FAA Specifications Item P628

The Federal Aviation Administration Research Engineering and Development Authorization Act was passed in August of 1994. The law took effect as of January 1, 1995.

A new specification was introduced by the FAA in April of 1996 covering a material designed to preserve asphalt pavements and to implement the use of cost-saving materials in an effective airport maintenance-management program.

FAA Item P628 was developed by a committee of the Airport Consultants Council and probably is the most unique specification as it was designed to get the sponsor what is specified with all possible assurances. Call or write for a FREE cost analysis.

The materials and application are now covered in the new FAA Item P628, Change 1, which was released in April of 1996.

FAA Specifications, Item P628 specifies the materials and methods to be used to accomplish this work with a three-year warranty from the contractor.

ITEM P-628 RUBBERIZED COAL-TAR EMULSION SLURRY SEAL COAT

CHANGE 1 – APRIL 4, 1996

DESCRIPTION

628-1.1 This item shall consist of an application of a rubberized coal-tar emulsion seal coat, with water and with or without mineral aggregate, and with the use of a silicone latex rubber applied on an existing, previously prepared bituminous surface, in accordance with these specifications for the area shown on the plans or as designated by the Engineer. The material is intended for use to rehabilitate and restore existing asphalt pavement surfaces and protect them from weathering. The material is capable of filling all voids and cracks, to prevent the loss of fines through oxidation, and is fuel-resistant. The material is used to even out small surface irregularities on the pavement surface (truing and leveling).

MATERIALS

628-2.1 AGGREGATE. The aggregate shall either be a natural or manufactured angular aggregate and shall be composed of clean, hard, durable, uncoated particles, free from lumps of clay and all organic matter. The aggregate shall meet the gradation in Table 1, when tested in accordance with ASTM C 136.

TABLE 1. GRADATION OF AGGREGATES

Sieve Size		Percentage by Weight Passing Sieves
No. 8	(2.36 mm)	100
No. 16	(1.18 mm)	97-100
No. 20	(0.85 mm)	85-100
No. 30	(0.60 mm)	15-85
No. 40	(0.40 mm)	2-15
No. 100	(0.15 mm)	0-2

628-2.2 BITUMINOUS MATERIALS. The bituminous material shall be a coal-tar emulsion prepared from a high temperature coal-tar conforming to the requirements of ASTM D 490, grade 11/12. The coal-tar emulsion shall conform to all the requirements of Federal Specification R-P-355e except the water content shall not exceed 50 percent.

628-2.3 WATER. The water used in mixing shall be potable and free from harmful soluble salts. The temperature of the water added during mixing shall be at least 50°F (10°C). The pH of the water to be added during mixing shall conform to the requirements of the coal tar emulsion manufacturer by certification.

628-2.4 LATEX RUBBER. The rubber shall be a copolymer latex containing 51-70 parts butadiene and 30-49 parts acrylonitrile with a minimum solids content of 40 percent, have a particle size less than 80 nanometers and silicones at 4% of the rubber content. The latex rubber shall be compatible with the coal-tar emulsion used by the Contractor and must mix homogeneously with the coal-tar emulsion water and sand in the proportions specified to produce a mixture that will adequately suspend the sand during mixing and application. Latex rubber materials shall be as manufactured by Walaschek & Associates, Inc., phone, (888) 451-1375 or approved equal.

COMPOSITION AND APPLICATION

628-3.1 COMPOSITION. The rubberized coal-tar emulsion slurry seal coat shall consist of a mixture of coal-tar emulsion, water, aggregate and latex rubber in the proportions that fall within the ranges shown in Table 2 and comply with the approved job mix formulation as determined by the design Engineer or the contractor quality control technician (CQC) and as approved by the Engineer.

628-3.2 JOB MIX FORMULA. For a rubberized slurry seal coat, the Contractor shall submit the latex manufacturer's recommended formulation and application rate to an independent and pre-approved testing laboratory, together with sufficient materials (four components) to verify the formulation. The laboratory shall verify the proportions of emulsion, water, aggregate and rubber using mix design procedures contained in Appendix A. The mix design shall be within the range shown in Table 2 and meet the requirements of Table 3. A copy of the mix design and test data shall be submitted to the Engineer for approval at least fifteen (15) days prior to the pre-construction conference. No slurry seal coat shall be produced for payment until a job mix formula has been approved by the Engineer. The independent testing laboratory shall be Soil and Material Engineers, Inc., phone (313) 454-9900.

