

## **PCTC Guide Specification-PCTC02**

# **Guide for Preparation of Specifications for the Application of A Refined Coal Tar Emulsion With Additives Over Asphaltic Pavements**

### **1. GENERAL**

This guide can be used to specify the application of a refined coal tar emulsion slurry system (with additives) over new or existing (aged) asphaltic concrete pavement. For more specific information, consult your local PCTC coal tar emulsion manufacturer for recommendations. See Appendix A of specification PCTC 01 for definition of terms and reasons for use of additives (specifically item #1).

### **2. DESIGN REQUIREMENTS**

When specifying the sealcoating of asphalt pavements there are two main categories to consider. They are *New Asphalt or Existing (Aged) Asphalt*. The specifications will have to be written differently depending on which situation you have.

2.1 **NEW ASPHALT:** The first question often asked is, "Why seal new asphalt?"

- 2.1.1 Asphalt, like any other environmentally degradable material, starts degrading from the first day it is placed.
- 2.1.2 Refined coal tar emulsion-based sealcoating protects asphalt from the ultraviolet rays of the sun, most deicing salts, and gas and oil drippings.
- 2.1.3 Refined coal tar emulsion-based sealcoating reduces the aging of the asphalt binder, thereby maintaining a true "flexible pavement."
- 2.1.4 If your pending project has new asphalt, proceed with writing the specs leaving out all the sections that reference existing (aged) asphalt.

2.2 **EXISTING (AGED) ASPHALT:** In the case of existing asphalt pavements, **no specification can be adequately written without visiting the job site and observing the conditions of the asphalt surface.** There are numerous questions that must be answered before writing a specification. Note: Most manufacturers offer Asphalt Pavement Conditions Surveys as guides to analyze your specific pavement situation.

- 2.2.1 **Pavement analysis:** With the help of a pavement condition survey, specific pavement maintenance requirements can be determined, such as overlays, patching, crack sealing, pavement priming, oil spot priming, etc.
- 2.2.2 **Drawing Coordination:** Attaching schematic drawings to the detail specifications can show the areas to be patched, crack sealed and/or sealcoated with two or three coats.

2.3 **FINISHED QUALITY:** The quality of the finished seal coat on the asphalt pavement depends not only on specifying a quality refined coal tar emulsion, adequate application rates for the traffic conditions and proper mix design, but also on seeing that specs are

adhered to at the job site by a quality oriented, properly equipped contractor. To assist in this effort see Appendix B of specification PCTC 01, Quality Control.

2.4 *SPECIFICATION COORDINATION*: Edit these guide specifications (the attached colored sheets) in accordance with project requirements. Delete, modify, add drawings and/or text as required. Where you see the [xxxx xx xxx] brackets you must make a choice as to what you want.

3. **A statement on personal safety and environmental impact when using REFINED COAL TAR EMULSION is included in Appendix C of specification PCTC 01.**

**REFINED COAL TAR EMULSION SLURRY  
WITH ADDITIVES  
ASPHALT PAVEMENT SEALING  
SPECIFICATION**

**PART 1--GENERAL**

*1.01 SUMMARY*

A. Section Includes

1. Refined coal tar emulsion slurry seal coat with additive over [new and/or existing (aged)] asphaltic concrete pavement.

*1.02 DESCRIPTION*

A. Provide [primer and] two coats of refined coal tar emulsion sealer with additive in all areas.

[B. Provide third coat in high traffic areas as shown in schedule and on drawing.]

