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**Standard Practice for**

# **Emulsified Asphalt Fog Seal Design**

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AASHTO Designation: PP xxx-17<sup>1</sup>

Technical Section: 2a

Release: Group 3 (Month yyyy)

Working Draft

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**AASHTO**

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# Emulsified Asphalt Fog Seal Design

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## 1. SCOPE

- 1.1. This standard determines an ideal application rate of emulsified asphalt for use as a fog seals.
- 1.2. A fog seal is the light application of emulsified asphalt to the pavement surface, which may be used to provide a surface seal, arrest light raveling, or create color contrast between traffic lanes and shoulders to improve visibility. Fog seals are also applied to newly placed chip seals to lock in loose chips and provide a more aesthetically pleasing finished product.

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## 2. REFERENCED DOCUMENTS

- 2.1. AASHTO Standards:
- M 140, Emulsified Asphalt
  - M 208, Cationic Emulsified Asphalt
  - M 316, Polymer-Modified Emulsified Asphalt
  - MP XXX, Materials for Emulsified Asphalt Fog Seal
  - MP XXX, Materials for Emulsified Asphalt Tack Coats
  - T 304, Uncompacted Void Content of Fine Aggregate

## 3. SIGNIFICANCE AND USE

- 3.1. This standard may be used to establish the ideal application rate, residual rate or quantity of emulsified asphalt required for the construction of emulsified asphalt fog seals.
- 3.2. Fog seals may be applied to a number of different pavement surface types. Common uses include sealing dense graded asphalt mixtures preventing raveling on open graded asphalt mixture locking down aggregates on new chip seals, or sealing shoulders to improve contrast for nighttime visibility. Although slow setting emulsified asphalts are most commonly used for fog seals, emulsified asphalt type, dilution ratio, and application rate vary markedly among the common applications. Climate, traffic, and local preferences also play important roles in selecting emulsified asphalt type and grade. For details regarding materials selection, refer to MP XXX .
- 3.3. Dilution—Fog seal emulsified asphalts are typically diluted 1:1 by weight with water or a compatible surfactant solution before application. The final diluted product shall be a fluid, homogeneous mixture that does not plug distributor nozzles. The minimum residue content for fog seal emulsified asphalts will typically be 50 percent of undiluted emulsified asphalt. Slow-setting emulsified asphalts can be diluted with water. All other emulsified asphalt types must be diluted at the manufacturer's plant site, using a surfactant solution compatible with the emulsified asphalt

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3.4. The rate of application may vary with the type and condition of the surface.

#### 4. EMULSIFIED ASPHALT FOG SEAL DESIGN REQUIREMENTS

4.1. *Materials*—Before dilution, emulsified asphalt for fog seal shall meet the requirements of M 140, M 208, and M 316 as applicable. If fine aggregate is used for friction, it shall have a minimum angularity of 45 as determined by T 304.

4.2. *Material Quantities*—Emulsified asphalt should meet specification in MP XXX and be representative of the materials used for the project. The application rates may be determined by a test strip according to the procedure in Section 4.4 or determined empirically by the ring test detailed in Section 4.5.

**Table 1—Initial Target Fog Seal Application Rate**

Surface Type	Residual Rate Gal/yd <sup>2</sup>	Undiluted Gal/yd <sup>2</sup>	Diluted 1:1* Gal/yd <sup>2</sup>
Dense-Graded Asphalt Mixture	0.015-0.021	0.025-0.035	0.05-0.07
Open-Graded Asphalt mixture	0.021-0.027	0.035-0.045	0.05-0.09
Chip Seal (<1/2 in. top agg size)	0.027-0.033	0.045-0.055	0.09-0.11
Chip Seal (≥1/2 in. top agg size)	0.033-0.039	0.055-0.065	0.11-0.13

\*Assume emulsified asphalt is 40% water and 60% asphalt

4.3. *Method to convert binder content to total emulsified asphalt content based on residual values:*

4.3.1. Calculating residual asphalt application rates need to account for not only the water that is present in the original emulsified asphalt, but also any added water via dilution.

4.3.2. For example, if an application of 0.10 gal/yd<sup>2</sup> was applied with an emulsified asphalt diluted 1:1 (original emulsified asphalt + water), and the original emulsified asphalt contained 40 percent water, calculation of the residual application rate would need to account for both sources of water. The application rate of 0.10 gal/yd<sup>2</sup> would be multiplied by 0.50, to account for the dilution, and then by 0.60, to account for the water in the original emulsified asphalt. Therefore, the residual tack coat rate in this example would be 0.030 gal/yd<sup>2</sup>.

4.4. *Test Strip:*

4.4.1. Emulsified asphalt for fog seal should be applied at an application rate of 0.05 to 0.13 gal/yd<sup>2</sup> of the diluted material. Lighter application rates are used for tight, smooth surfaces and heavier application rates for open, coarse surfaces such as a chip seal, as described in Table 1.

4.4.1. Construct a 100-ft test strip for a fog seal and adjust the application rate as needed and assure that a uniform application of the fog seal emulsified asphalt is applied with no streaking. Apply the fog seal to minimize the amount of overspray and do not allow traffic on the fog seal until it has cured.

**Note 1**—Care should be taken to ensure that the fog seal application rate does not cause a significant reduction in the surface texture of the pavement.

4.5. *Ring Test:*

4.5.1. Sweep the section of road to be fog sealed clean of debris and dust.

4.5.2. Draw two or three 6-in. diameter circles on the swept pavement.

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- 4.5.3. Select two or three target application rates and translate them to the required volume of emulsified asphalt from Table 2.
- 4.5.4. Label each circle with its application rate.
- 4.5.5. Use a suitable measuring instrument such as a 10-mL graduated cylinder to pour the required amount of emulsified asphalt into each circle. Evenly distribute the material within the circle with a small brush.
- 4.5.6. The ideal application rate will evenly and completely cover the pavement within the circle, with no emulsified asphalt draining outside.
- 4.5.7. Record the optimal application rate.

**Note 2**—Fog seals for chip seals may be applied at a higher content. Normally the ring test can be used only when the pavement is tight and a slippery pavement can result due to the application of the treatment.

**Table 2**—Amount of Emulsified Asphalt for Ring Test

gal/yd <sup>2</sup>	mL (6-in. Circle)
0.06	5.0
0.07	5.8
0.08	6.6
0.09	7.4
0.10	8.3
0.11	9.1
0.12	10.0
0.13	12.8

- 4.6. All design work will be carried out using the emulsified asphalt to be used on the job site or from equivalent material from the same source and having substantially the same material properties.

## 5. REPORT

- 5.1. Report the emulsified asphalt residual rate in gallons per square yard to the nearest 0.01 gal/yd<sup>2</sup>.

## 6. KEYWORDS

- 6.1. Fog seal; surface seal; emulsified asphalt.

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