TABLE 2. COMPOSITION OF MIXTURE

Type of Seal	Coat Composition and Quantities			
	Water gal./gal. of emulsion	Aggregate lbs./gal. of emulsion	Rubber gal./gal. of emulsion	Application Rate gal./sq. yd. (per application)
Rubberized Sand Slurry	0.80 (max)	16 or 20	0.10 or 0.14	0.35-0.55
Rubberized Emulsion	0.80 (max)	-	0.04 or 0.05	0.20-0.25

Note: The formulation and application rates shall be pre-determined by the design engineer and the Independent Technical Consultant (ITC/CQC) specializing in coal-tar emulsion slurry seals, and approved by the Engineer. Sand loadings of 16 pounds are designed to be used over good pavements. Sand loadings of 20 pounds are for pavements with a very heavy void condition and truing and leveling for standing water.

TABLE 3. DESIGN CRITERIA

Steps	Test Property	Purpose	Criterion
1.	**Brookfield Viscosity poises @ 77°F**	**Incompatibility between latex and coal tar**	**10-90**
2.	**Brookfield Viscosity**	**Workability of composite mix**	**10-90**
3.	**Scuff Resistance**	**Rate of set** **Final scuff resistance**	**>8-hour torque 100 in-lbs** **24-hour torque 8-hour torque Std Dev = 15 in-lbs**
4.	**Freeze-Thaw 5 cycles 10 cycles**	**Cracking**	**<___1 <___3**
5.	**Adhesion**	**Loss of adhesion**	**Rating = 5A**
6.	**Fuel Resistance (One composite coat)**	**Fuel penetration** **Loss of adhesion**	**No penetration** **No loss of adhesion**

628-3.3 APPLICATION RATE. The rubberized coal-tar emulsion seal coat shall be applied in three coats. The first and second coats shall consist of a rubberized sand slurry; the third coat shall consist of a rubberized emulsion. The predetermined formulation and application rate shall be verified during placement of the test section and shall be within the limits shown in Table 2 and shall be within 10% ± of the application rates as prescribed in Table 2, as determined by the Engineer or ITC/CQC technician.

628-3.4 TEST SECTION. Before the start of the work, the ITC/CQC technician shall conduct the viscosity tests and examine the formulation of materials for compatibility and conglomeration. A complete test section shall be applied to the pavement under the supervision of the Engineer and ITC/CQC technician on an area of approximately 250 square yards or more at the rates specified in Table 2. The area to receive the test section shall be selected by the Engineer and shall be representative of the pavement to be seal coated. Allowable variation from the specified application rates shall not exceed 10.0 percent. Any section placed below the allowable variation of 10.0 percent shall be rejected by the Engineer. The Contractor, at his own expense, shall bring the application rate into conformance on any rejected section, to the satisfaction of the Engineer. Test sections which conform to all specification requirements shall become part of the sealed surface.

The test section shall be used to verify the adequacy of the mix design, the workability of the formulation and the application rate on each coat of the three-coat system. The same equipment and

method of operations used on the approved test section will be used on the remainder of the work. Random viscosity tests shall be made to determine conformance with the requirements of Table 3 on the composite mix on the job site, by the ITC/CQC technician.

If the test section should prove to be unsatisfactory, the necessary adjustments to the mix composition (approved by the laboratory for compliance -with Table 3), application rate, placement operations and equipment shall be made. Additional test sections shall be placed and evaluated, if required. Full production shall not begin without the laboratory approval of the formulation and the approval of the Engineer. Acceptable test sections shall be paid for in accordance with paragraph 7.1.

CONSTRUCTION METHODS

628-4.1 WEATHER LIMITATION. The seal coat shall not be applied when the surface is wet or when the humidity or impending weather conditions will not allow proper curing nor when the atmospheric or pavement temperature is below 50°F (10°C), unless otherwise directed by the Engineer.

628-4.2 EQUIPMENT AND TOOLS. The Contractor shall furnish all equipment, tools and machinery necessary for the performance of the work. All methods employed in performing the work and all equipment, tools and machinery used for handling materials and executing any part of the work shall be subject to the approval of the Engineer before the work is started.

a. **Distributors**. Distributors or spray units used for the spray application of the seal coat shall be self-propelled and capable of uniformly applying (0.05 to 0.55) gallons per square yard (0.23 to 2.5) liters per square meters of material over the required width of application. Distributors shall be equipped with removable manhole covers, tachometers, pressure gauges, and volume-measuring devices.

