubility in TCE*, %	D 2042	97.5 Min.	
Ductility, 25°C (77°F), 5cm/min, cm	D 113	40 Min.	
Softening point, °F	D36	130 Min.	

1. The base asphalt shall contain a minimum of 5% recycled tire rubber. The finished asphalt binder composition shall be smooth and homogeneous. The tire rubber material shall be totally incorporated into the asphalt cement yielding a finished product of singular composition.

* The solubility to be run on the base asphalt of the emulsion containing the tire rubber.

2) The additives for quick – and slow-setting emulsion and the asphalt modifier shall be a type approved by the Engineer. The Amount of additive and asphalt modifier to be included in the quickset slurry shall be the amount necessary to ensure that the applied slurry can support vehicular traffic within 60 minutes after the last application.

3) Water shall be potable and compatible with the other ingredients of the slurry.

4) The Contractor shall provide an aggregate stockpile 24 hours prior to starting the work.

5) Aggregate shall be rock dust or other mineral aggregates approved by the Engineer and shall conform to the requirements of Section 200. The aggregate without any additive shall conform to the following requirements:

TABLE 203-5.2 (B)

TESTS	ASTM Test Method	Requirements
Percentage Wear 500 Revolutions[1]	C 131	40% Maximum
Sand Equivalent	C 2419	55% Minimum
Soundness (5 Cycles)[1]	C 88	15% Maximum

1. ASTM C 131 to be run on plus four graded material before final crushing.

100-3 Composition and grading

(Greenbook) 203-5.3 The grading of the combined aggregate and the percentage of emulsified asphalt shall conform to the requirements indicated in Table 203-5.3 (A)

TABLE 203-5.3(A)

Class	Percentage Passing Sieves					
	Type I		Type II		Type III	
Sieve Size	Min.	Max.	Min.	Max.	Min.	Max.
3/8 in (9.5 mm)	100	---	100	---	100	---
No. 4 (4.74 mm)	100	---	90	100	70	90
No. 8 (2.36 mm)	90	100	65	90	45	70
No. 16 (1.18 mm)	65	90	45	70	28	50
No. 30 (600 µm)	40	60	30	50	19	34
No. 50 (300 µm)	25	42	18	36	12	25
No. 100 (150 µm)	15	30	10	24	7	18
No. 200 (75 µm)	10	20	5	15	5	15
Residual Asphalt % of Dry Aggregate Weight	10 min		7.5 min		6.5 min	
Emulsified asphalt % of dry aggregate weight must meet residual asphalt requirement.						

100-4 Mix Design

(Greenbook) 203-5.4 The Contractor, at its expense, shall submit for Engineer approval laboratory reports of mix designs performed in accordance with ASTM D 3910 procedures, utilizing the specific materials to be used. ASTM D 3910 procedures shall be modified to include the retained 4.75 mm (No. 4) aggregate if present in the mix design. The Engineer will approve the mix proportions that are best suited for use on the project, based upon the emulsion content and water needed to produce a slurry with a maximum loss of 540 grams per square meter (50 grams per square foot) by the modified Wet Track Abrasion Test. For mix designs containing more than 4% aggregate retained on the 4.75 mm (No. 4) sieve, the maximum loss will be 650 grams per square meter (60 grams per square foot).

The Contractor, at its expense, shall calibrate each slurry mixer to be used in the work according to the approved slurry mix design. The Contractor shall allow 2 days prior to the start

of work for calibration and testing at a location to be approved by the Engineer. The Engineer will obtain field samples at the time of calibration for Extraction Test (ASTM D 2172, California Test 382). Consistency Test, and Wet Track Abrasion Test (Modified ASTM D 3910). When in the judgment of the Engineer, the field samples meet the requirements stipulated in these specifications, the Engineer will notify the Contractor to start the work.

100-5 Mixing

(Greenbook) 302-4.2.1 General. Mixing shall be performed by a continuous-flow mixer. All aggregate particles will be uniformly saturated and coated with asphalt.

302-4.2.2 Continuous-Flow Mixers. The slurry mixer shall be a multiblade or spiral continuous-flow in good working condition capable of accurately delivering a predetermined proportion of aggregate, water, emulsion, additive and asphalt modifier to the mixer and of discharging the thoroughly mixed slurry on a continuous basis. Each mixer shall have a metering device to measure the quantity of water in liters (gallons) used I each load of slurry and a separate metering device or equivalent which meets the approval of the Engineer to measure the quantity of emulsified asphalt used in each load of slurry.

The spreader box shall be equipped with flexible material in contact with the pavement and shall be maintained so as to prevent loss of slurry. It shall be adjustable to ensure a uniform controlled spread and be equipped with a mechanical or hydraulic type horizontal shifting device.

100-6 Application

(Greenbook) 302-4.3.1 General. The work shall consist of mixing asphaltic emulsion, aggregate, additive, and water and spreading the mixture on the pavement where shown on the Plans. Type I and Type II slurry shall be applied at the application rate shown in Table 302-4.3.1 (A).