*1.03 REFERENCES*

A. **ASTM Standards**

C136 Method of Sieve Analysis of Fine & Coarse Aggregates

D160 Practice of Sampling Bituminous Materials

D490 Standard Specification for Road Tar

D2939 Standard Test Methods For Emulsified Bitumen Used as Protective Coatings

D4866 Standard Performance Specification for Coal Tar Pitch Emulsion Pavement Sealer Mix Formulations Containing Mineral Aggregates and Optional Polymeric Admixtures

B. **Federal Specifications**

RP-355 Pitch, Coal Tar Emulsion (Coating for Bituminous Pavements)

**PART 2--PRODUCTS**

*2.01 MATERIALS*

A. **Refined Coal Tar Emulsion:** A refined coal tar emulsion prepared from a high temperature refined coal tar conforming to the requirements of ASTM specification D490 for RT12. The use of oil and water gas tar is not allowed. Base refined coal tar emulsion must conform to all requirements of Federal Specification RP-355.

B. **Aggregate:** Use washed dry silica sand or boiler slag free of dust, trash, clay, organic materials or other contaminants. It is recommended that this aggregate meet the gradation in Table 1, when tested in accordance with ASTM C136.

**TABLE 1. GRADATION OF AGGREGATES \***

Sieve Size		Percent Retained	
		Minimum	Maximum
#20 or coarser	(0.850 mm)	0	2
#30	(0.600 mm)	0	12
#40	(0.425 mm)	2	60
#50	(0.300 mm)	5	60
#70	(0.212 mm)	5	60
#100	(0.150 mm)	5	30
#140	(0.106 mm)	0	10
#200	(0.075 mm)	0	2
Finer than #200		0	0.3

\* Table 1 represents the maximum range of aggregate gradations. In all cases the refined coal tar emulsion supplier is to give written approval of the aggregate used in the mix design.

- C. **Additive:** As specified by the coal tar emulsion manufacturer. (See Appendix A, #1 of PCTC 01.)
- D. **Water:** Use water for mixing that is potable and free of harmful soluble salts. Control water temperature so it is at least 50\_F (10\_C).
- E. **Crack Sealant:** Must be certified for compatibility with the refined coal tar emulsion by the manufacturer of the refined coal tar emulsion, and approved by the engineer.
- F. **Oil Spot Primer:** Must be certified for compatibility with the refined coal tar emulsion by the manufacturer of the refined coal tar emulsion, and approved by the engineer.
- [G. **Pavement Primer:** Must be certified for compatibility with the refined coal tar emulsion by the manufacturer of the refined coal tar emulsion, and approved by the engineer.]

2.02 *APPLIED MIXTURE*

- A. **Composition:** The refined coal tar emulsion seal coat is to consist of a mixture of refined coal tar emulsion, water, additive and aggregate, and be proportioned as shown in Table 2. The composition must have written approval of the coal tar emulsion manufacturer.

**TABLE 2.  
COMPOSITION OF MIXTURE PER 100 GAL OF REFINED COAL TAR EMULSION<sup>1</sup>**

Application	Refined Coal Tar Emulsion	Water	Additive	Aggregate <sup>2</sup>	Formula Rate of Application of Mix per Square Yard	
	Gallons	Gallons	Gallons	LBS	Minimum Gallons	Maximum Gallons
[Prime Coat (As specified by the coal tar emulsion manufacturer. As required, see 3.01,A 5)]						
1st Seal Coat	100	25-70	2-6	300-700	0.12	0.20
2nd Seal Coat	100	25-70	2-6	300-700	0.12	0.20
[Additional coats may be specified for greater wearability.]						

<sup>1</sup>The numbers shown in Table 2 represent the maximum recommended range of values. In all cases, the refined coal tar emulsion supplier is to give written approval of specific composition numbers to be used in the mix design.

<sup>2</sup>Some specifications covering this type of coating have allowed sand loadings in excess of 10 pounds per gallon of refined coal tar emulsion. These coatings have not performed well in the field due to poor fuel resistance and loss of adhesion and are not recommended.

- B. **Application Rate:** Application rates are not to exceed 0.17 gal/yd.<sup>2</sup>/coat, and at no time are total coats to exceed 0.51 gal/yd.<sup>2</sup>

### 2.03 PRECAUTIONS

- A. Sealer should not be applied unless pavement temperature is at least 50\_F (10\_C) and the air temperature is 50\_F (10\_C) and rising.
- B. Sealer should not be applied during rainy or wet weather, or when rain is anticipated within eight hours after application is completed.
- C. Sealer should not be applied to hot surfaces under the summer sun (over 90\_F, ambient) without first cooling the surface with clean water. Water should dampen the surface without leaving puddles.
- D. Since an emulsion may be damaged by freezing, it should be protected at all times when the temperature drops below 40\_F (4\_C).

### 2.04 EQUIPMENT

- A. Use application equipment that is capable of applying the required coating rates evenly over the entire width of the application mechanism to provide a uniformly coated surface. To insure this, equip all spray units with a pumping distribution system using positive displacement pumps. Equip all squeegee/brush units with squeegees/brushes that are properly adjusted and in a condition so that the application of seal coat materials is without streaks.
- B. The mixing part of the application equipment must be tank type with a mechanically powered, full sweep mixer capable of homogeneously mixing the entire contents of the tank.
- C. Use of hand squeegee or brush application is to be restricted to places not accessible to the mechanized equipment or to accommodate neat trim work at curbs, etc. Material that is applied by hand is to meet the same standards as that applied by machine.

## PART 3--EXECUTION

### 3.01 SURFACE PREPARATION

- A. **Preparation Of Aged Asphalt Pavement Surfaces** (See Appendix A, #5)
  - [1. *Patching:* Patch bituminous pavement surfaces which have been softened by petroleum derivatives or have failed due to any other cause. Remove damaged pavement to the full depth of the damage and replace with new bituminous concrete similar to that of the existing pavement. If a solvent containing cold-applied material is used, complete patching a minimum of 90 days prior to the planned application of the sealer to permit solvent to escape before sealing.]
  - [2. *Crack Sealing:* Remove all vegetation and debris from cracks to a minimum depth of ½". If extensive vegetation exists treat the specific area with a concentrated solution of a water-based herbicide approved by the engineer. Fill all cracks, ignoring hairline cracks (< ¼" wide) with a crack sealant. Wider cracks (over ¼" wide (6.35 mm)), along with soft or sunken spots, indicate that the pavement or the pavement base should be repaired or replaced as in #1 above.]
  - 3. *Cleaning Existing Surface:* Clean pavement surface immediately prior to placing the prime coat or seal coat by sweeping, flushing well with water

leaving no standing water, or a combination of both, so that it is free of dust, dirt, grease, vegetation, oil or any type of objectionable surface film.

- [4. *Oil Spot Priming:* Remove oil or grease that has not penetrated the asphalt pavement by scraping or by scrubbing with a detergent, then wash thoroughly with clean water. After cleaning, treat these areas with the oil spot primer.]
- [5. *Pavement Priming:* Older, highly oxidized pavements sometimes have trouble allowing pavement sealers to adhere. To insure adhesion to sound but oxidized pavements, mix and apply a prime coat of a type and at a rate recommended by the coal tar emulsion manufacturer, after all loose aggregate is removed.]

#### **B. Preparation Of New Asphalt Pavement Surfaces**

1. Cure new asphalt pavement surfaces so that there is no concentration of oils on the surface.
2. A period of at least 90 days at +70\_F daytime temperatures must elapse between the placement of a hot mixed asphaltic concrete surface course and the application of the seal coat.
3. Perform a water-break-free test to confirm that the surface oils have degraded and dissipated. (Cast one gallon of clean water out over the surface. The water should sheet out and wet the surface uniformly without crawling or showing oil rings.) If asphalt does not pass this test, additional time must be allowed for extra curing and retesting prior to sealing.
4. *Cleaning:* Clean as detailed in 3.01-A.3 above.
- [5. *Oil Spot Priming:* As needed, see 3.01-A.4 above.]

### **3.02 MIXING and APPLICATION OF REFINED COAL TAR EMULSION SLURRY**

#### **A. MIXING**

1. Blend the coal tar emulsion mixture in the equipment described in section 2.04 using the ingredients described in Table 2. The mixing must produce a smooth homogeneous mixture of uniform consistency. (Consult coal tar emulsion supplier for its recommended order of addition of the ingredients.) During the entire mixing and application process, no breaking, segregating or hardening of the emulsion, nor balling or lumping of the sand is to be permitted.  
Continue to agitate the sealcoating mixture in the mixing tank at all times prior to and during application so that a consistent mix is available for application.
2. Small additional increments of water may be needed to provide a workable consistency, but in no case is the water content to exceed the specified amount.

#### **B. APPLICATION OF AGGREGATE FILLED SEALCOAT**

- [1. *Water Fog:* To provide maximum adhesion the engineer may require a water fog spray (dampening).]
- [2. *Prime Coat:* As needed, see 3.01-A.5.]
3. *First Coat:* Apply the mixture uniformly to obtain the rates specified in Table 2.
4. *Drying and Initial Cure Between Coats (Appendix A, #12 & #13):* Allow each coat to dry and initially cure before applying any subsequent coats.
5. *Second Coat:* Apply the second coat as outlined for the first coat above.

- [6. *Additional Coats:* Additional coats may be applied over the entire surface or in heavy traffic areas such as drive lanes.]
7. *Final Look:* The finished surface must present a uniform texture.

**C. DRYING AND INITIAL CURE**

1. The final coat must be allowed to dry a minimum of eight hours of good daylight drying conditions before opening to traffic, and initially cure enough to drive over without damage to the sealcoat.
2. If marginal weather conditions exist during this eight hour drying time, additional time will be required. In some cases this could exceed 24 hours. Check the surface after this for trafficability before opening it to vehicle traffic.

**[D. STRIPING**

1. If striping is required, use a compatible striping paint recommended by the coal tar emulsion manufacturer.]

# Appendix A

## Definition of Terms

1. *Additive*: One or more ingredient that can be added to a specific refined coal tar emulsion, water and/or sand mixture to improve the coatings' durability, fuel resistance, drying time, color uniformity, and/or length of time required before opening the surface to traffic. This material can also be used to modify the wet mixture's viscosity to improve aggregate suspension.
2. *Application Rate*: The amount of volume of mixed material applied per area of pavement surface, usually expressed in gallons per square yard.
3. *Applied Mixture*: The combination of all ingredients mixed together and ready for application to the pavement. Also referred to as **seal coat** or **sealer**.
4. *Asphaltic Concrete Pavements, New*: Pavements that have been placed less than 90 days.
5. *Asphaltic Concrete Pavements, Aged*: Pavements that have weathered over at least one summer season and have shown signs of one or more of the following: cracking, raveling, aggregate polishing and/or graying due to oxidation.
6. *ASTM*: American Society of Testing and Materials; a scientific and technical organization for the development of standards on characteristics and performance of materials, products, systems and services.
7. *Brush applicator*: A hand type or mechanized brush used to apply pavement sealer.
8. *Crackfiller*: A material that is placed in a pavement crack or joint to fill but not necessarily seal the void created by the crack or joint.
9. *Crack sealant*: A material that has adhesive and cohesive properties to seal cracks, joints or other narrow openings (less than 1 1/2" wide) in pavements against the entrance or passage of water or other debris.
10. *Crude Coal Tar*: Condensed material taken from the coking process (high temperature heating of coal under a vacuum) and containing all the volatile constituents.
11. *Cure, final (of the seal coat)*: The process of evaporation of water and volatiles of the applied sealcoating mixture over a period of days, resulting in the coating reaching its ultimate strength. The duration of this process is dependent upon ambient conditions.
12. *Cure, initial (of the seal coat)*: The condition of an applied sealcoating material that enables it to withstand vehicle traffic without damage to the sealcoat.
13. *Drying (of the seal coat)*: The process of evaporation of water of the applied sealcoating mixture, resulting in the coating being able to sustain light foot traffic.
14. *PCTC*: The Pavement Coatings Technology Center; a cooperative group of manufacturers, suppliers, contractors, government agencies and professional organizations that develop standards, specifications, test methods and other technical data for the pavement coatings industry.
15. *Priming*: Application of an initial coat of a material designed to assist the adhesion of the additional coats of sealcoating materials. Primers are always used as under-coatings and are not designed to be used by themselves.
16. *Refined Coal Tar*: A selectively distilled coal tar meeting the requirements of ASTM D490 grade RT-12.
17. *Refined Coal Tar Emulsion*: A stable and homogeneous dispersion of refined coal tar, clay, mineral fillers and specialty chemicals in water.
18. *Sealcoating*: Process of applying a protective coating to an asphaltic concrete pavement.

19. *Spray Unit*: A piece of equipment equipped with a mixing tank and positive displacement pump that can homogeneously mix and apply protective coatings uniformly over the entire width of a spray bar or wand type application device.
20. *Squeegee Unit*: A piece of equipment equipped with a mixing tank and squeegee that can homogeneously mix and apply protective coatings uniformly over the entire width of a rubber squeegee or brush type application device.
21. *Trafficability*: The ability of a sealcoating material to withstand vehicle traffic without damage to the sealcoat.
22. *Uniform coated surface*: A surface that has an even distribution of sealcoating material free of pinholes, streaks and/or other uneven characteristics.

## Appendix B

### Quality Control

- 1.1: *At the Pre-Bid meeting the owner must inform the contractor that there will be a quality control procedure used during the execution of the project and the contractor will be expected to apply the amounts of material detailed in Table 2 using the materials specified in Part 2.*
  - 1.1.2: Prior to awarding the job, the owner again must stress the points as in Section 1.1.
- 1.2: *Small Projects-* Defined as under 3,000 yd<sup>2</sup> (27,000 ft<sup>2</sup>) with the applied mixture normally made at the contractor's yard. Owner should:
  - 1.2.1: Verify proportions of mixture per Table 2 with contractor.
  - 1.2.2: Take samples as detailed in section 1.3.6. [This may be hard to justify because of the small size of the job.]
  - 1.2.3: Check coverage rates as detailed in 1.3.7, but checking as in 1.2.4 is usually sufficient to assure a quality job.
  - 1.2.4: Check contractor references for material longevity of prior projects before contract award.
  - 1.2.5: Proof of adequate liability insurance and statutory workers compensation coverage shall be provided by the contractor in a form satisfactory to the project engineer.
- 1.3: *Large Projects-* Defined as over 3,000 yd<sup>2</sup> (27,000 ft<sup>2</sup>).
  - 1.3.1: Mix is normally made at the contractor's yard but on jobs exceeding 20,000 yd<sup>2</sup> (180,000 ft<sup>2</sup>), it is often made at the job site.
  - 1.3.2: Owner should assign a person to perform a high degree of inspection during the entire execution of the project.
  - 1.3.3: Instructions for this person should be obtained from the local refined coal tar emulsion manufacturer.
  - 1.3.4: Whenever possible the concentrated refined coal tar emulsion should be delivered to the job site. Any addition, water and/or sand should be mixed according to Table 2 and verified by the owner.
  - 1.3.5: Owner's representative should take one pint sample from each shipment of all ingredients prior to preparing the applied mixture.
  - 1.3.6: Owner's representative should take two one pint samples of the mixed product at the job site, one at the beginning of application, and one before second coat. With spray units these samples can be taken by placing the spray wand in the manhole, spraying back into the tank for three minutes, then into the sample container. On a sealing machine they can be dipped off the top of the unit immediately after five minutes of agitation. The samples can be used for future testing, if the owner so desires.
  - 1.3.7: Owner's representative should use the chart supplied by the manufacturer of contractor's equipment to verify amount of mixture in tank prior to and after applying mixture. Taking the difference between these two amounts and the known pavement areas, coverage rates (gallons/yd<sup>2</sup>) can be calculated for verification with Table 2.
  - 1.3.8: Owner's representative should verify materials purchased from the local refined coal tar emulsion manufacturer by obtaining all shipping papers.