The mix tank shall have a mechanically powered mixer with sufficient power to move and homogeneously mix the entire contents of the tank.

The distributor shall be equipped with a positive displacement pump or pressurized so that a constant pressure can be maintained on the mixture to the spray nozzles.

b. **Mixing Equipment**. The mixing machine shall have a continuous flow mixing unit capable of accurately delivering a predetermined proportion of emulsion, water, aggregate and rubber and of discharging the thoroughly-mixed product on a continuous basis. The mixing unit shall be capable of thoroughly blending all ingredients together and discharging the material to the spreading/application equipment.

c. **Spreading Equipment**. Attached to the spreading/application machine shall be a mechanical-type squeegee distributor, equipped with flexible material in contact with the surface to prevent loss of slurry from the spreader box. It shall be maintained to prevent loss of slurry on varying grades and adjusted to assure uniform spread. There shall be a lateral control device and a flexible strike-off capable of being adjusted to lay the slurry at the specified rate of application. The spreader box shall be kept clean; coal-tar emulsion and aggregate build-up on the box shall not be permitted.

d. **Calibration**. The Contractor shall furnish all equipment and materials and labor necessary to calibrate the mixing equipment. It shall be calibrated with water to assure that it will produce a mix that conforms to the job mix design. A copy of the calibration test results shall be furnished to the Engineer.

628-4.3 PREPARATION OF PAVEMENT SURFACE. Bituminous pavement surfaces which have been softened by petroleum derivatives or have failed due to any other cause shall be removed to the full depth of the damage and replaced with new bituminous concrete similar to that of the existing pavement, as agreed to in the contract. Areas of the pavement surface to be treated shall be in a firm consolidated condition. They shall be sufficiently cured so that there is no concentration of oils on the surface. All newly-placed surface courses shall be primed with a synthetic resin. A period of thirty (30) to ninety (90) days shall elapse between the placement of a bituminous surface course and the application of the seal coat. The Engineer shall specify the time period. In order to ensure adequate adhesion and minimize cracking and curling, the pavement surface must be sufficiently cured prior to applying the seal coat. Experience has shown that approximately sixty (60) days or more of hot weather (daytime temperatures of 70°F) may be needed for adequate curing. One means of determining if the pavement has cured adequately is to pour a cup of water on the pavement surface and observe if any oils appear in the standing water. If oils appear, the surface is not sufficiently cured to accept a seal coat.

628-4.4 CLEANING EXISTING SURF ACE: Prior to placing the seal coat, the surface of the pavement shall be clean and free from dust, dirt, or other loose foreign matter, grease, oil, or any type of objectionable surface film. When directed by the Engineer, the existing surface shall be cleaned with wire brushes and a power blower. Where vegetation exists in cracks, the vegetation shall be removed and the cracks cleaned to a depth of two inches where practical. Cracks shall then be airblown vertically. Those cracks shall be treated with a concentrated solution of an herbicide approved by the Engineer. Areas that have been subjected to fuel or oil spillage shall be wire brushed and blown clean to remove any dirt accumulations. The area shall then be primed with a synthetic resin to prevent the seal coat from debonding.

628-4.5 TACK COAT. After the surface has been prepared, a tack coat of 3 parts water to 1 part coal tar emulsion, as specified in paragraph 2.2, shall be applied at the rate of 0.05 to 0.10 gallons per square yard of surface. A tack coat shaft be applied only if recommended by the Engineer or the ITC/CQC technician and will have been determined at the pre-bid conference.

628-4.6 APPLICATION OF RUBBERIZED SAND SLURRY. The rubberized sand slurry shall be applied at a uniform rate with a distributor, spray unit or squeegee applicator at the rate determined in paragraph 3.4 and/or specified in Table 2.

The mixing sequence of the various components shall be coal tar emulsion, water, aggregate and latex. After all constituents are in the mixer, the mixing shall continue until it produces a smooth, free-flowing homogeneous mixture of uniform consistency. Slow mixing shall be continuous from the time the emulsion is placed into the mixer until the slurry is applied by distributor truck or application equipment. During the entire mixing process, no breaking, segregating, or hardening of the emulsion, nor balling, lumping or swelling of the aggregate shall be permitted. The slurry shall be applied at a uniform rate to provide the quantity pre-determined by the Engineer.