TABLE 302-4.3.1 (A)

	Application Rate		Area Covered	
Slurry Seal	**Minimum**	**Maximum**	**Minimum**	**Maximum**
Type I	4.3 kg/m² (8lbs/yd²)	5.4 kg/m² (10 lbs/yd²)	167 m² /ELT (1800 ft²/ELT)	209 m²/ELT (2250 ft²/ELT)
Type II	6.5 kg/m² (12 lbs/yd²)	8.1 kg/m² (15 lbs/yd²)	112 m²/ELT (1200 ft²/ELT)	139 m²/ELT (1500 ft²/ELT)
Type III	8.7 kg/m² (16lbs/yd²)	10.8 kg/m² (20 lbs/yd²)	93 m²/ELT (900 ft²/ELT)	116 m²/ELT (1125 ft²/ELT)

An ELT of slurry is made up pf 907 kg (2000 pounds) of dry aggregate plus emulsified asphalt, accelerator or retardant, and water. Quantities and application rate shall be approved by the Engineer. When the Engineer determined that the application rate does not conform to the requirements, the Contractor shall take immediate corrective action. When the rate is less than the minimum amount required, the Contractor shall reapply additional slurry seal to the nonconforming area to meet the requirements. When the rates exceed the maximum specified Table 302-4.3.1 (A), the Engineer should refer to 4-1.1.

The sites for stockpiling and batching materials shall be clean and free from objectionable materials. Arrangements for these sites shall be the responsibility of the Contractor.

Hand squeegees and other hand equipment shall be provided to remove spillage and spread slurry in areas inaccessible to the spreader box.

The Contractor shall have two fully operational mixers for use at the project site at all times. These mixers shall be available for inspection by the Agency at least 48 hours prior to commencing work.

302-4.3.2 Spreading. Slurry shall not be applied when the atmospheric temperature is less than 10 °C (50°F). The maximum speed of the slurry machine shall not exceed 80 meters per minute (270 feet per minute).

The application of slurry shall not commence until after 7:00 a.m. and the slurry shall be sufficiently cured to be open to traffic by 4:00 p.m. The streets to be sealed shall be closed from the time the application begins until the Engineer determines the mixture has achieved sufficient set to be opened to traffic.

Prior to applying slurry, the surface to be sealed shall be cleaned by the Contractor unless otherwise specified. Immediately ahead of the mixer, the pavement shall be prewetted by a pressure water distribution system equipped with a fog-type spray bar which will completely fog the surface of the pavement. The need for application and the rate of application will be determined by the Engineer.

Evidence of solidification of the asphalt, balling or lumping of the aggregates, or the presence of uncoated aggregate will be cause for rejection of the slurry.

Slurry shall be applied in such a manner that no ridges shall remain.

The Contractor shall prevent slurry from being deposited on other than asphalt concrete surfaces and shall remove slurry from surfaces not designated to be sealed at no cost to the Agency. The method of slurry removal shall be approved by the Engineer.

At the direction of the Engineer, the Contractor shall repair and reseal all areas of the streets which have not been sealed properly or completely, at no cost to the Agency.

Where the completed slurry is not uniform in color, the street shall be treated to eliminate the color variation at the Contractor's expense. The method of treatment shall be approved by the Engineer.

100-7 PUBLIC CONVENIENCE AND TRAFFIC CONTROL.
(Greenbook) 302-4.4 At least 5 working days prior to commencing work, the Contractor shall summit its spreading schedule to the Agency for approval. This schedule shall allow residents on the streets to be sealed ample "on street" parking within a reasonable distance from their homes. Based upon the spreading schedule, the Contractor shall notify residents and business of the work and post temporary "No Parking" signs. Requests for changes in the schedule shall be submitted by the Contractor to the Engineer for approval at least 48 hours prior to the scheduled sealing of the streets affected.

The Contractor shall be responsible for adequate barricading of the work area and controlling of traffic in the vicinity of the project as specified in these specifications, or as directed by the Engineer.

When necessary to provide vehicular or pedestrian crossings over the fresh slurry, the Engineer shall direct the Contractor to spread sufficient sand or rock dust on the affected area to eliminate tracking or damage to the slurry. Sand or rock dust used for this purpose shall be at the Contractor's expense.

100-8 MEASUREMENT AND PAYMENT.
(Greenbook) 302-4.5 Slurry will be paid at the Contract Unit Price per ELT. The payment quantity will be determined by the weight of dry aggregate used in the slurry.

The contract unit price paid per extra long ton shall include full compensation for furnishing emulsion, accelerator or retardant, and water.

Specifying CQS-1h TR in Special Provisions

To specify CQS-1h TR in your special provisions all you need to do is add the following language:

Tire Rubber Modified Slurry Seal (CQS-1h TR) shall conform to 203-5 of Greenbook with the following substitution:

203-5 EMULSION-AGGREGATE SLURRY.

203-5.2 Materials. Delete Subparagraph 1), and substitute the following:

The base asphalt of the emulsion shall contain a minimum of 5% recycled tire rubber, and its composition shall be smooth and homogeneous. The tire rubber material shall be totally incorporated into the asphalt cement yielding a finished product of singular composition. The emulsified asphalt shall be a cationic quick-set type, with 2 ½% latex, and conform to the requirements of CQS-1h of 203-1.3, Test Reports and Certification, and to the following specifications when tested according to appropriate ASTM Methods: