

ITEM 417 ASPHALT EMULSION SLURRY SEAL

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417.01 Description. This work consists of constructing a slurry seal composed of a mixture of emulsified asphalt, mineral aggregate, and water; properly proportioned, mixed, and spread evenly on the surface as specified herein and as directed by the Engineer. The cured slurry shall have a homogeneous appearance, fill all cracks, adhere firmly to the surface and have a skid resistant texture.

417.02 Materials.

A. Asphalt Emulsion. Furnish emulsified asphalt conforming to AASHTO specifications for dense mixing grade SS-1h except that they shall be of the QUICK SET SLURRY SEAL EMULSION TYPE, either anionic or cationic, whichever in the opinion of the Engineer and the Laboratory is best suited to the aggregates and job conditions to be encountered. The following specifications will apply:

TABLE 417.02-1

	Quick Set Anionic	Quick Set Cationic
Viscosity at 77° F (25° C), SSF, secs.	15-50	15-50
Residue from Distillation Weight, %	57% min.	57% min.
Sieve Test, Retained on 20 mesh, %	0.10 max.	0.10 max.
Particle Charge, Electroplate	Negative	Positive
Tests on Residue from Distillation:		
Penetration at 77° F (25° C), 100 G., 5 sec.	40-90	40-90
Solubility in CS ₂ or TCE	97.5 min.	97.5 min.
Ductility at 77° F (25° C), cm.	40 min.	40 min.
Tests on Job Design Slurry:		
Mixing Time Test Sec.	120 min.	120 min.
Set Time Blotter Test, 30 mins.	No brown stain or displacement	No brown stain or displacement
Water Resistance Test, 30 mins.	No - discoloration	No - discoloration

Coating Test (3 min. in boiling water), %	90 min.	90 min.
Wet Track Abrasion Test, Loss in gms. per sq. ft.	75 max.	75 max.
Loaded Wheel Test, Sand Adhesion gms. per sq. ft.	60 max.	60 max.

B. Aggregate. Furnish mineral aggregate consisting of 100 percent crushed gravel, or slag, or approved limestone and that is clean and free from vegetable matter and other deleterious substances. When tested by AASHTO T176, the aggregate blend shall have a sand equivalent of not less than 45. When tested according to AASHTO T104, the aggregate shall show a loss of not more than 35 percent.

Consider mineral fillers such as Portland cement or limestone dust as part of the blended aggregate and use in minimum required amounts. Ensure mineral fillers meet the gradation requirements of ASTM D242 (Dry). Only use mineral fillers if needed to improve the workability of the mix or gradation of the aggregate.

Only use aggregates in the work that have a proven durability record for the conditions and traffic expected. The Engineer will approve the aggregate source before work proceeds. The combined mineral aggregate shall conform to the following gradation when tested by the previously mentioned test, ASTM D242 / D242M:

TABLE 417.02-2

Sieve Size	Type I (Slurry Seal) Percent Passing	Type II (Slurry Seal) Percent Passing	Type III (Slurry Seal) Percent Passing
3/8 (9.5 mm)	100	100	100
No. 4 (4.75 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 (600mm)	40-60	30-50	19-34
No. 50 (300mm)	25-42	18-30	12-25
No. 100 (150mm)	15-30	10-21	7-18
No. 200 (75mm)	10-20	5-15	5-15
Theoretical	10-16	7.5-13.5	6.5-12
Asphalt Content, (% Dry Aggregate) % Extracted from dry sample			
Application Rate, Aggregate lbs./SY (kg/m ²), Dry	8+/-2 (4+/-1)	15+/-2 (8+/-1)	20+/-3 (10+/-1.5)

C. Water. Only use potable water, that is free from harmful soluble salts, with the slurry mixture.

D. Stockpiling of Aggregate. Do not stockpile at areas other than the quarry site without the Engineer's approval. Stockpile in a manner that prevents contamination and segregation of the aggregate.