When a spreader box is used, a sufficient amount of slurry shall be fed in the spreader box to keep a full supply against the full width of the squeegee, so that complete coverage of all surface voids and cracks is obtained.

The recommendations of the Engineer or the ITC/CQC regarding application by spraying or squeegeeing shall be followed. In areas inaccessible to equipment, the slurry may be applied by means of a hand squeegee.

Upon completion of the work, the seal coat shall have no pinholes, bare spots or cracks through which liquids or foreign matter could penetrate to the underlying pavement. The finished surface shall present a uniform texture, void of ridges or excessive slurry buildup.

Each application shall be allowed to dry thoroughly before the next coat is applied.

628-4.7 CURING. The mixture shall be permitted to dry for a minimum of eight (8) hours after the final application before opening to traffic and shall be sufficiently cured to drive over without damage to the seal coat. Any damage to the uncured mixture will be the responsibility of the Contractor.

628-4.8 HANDLING. The mixture shall be continuously agitated from the initial mixing until its application on the pavement surface. The distributor or applicator, pumps and all tools shall be maintained in satisfactory working condition.

QUALITY CONTROL

628-5.1 CONTRACTOR'S CERTIFICATION. The Contractor shall furnish the coal tar emulsion manufacturer's certification that each consignment of coal tar emulsion shipped to the project meets the requirements of Federal Specification R-P-355e, except the water content shall not exceed 50 percent. The certification shall also indicate the solids and ash content of the emulsion, and the date the tests were conducted. The Contractor shall furnish the latex manufacturer's certification to the Engineer that the latex rubber shipped to the project meets the requirements of the material specified in paragraph 2.4, together with an independent laboratory confirmation that the formulation described in Table 2 has previously passed the Appendix A test procedures, and a list of three (3) airports where it has been previously applied. It shall also indicate that the latex and coal-tar emulsion proposed for use are compatible and that the latex is recommended for combining with the coal-tar emulsion, water and aggregate for the project requirements in the preparations as shown in Table 2. The certifications shall be delivered to the Engineer fifteen (15) days prior to the pre-construction conference. The manufacturer's certification for the emulsion and rubber shall not be interpreted as a basis for final acceptance. Any certification received may be subject to verification by testing samples received for project use, at the Contractor's expense.

The Contractor shall furnish latex manufacturer's certification that the combination of emulsion, water, aggregate and latex proposed for use is approved by an independent laboratory and has been successfully used in coal tar emulsion seal coat mixtures for a minimum of ten (10)years on airport pavements. The Contractor shall also furnish a certification demonstrating their experience in the application of a rubberized coal-tar emulsion seal coat for a minimum of three (3) years as prescribed in Tables 2 and 3. The Contractor shall be Pavement Sealants Corporation, phone (248) 348-1888 or approved equal.

628-5.2 QUALITY ASSURANCE. This project shall be subject to Pre-Design and Pre-Construction meetings according to AC 150/5300-9. The Engineer shall furnish and be responsible for an independent Technical Consultant's (CQC's) attendance on site for design and specification recommendations. The Contractor is responsible for quality control. He/she must furnish and be responsible for a Quality Control Technician

(CQC); see 5.3 for requirements. The Engineer may require, at his discretion, the latex manufacturer to furnish the pre-approved ITC/CQC. The ITC/CQC shall be T.T.A. Pavements Consultants, Inc. phone (209)222-1893, or approved equal.

628-5.3 CONTRACTOR QUALITY CONTROL. He/she shall have a minimum of five (5) years experience in the use of rubberized coal-tar applications, materials, procedures and equipment described in this specification, using 16 pounds to 20 pounds of aggregate applications. Documentation of the experience, qualifications and certification of the ITC or the CQC technician must be in writing and certified by the Engineer. The ITC/CQC technician shall assist the Contractor regarding the proper mixing and application of the component materials. The ITC/CQC technician shall be responsible to the Engineer; he/she shall perform the required viscosity tests and perform quality control functions as necessary to ensure compliance with these specifications. The ITC/CQC technician shall inform the Contractor and Engineer of corrective actions needed to control compliance with these specifications.