# **Appendix C**

## **Personnel Safety and Environment When Using Refined Coal Tar Emulsion**

Coal tar and its derivatives have been in use since the early 1900s. Because of this lengthy history, the properties and characteristics of refined tar products are well known and understood.

The term coal tar has historically referred to the crude coke oven tar produced in the manufacture of steel, and not refined coal tar. Refined coal tar is a selectively distilled product that is utilized in the preparation of pavement sealers and other consumer and industrial products. Refined coal tar RT-12, as defined by ASTM D490, is the grade utilized in the manufacture of refined coal tar emulsion pavement sealer. Although it is produced using similar techniques that are employed in the production of asphalt from crude oil, it is not a petroleum derivative. Consequently, its unique composition imparts properties that make pavement sealers resistant to chemicals, oil, gas, water and ultraviolet radiation (sunlight).

Because of refined coal tar's distinct odor, there is a natural concern about its hazards. However, air monitoring studies conducted during various methods of application indicate that emissions are negligible and well below Occupational Health and Safety Administration (OSHA) exposure limits.<sup>i</sup> Nevertheless, like many industrial chemicals, refined coal tar exhibits some potentially harmful properties, but can be controlled by using good personal hygiene and safe work practices.

- \* Wash hands before eating, drinking or using tobacco products.
- \* Wear full length clothing and change clothing daily.
- \* Launder contaminated clothing thoroughly before wearing again.
- \* Shower at the end of each work day.
- \* Wear chemical or liquid repellent gloves.
- \* During spray applications wear protective glasses and a non-toxic particulate mask to avoid inhalation of sealer droplets, and work from "downwind to upwind."
- \* Use protective creams specifically formulated for coal tar products, or a general protective cream used in conjunction with a minimum SPF 15 sun block.

Adherence to these simple practices will limit potential exposures, including exposure to the sun (itself a contributor to skin cancer risk), thereby reducing the possibility of chronic exposure symptoms contributing to skin cancer.

Refined coal tar-based sealers can be specified throughout the country without restriction. Based upon extensive Toxicity Characteristic Leaching Procedure (TCLP) testing and the review of current Federal regulations, neither RT-12 pavement sealer base nor refined tar pavement sealer emulsion manufactured with ASTM D490 Grade RT-12 refined coal tar would be classified as a hazardous waste.<sup>ii</sup> Therefore, refined coal tar emulsions would not be subject to the Resource Conservation & Recovery Act (RCRA) disposal requirements. Further, refined coal tar is not banned by any state regulatory agency and complies with all current Volatile Organic Compound (VOC's) regulations.

Based upon its historical performance and widespread usage compared to other available products, refined coal tar emulsion remains the most effective and continues to be the preferred pavement sealer throughout the United States and Canada. Refined coal tar emulsion gives the sealer unsurpassed wear characteristics and protects the pavement from motor oil, gasoline and other petroleum products.

Ask your supplier for material safety data sheets and technical support to assure the safe and proper use of Refined coal tar pavement sealer. Documentation and source reference reports are available for a nominal fee by writing the Pavement Coating Technology Center, Department of Civil Engineering, University of Reno, Reno, NV 89557-0152.

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i "Using Refined Coal Tar Emulsions Safely," *Pavement Maintenance Magazine* — March 1992 Issue

ii "Toxicity Characteristics Leaching Procedure Results for RT-12 Refined Tar as well as Sealer"  
(Federal material and various design mixes formulated with RT-12)