417.03

E. Storage. Provide suitable storage facilities for the asphalt emulsion. Equip the container to prevent water from entering the emulsion. Provide suitable heat if necessary to prevent freezing.

F. Sampling. Provide samples of materials and of the finished slurry surface as directed by the Engineer during progress of the work. The Engineer may request test reports as additional materials arrive.

G. Design. Submit to the Engineer a complete laboratory design made in a qualified laboratory at the Pre-Construction Conference, but no later than 30 days prior to start of work. Perform a complete analysis of the materials and JMF proposed for use in the performance of the work in accordance with procedures outlined in the current issue of International Slurry Seal Association Technical Bulletin No. 111 as indicated by the Engineer. The Engineer will review and approve the selection of the optimum mix design from the material data presented.

H. Submittals. Submit along with the required written materials analysis and proposed JMF the following physical specimens:

1. 11 lb (5 kg) of the proposed aggregate selected.
2. 1 gal (4 liters) of the proposed emulsion selected.
3. 1 lb (1/2 kg) of the filler selected, if applicable.
4. 3 series of consistency tests at 100, 85 and 70 percent BR and at 2-3, 4-5, and 6-7 cm. consistencies.
5. 2 each of abraded Wet Tract Abrasion Test specimens at 100, 85 and 70% BR.
6. 2 each of sand adhered Loaded Wheel Test specimens at 100, 85 and 70% BR.

Identify each specimen indelibly with the date and source.

The Engineer may waive the design submittals provided the Contractor has previously applied, in accordance with 417.02.H, a satisfactorily designed and applied slurry with substantially the same materials proposed for this work. In any case, the Contractor may not introduce untried materials into this work without complete analysis and design of a JMF for each new material and the approval of the Engineer.

417.03 Equipment. Maintain all equipment, tools, and machines used in the performance of this work in satisfactory working order at all times. Furnish proof by certification that the slurry machines to be used on the project have been calibrated within the past 2 months. Such certificate shall consist of a letter from a professional engineer or an acceptable testing laboratory.

A. Slurry Mixing Equipment. Use a continuous flow mixing unit, capable of delivering accurately a predetermined proportion of aggregate, water and asphalt emulsion to the mixing chamber and discharging the thoroughly mixed product on a continuous basis. Pre-wet the aggregate immediately prior to mixing with the emulsion. Ensure that the mixing unit of the mixing chamber is capable of thoroughly blending all ingredients together. Do not allow any violent mixing. Equip the mixing machine with an approved fines 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 fines feeder whenever added mineral filler is a part of the aggregate blend.

Equip the mixing machine with a water pressure system and fog type spray bar adequate for completing fogging the surface preceding spreading equipment with a maximum application of 0.05 gallons per square yard (2 L/m²). Do not carry free water in front of the spreader. Equip the emulsion tanks with some type of measuring device that will provide a quick reference to determine application rate in gallons of emulsion per square yard (liters per square meter). Use a minimum of two complete slurry machines of at least 10 tons (9 metric tons) aggregate capacity each to provide as nearly a continuous operation as possible.

B. Slurry Spreading Equipment. Attach to the mixing machine a mechanical type squeegee distributor box equipped with flexible material to contact with the surface to prevent loss of slurry from the spreader box. To prevent the loss of slurry on varying grades and crowns, adjust the spreader box to ensure a uniform spread.

Provide a steering device and a flexible strike-off. The spreader box shall have an adjustable width. Keep the box clean, and prevent build-up of asphalt and aggregate on the box. Use burlap drags or other drags with the Engineer's approval.

C. Cleaning Equipment. Use power brooms, power blowers, air compressors, water flushing equipment, and hand brooms to clean the surface and cracks of the old surface. Only use high pressure water (10 gal/m (38 L/m) at 1,000 psi (6.9 Mka)) to remove mud and adhesive clays.

D. Auxiliary Equipment. Provide hand squeegees, shovels, and other equipment as necessary to perform work.

417.04 Preparation of Surface. Perform sweeping, weed removal and final cleaning just before the machine. The Contractor may use any standard cleaning method to clean pavements, except water flushing will not be permitted in areas where considerable cracks are present in the pavement surface. The Engineer will give final approval of the surface.

If the slurry is being placed over a brick or concrete surface, highly absorbent asphalt surface, or over a surface where the aggregate has become exposed and is polished and slick, the Contractor may apply, with the slurry machine spreader box, a one part emulsion, three parts water, tack coat of the same asphalt emulsion type and grade as specified for the slurry. The normal application rate is 0.05 to 0.10 gallons (2 to 4 liters) of the diluted emulsion per square yard (square meter) of surface. Do not proceed without the Engineer's final approval.

417.05 Composition and Rate of Application of the Slurry Mix. Translate the optimum JMF as set forth in the materials section of this specification into job control quantities in accordance with ISSA TB #107.

The slurry seal mixture shall be of proper consistency at all times so as to provide the application rate required by the surface condition. The average application rate, as measured, shall be in accordance with the following table.

Aggregate Type	Application	Application Rate
Type I	Parking Areas	8-12 lb/yd ²

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	Urban and Residential Streets	(4.3-6.5 kg/m ²)
Type II	Urban and Residential Streets	15 – 17 lb/yd ² (8.1 – 9.2 kg/m ²)
Type III	Primary and Interstate Routes	15-22 lb/yd ² (8.1-12.0 kg/m ²)

The application rate is based upon the weight of dry aggregate in the mixture. The application rate is affected by the unit weight of the aggregate, the gradation of the aggregate and the demand of the surface to which the slurry seal is being applied. ISSA TB #112 gives a method to determine expected application rates.

Control the consistency of the mix to within 2.5 and 3.5 cm.

Maintain a complete load-by-load record of the quantities used as in ISSA TB #107 and make available to the Engineer or City representative upon request. The City will not make final payment for the work until all load tickets and inventories are verified to ensure that specification quantities have been applied. In case of disputes, the Engineer's judgment will be final.

417.06 Weather Limitations. Do not apply the slurry seal surface if either the pavement or air temperature is 50° F (10° C) or below and falling. However, the Contractor may apply the mixture when both the air and pavement temperature are 45° F (7° C) or above and rising. Do not apply the mixture if high relative humidity prolongs the curing beyond a reasonable time.

417.07 Traffic Control. Use suitable methods such as pennants, barricades, flaggers, and pilot cars to protect the uncured slurry surface from all types of traffic. Any damage to the uncured slurry will be the responsibility of the Contractor. The Engineer will give final approval as to the method used. If damage occurs where suitable means have been made to protect the uncured slurry, the City will prosecute violators and reimburse the Contractor for the amount of the damages. Notify residents affected by the work in writing, 1 week before the work is to be done. Post “No Parking” signs 3 working days before the work is to be done. Tow parked vehicles after 3 days of notification, assuming responsibility and liability for the removal of these vehicles.

417.08 Application of the Slurry Surfaces.

A. General. Fog the surface with water directly preceding the spreader. Ensure that the slurry mixture is of the desired consistency when deposited on the surface; do not add additional elements. Total time of mixing shall not exceed 4 minutes. Ensure that a sufficient amount of slurry is carried in all parts of the spreader at all times so that complete coverage is obtained. Do not allow lumping, balling, or unmixed aggregate, or excessive breaking of the emulsion in the spreader box. Do not leave any streaks such as caused by oversized aggregate in the finished pavement.

B. Test. Furnish the City a cone consistency test each morning for each slurry machine used on the job, see ISSA TB #106.