628-5.4 ENGINEER'S RECORDS. The Engineer and the ITC/CQC technician will keep an accurate record of all materials used in the formulation of the seal coat.

629-5.5 TOTAL THEORETICAL MATERIALS REQUJREMENTS BASED ON SQUARE YARDS TO BE SEAL COATED AND THE APPUCATION RATES PRE-SCRIBED IN 3.2, TABLE 2:

Coal Tar Emulsion	**Gallons_____**	**Liters_____**
Water	**Gallons_____**	**Liters_____**
Aggregate	**Gallons_____** **Liters_____**	**Sand Requirement** **_____ Tons** **Metric Tons _____**
Rubber Latex	**Gallons_____**	**Liters_____**
TOTAL LIQUID	**GALLONS_____**	**LITERS_____**

METHOD OF MEASUREMENT

628-6.1 The coal-tar emulsion shall be measured by the gallon (liter) of undiluted emulsion.

628-6.2 The mineral aggregate shall be measured by the ton (metric tons).

628-6.3 The latex rubber shall be measured by the gallon (liter).

628-6.4 The water shall be measured by the gallon (liter).

628-6.5 Warranty: Contractor shall furnish a three-year warranty on materials and labor, to cover any failure of the coal tar system due to materials or workmanship, excluding any normal wear and tear or misuse, and excluding mechanical, base failure, reflective cracking and areas over fresh resilient joint and crack seal materials.

BASIS OF PAYMENT

628-7.1 Payment shall be made at the contract unit price per gallon (liter) for the coal-tar emulsion, per ton (metric tons) for the mineral aggregate and per gallon (liter) for the latex rubber. These prices shall fully compensate the Contractor for furnishing all materials, and for all labor, equipment. tools and

incidentals necessary to complete the items. Payment for water shall only be paid if the Contractor is required to pay for water use, per gallon (liter).

Payment will be made under:

Item 628-7.1 Coal-Tar Emulsion - per gallon (liter)

Item 628-7.2 Aggregate - per ton (tonnes)

Item 628-7.3 Latex Rubber - per gallon (liter)

Item 628-7.4 Water - per gallon (liter)

TESTING AND MATERIAL REQUIREMENTS

ASTM C 136	**Sieve or Screen Analysis of Fine and Coarse Aggregates Mix Design Procedure for Appendix A**
Fed. Spec.R-P-3 5 5e	**Coal-Tar Emulsion (Coating for Bituminous Pavements)**
ASTM D 490	**Tars (For Use in Road Construction)**

(When required)

FURNISH LABOR AND EQUIPMENT TO PLACE TRUING AND LEVELING COURSES

DESCRIPTION

It is the intent of this item to (1), identify those areas of pavement where ponding of water exists and two (2), to mitigate that ponding by placing successive lifts of truing and leveling, as ordered by the Engineer.

CONSTRUCTION DETAILS

After placement of the first coal coat application on a given area, the Contractor shall apply water in sufficient quantity to determine, if any, the extent of depressed areas holding water. The Engineer shall then designate those areas to be trued and leveled and mark the area limits accordingly.

It is the intent to mitigate the puddling in these areas by successive placement of rubberized coal-tar emulsion seal coat as described in 0.1 through 1.4 Materials. The Engineer shall be the sole judge as to the number of lifts required to mitigate the puddling problem.

METHOD OF MEASUREMENT

The quantity to be paid for will be the number of square yards (square meters) of each successive lift ordered and accepted by the Engineer.

BASIS OF PAYMENT

The unit price bid by square yard (square meter) shall include the cost of furnishing all labor and equipment necessary to complete the work as specified, as order by the Engineer, and as described in these specifications.

Payment for the coal tar emulsion, aggregate, water and rubber latex shall be made under their respective items: 7 .1, 7.2, 7.3, 7.4.

APPENDIX A
MIX DESIGN PROCEDURE ITEM P-628
TEST METHODS - CRITERION

This procedure shall be used to determine the capability of the materials furnished (4 components) by the contractor to produce a seal coat mix within the range of TABLE 2 and meeting the requirements of TABLE 3 as recommended by the latex manufacturer and approved by the Engineer.

The formulation is a combination of coal tar emulsion, water, sand and latex rubber. The samples furnished by the contractor shall be combined in the proportions recommended by the latex manufacturer and subjected to a sequence of six tests designed to eliminate any materials or combination of materials which do not meet the test criteria. Unacceptable materials in the formulation shall be eliminated from further testing and consideration.

BROOKFIELD VISCOSITY
Step 1 & Step 2

1. Scope

This method covers the determination of the Brookfield viscosity, using materials and the latex supplier's formulations. It is designed to detect formulations that have incompatible quantities of latex and coal tar emulsion, that might flocculate, show incompatibility or conglomeration and that have viscosities too low to suspend sand, and to identify any incompatibilities created by introducing sand or latex.

2. Definitions

2.1 Brookfield viscosity - the viscosity determined by this method. The viscosity is expressed in centipoises (100 centipoises = 1 poise). Its value may vary with the spindle speed (shear rate) due to the non-Newtonian behavior of the coal tar emulsion, water and the latex added.

2.2 Total liquids – coal tar emulsion, water and latex additive.

2.3 Composite system – total liquids and latex.

3. Apparatus

3.1 Brookfield digital viscometer (model DV -11) and stand.

3.2 Number 1 and 3 HB spindles for DV -11 viscometer.

3.3 Paint cans

3.3.1 One-quart capacity

3.3.2 One-gallon capacity

4. **Sample preparation for Step 1 (4.1-4.3) and Step 2 (4.1-4-4)**
   - 4.1 Allow components (coal tar emulsion, water, sand and latex additive) to reach 70°F. This should take approximately 24 hours.
   - 4.2 Mix coal tar emulsion and water in container specified in 3.3.2 with 50 strokes of a large laboratory mixing spoon.
   - 4.3 Introduce latex additive to the mixture with an additional 50 strokes of the mixing spoon.

5. **Procedure**

   Step 1

   - 5.1 Fill quart paint can specified in 3.3.1 to within one inch of the top with material prepared in
   - 5.2 Insert spindle No. 3 HB in the material until the mixture level coincides with the in1mersion groove on the spindle shaft.
   - 5.3 Avoid trapping air bubbles underneath the spindle.
   - 5.4 Adjust rotational speed on the Brookfield viscometer to 50 revolutions per minute (rpm).
   - 5.5 Start motor and record viscosity value in centipoise after five seconds of rotation. If the viscosity reading is too low for spindle 3, repeat procedure 5.1 through 5.5, using spindle No. 1.

   Step 2

   - 5.6 Repeat 5.1 - 5.5 with the composite mixture prepared in accordance with 5.7.1 through 5.7.3.
   - 5.7
     - 5.7.1 Mix coal tar emulsion and water in container specified in 3.3.2 with 50 strokes of a large laboratory mixing spoon.
     - 5.7.2 Add sand to the mixture with 50 strokes of the laboratory mixing spoon.
     - 5.7.3 Introduce latex additive to the mixture with 50 strokes of the laboratory mixing spoon, for composite mixture. Stir composite mixture for 5 minutes and immediately proceed to Step 1.

6. **Report**
   - 6.1 The report date should include:
     - 6.1.1 Date of test and complete identification of the coal tar formulation tested.
     - 6.1.2 Spindle number and rpm setting.
     - 6.1.3 Temperature of the sample tested.
     - 6.1.4 Viscosity of total liquids in poises. (Step 1)
     - 6.1.5 Viscosity of composite system in poises. (Step 2)

Step 1 Criterion: Viscosities between 10 and 90 poises are acceptable.

Step 2 Criterion: Viscosities between 10 and 90 poises are acceptable.

For materials to move into Step 2 testing, the viscosity range must be met in Step 1. Likewise Step 3 will not be continued until viscosity range is met in Step 2 testing. If a material fails to meet testing criteria in any step, it will be eliminated from further testing.

SCUFF RESISTANCE TEST

Step 3

1. Scope

This method covers the determination of the initial set and final scuff resistance characteristics of a coal tar emulsion seal coat.

2. Definitions

2.1 Initial set – torque reading at 8 hours of curing.

2.2 Final scuff resistance – torque reading at 24 hours of curing.

3. Apparatus

3.1 "Scuff' resistance tester similar to the cohesion tester in ASTM D 3910-80a but modified as follows:

- 3.1.1 Proving ring used to measure applied load.
- 3.1.2 Screw jack used to apply load.
- 3.1.3 5” x ¾” ID 1 7/32” OD reinforced rubber hose (two braid, 300 psi, green, oil-resistant cover).