C. Joints. Do not allow excessive build-up or unsightly appearance on longitudinal or transverse joints.

D. Hand Work. The Contractor may use approved squeegees to spread slurry in areas inaccessible to the slurry mixer. Take care to leave no unsightly appearance from

hand work. In areas with adjacent concrete curb or curb and gutter which are not to be treated, use special care to avoid covering the concrete. If the Engineer determines that insufficient care is being taken to protect the concrete, the Engineer may require masking with suitable material at no additional cost to the City.

E. Curing. Allow treated areas to cure until such time as the Engineer permits their opening to traffic.

F. Structures. Prior to the work, mask all structures that may become marred by the slurry, such as open gates, catch basins, manholes and valve boxes, with 0.006 inches (0.15 mm) plastic or equal and attached so as not to be displaced by the operations. Remove masking material after the slurry has cured. To achieve a clean straight line at intersections, use 15 pound (6.8 kg) roofing felt or equal as directed by the Engineer. Remove all masking materials at the completion of the work.

417.09 Delayed Acceptance. A minimum of 30 days after the completion of the slurry seal project, the Engineer will inspect the project with the Contractor for surface flushing and loss of material. If these deficiencies are found, corrective work is required.

Complete all corrective work within seven working days of the review, or by an agreed date. All costs associated with completing this corrective work, to the satisfaction of the Engineer, will be paid for by the Contractor.

417.10 Documentation. Provide a Summary of Slurry Seal Quantities - Yield Report for each worksheet to the Engineer, within one working day, with the following information:

- A. Control Section, Project Name, Street Name, County, Engineer
- B. Date, Time and Air Temperature
- C. Control Settings (From Calibration), Calibration Values (lbs/count)
- D. Unit weight of emulsion (Ibs/gal), % residue in emulsion
- E. Beginning and ending stations of project
- F. Counter readings for Cement, Emulsion and Aggregate (beginning, ending and total)
- G. Length (Ft), width (Ft), area (Sq.Yd), weight of aggregate placed (Lbs) and weight of emulsion placed (Lbs)
- H. % of each material, percent of asphalt cement, application rate
- I. JMF (% Portland cement, % emulsion, gradation and % A.C.)
- J. Contractor's authorized signature
- K. Contractor to calculate:
 - a. % Cement
 - b. % Emulsion
 - c. Aggregate Spread Rate
 - d. Gallons Emulsion/ Unit weight of emulsion (Ibs/gal)
 - e. Weight of emulsion placed (Lbs)/ % residue in emulsion
 - f. Asphalt Content

Use the Summary of Slurry Seal Quantities - Yield Report template as provided by the City. The Contractor is still responsible for completing a load by load record of the quantities used as in ISSA TB #107 as per 417.05.

417.09 Method of Measurement. The City will measure slurry seal surface by the square yards (square meter) of work completed and accepted as designated by the

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Engineer for each type applied. The City may require one test section per 10,000 square yards (8,361 m²) completed; the Engineer will select the sections. At each location, the Contractor will remove a 1 x 1-foot (0.3 x 0.3m) square area of the fresh dried slurry. In the presence of the Engineer, the Contractor will place a piece of steel bar stock across the removed section and measure the thickness daily. Acceptable minimum thickness for each type is:

Type I	1/16 inch (1.6 mm)
Type II	3/16 inch (4.8 mm)
Type III	5/16 inch (8.0 mm)

The City will apply a payment deduction if the average thickness is less than the acceptable minimum. The payment will be paid for at the ratio of the average actual thickness to the acceptable minimum thickness applied to the unit bid for the item.

417.10 Basis of Payment. The City will pay for accepted quantities complete in place at the contract unit price per square yard (square meter). Price and payment will be full compensation for furnishing and placing all materials; however, for slurry seal found deficient in thickness, the City will pay only the reduced price stipulated in Section 417.09.

The City will make no additional payment over the unit contract bid price for slurry seal having an average thickness in excess of that shown in Section 417.09.

The City will pay for accepted quantities complete in place, at the contract price as follows:

Item	Unit	Description
417	Square Yard (Square Meter)	Asphalt Emulsion Slurry Seal, Type ____