3.2 Torque wrench with 300 inch pound capacity.

3.3 6" x 6" square 16 gauge sheet metal mask with

3.4 6" x 6" lli7glazed white ceramic tile with an absorption rate of 10-18 percent (determined in accordance with ASTM-67).

4. Procedure

4.1 Using mask described in 3.3, apply uniform thickness of composite coal tar emulsion mixture to two of the ceramic tiles as described in 3.4.

4.2 Allow tiles to cure at 77°F and 70 ± 10 percent relative humidity.

4.3 Test the first tile after 8 hours of curing.

4.4 Place tile on lower platen and secure with "c" clamps.

4.5 Raise platen with screw jack until sample comes in contact with the rubber abrasion head.

4.6 Continue raising the platen until a normal load of28 psi, as measured through the dial gauge, is applied to the sample.

4.7 Tap platen to ensure proper load is applied to the sample.

4.8 Pull the torque wrench through an arc of 180° in 1-2 seconds.

4.9 Record torques reading in inch-pounds.

4.10 Repeat procedures 4.4 through 4.9 on second sample after 24 hours of curing and record the torque reading in inch-pounds.

5. Report

5.1 Report the following information:

- 5.1.1 Date and material tested.
- 5.1.2 Initial set as the torque reading at 8 hours of curing.
- 5.1.3 Final scuff resistance as the torque reading at 24 hours of curing.
- 5.1.4 No loss of adhesion; no loss of surface aggregate.

CYCLIC FREEZE-THAW CONDITIONING

Step 4

1. Scope

This method covers the analysis of crack development in a composite rubberized coal tar emulsion seal coat when exposed to multiple cycles of freezing and thawing.

2. Apparatus

2.1 12" x 12" square 16 gauge sheet metal mask with an 11" X 1 1 " square center removed.
2.2 12" x 12" square section of aluminum panel 3/16" thick.
2.3 Oven capable of maintaining 140°F.
2.4 Freezer capable of maintaining 10°F.

3. Procedure

3.1 Using mask described in 2.1, apply uniform thickness of the composite rubberized coal tar emulsion mixture to a panel as described in 2.2.
3.2 Allow material to cure at 77°F ± 10°F and 50 ± 20 percent relative humidity for 24 hours.
3.3 Place sample in the 140°F oven for 24 hours.
3.4 Remove sample and record crack development.
3.5 Place sample in 10°F freezer for 24 hours.
3.6 Remove from freezer; this constitutes one freeze-thaw cycle.
3.7 Repeat procedures 3 .3 through 3 .6 for a total of 10 cycles.
3.8 Inspect the samples after 5 and 10 cycles and rate the cracking in accordance with the following scale and the following procedure.

3.8.1 Using a commercially available thickness gauge, estimate the width of the largest crack appearing on the surface.

3.8.2 Next, place a grid frame over the coal tar seal coated shingle (after freeze/thaw conditioning). The grid is a wood frame with an inside diameter of 12x 12 inches. A grid is formed across the inside opening of the frame by subdividing the opening into 10 equal divisions both horizontally and vertically with twine anchored to the frame. This will provide 100 equally sized squares.

3.8.3 Count the number of squares in which a crack occurs. The percent cracking is equal to the number of squares.

3.8.4 Compare the results to table below:

Severity of Cracking	Width of Widest Crack	Percent of Cracking
Hairline	**0.010 mm**	**N/A – Cracks are barely visible**
Slight Cracking	**0.015 mm**	**<25%**
Moderate Cracking	**0.020 mm**	**>25%**
Severe Cracking	**0.020 mm or greater**	**>50%**

0 – No cracking
1 – Hairline cracking
2 – Slight cracking

3 – Moderate cracking
4 – Severe cracking

4. Report

4.1 Report the crack rating at 5 and 10 cycles.

Step 4 Criterion: Rating of 1 or less at 5 cycles is required. Rating of 3 or less at 10 cycles is required. Any materials not meeting this requirement shall be eliminated from **Step 5**.

ADHESION

Step 5

1. Scope

This method covers the determination of adhesion of a composite rubberized coal tar emulsion seal coat and retention of sand by applying pressure-sensitive tape.

2. Apparatus

2.1 12" x 12" square 16 gauge sheet metal mask with 3" X 6" rectangular center removed.
2.2 12" x 12" aluminum panel 3/16" thick.
2.3 Razor-sharp blade, scalpel, or other cutting device with cutting edge in good condition.
2.4 Steel straight edge.
2.5 One-inch wide semitransparent pressure-sensitive tape with an adhesion strength of 38 ± 5 oz./in. when tested in accordance with ASTM D 3330. The backing of the tape may consist of fiber-reinforced cellulose acetate, unplasticized polyvinyl chloride, or polyester film.
2.6 Hard, small head rubber eraser.
2.7 Table lamp.

3. Procedure

3.1 Using the mask described in 2.1, apply a uniform thickness of the composite mixture to the aluminum panel as described in 2.2.
3.2 Allow mix to cure at 77°F ± 2°F at 50 ± 10 percent relative humidity for 24 hours.
3.3 Select a representative area.
3.4 Make a horizontal cut of about 1.5 inches. Then make another cut of 1.5 inches at about 40° to the horizontal cut. The cuts should intersect each other at their centers. When making the cuts, use the straight edge and cut through the coating to the substrate in one steady motion. Brush off dislodged materials.
3.5 Inspect the cuts for reflection of light from the metal substrate to establish that the coating has been cut through completely. If the substrate has not been reached, do not attempt to deepen the cut. Instead, make another "X" in a different location. Remove the dislodged materials by brushing lightly.
3.6 Remove two laps of the pressure-sensitive tape from the roll and discard. Remove an additional length at a steady rate and cut a piece about three inches long.
3.7 Place the center of the tape at the intersection of the cuts with the tape running in. the same direction as the smaller angles. Smooth out the tape in the area of the cuts and then rub firmly with the eraser.

3.8 Wait for 60 seconds, then rapidly pull one end of the tape back on itself with the non-stick surfaces touching and running parallel to each other.

3.9 Inspect the "X' cut area for removal of the coating from the substrate and rate the adhesion in accordance with the following scale:

5A	No peeling or removal
4A	Trace peeling or removal along incisions
3A	Jagged removal along incisions up to 1/16 inch on either side
2A	Jagged removal along most incisions up to 1/8 inch on either side
1A	Removal from most of the area of the "X" under the tape
0A	Removal beyond the area of the "X"

3.10 Inspect the tape for adhesion of sand.

3.11 Repeat the test in two other locations on the test panel.

4. Report

4.1 Report the number of tests, their mean value and range.

4.2 Allow mix to cure at 77°F ± 2°F at 50 ± 10 percent relative humidity for 24 hours.

Step 4 Criterion: No sand can adhere to the tape. No debonding of the seal coat or the test medium is allowed (adhesion rating of 5A is required.) Any materials not meeting this requirement shall be eliminated from being tested in **Step 6**.

FUEL RESISTANCE

Step 6

1. Scope

This method determines the resistance of the composite rubberized coal tar emulsion seal coat to kerosene.

2. Apparatus

2.1 6" x 6" square 16 gauge sheet metal mask with a 4" x 4" square center removed.

2.2 6" x 611 unglazed white ceramic tile with an absorption rate of 10-18 percent (determined in accordance with ASTM C 67).

2.3 Brass ring, 2" diameter and 2" high.

2.4 Kerosene meeting requirements of ASTM D 3699.

2.5 Silicone rubber sealant.

3. Procedure

3.1 Immerse the ceramic tile in distilled water for a minimum of 24 hours.

3.2 Remove excess water from the tile to produce a damp surface before applying the seal coat.

3.3 Using the mask described in 2.1, apply one layer of the composite coal tar emulsion mixture to the tile. Spread even with the top of the mask, using a spatula or other straight edge.

3.4 Allow the sample to cure for 96 hours at 77°F ± 2°F at 50 ± 10 percent relative humidity for 24 hours.
3.5 After curing, affix the brass ring to the seal coat on the tile with silicone rubber.
3.6 Fill the brass ring with kerosene.
3.7 After 24 hours, remove the kerosene from the brass ring, blot dry and immediately examine the film for softness and loss of adhesion. Immediately after the film is examined, break the tile in half, exposing that part of the tile whose film was subjected to the kerosene.
3.8 Evaluate for penetration of kerosene through the tile.

4. **Report**

4.1 Report the results as pass or fail. Visible evidence of leakage or discoloration shall constitute failure of the test.

Step 6 Criterion: A "pass" rating in the fuel resistance test is required.