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**Standard Specification for**

**Materials for Full-Depth**

**Reclamation Mixtures with**

**Emulsified Asphalt**

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

Technical Section: 2a

Release: Group 3 (Month yyyy)

**AASHTO**

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# Materials for Full-Depth Reclamation Mixtures with Emulsified Asphalt

AASHTO Designation: MP xxx-18

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## 1. SCOPE

- 1.1. This standard covers requirements for component materials and asphalt mixtures for full-depth reclamation (FDR) to produce a job mix formula.
- 1.2. This standard specifies minimum quality requirements for full-depth reclamation mixtures and the emulsified asphalt.

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## 2. REFERENCED DOCUMENTS

- 2.1. *AASHTO Standards:*
  - M 85, Portland Cement
  - M 140, Emulsified Asphalt
  - M 208, Cationic Emulsified Asphalt
  - M 216, Lime for Soil Stabilization
  - M 320, Performance-Graded Asphalt Binder
  - PP XX, Emulsified Asphalt Content of Full-Depth Reclamation Mixture Design
  - T 283, Resistance of Compacted Asphalt Mixtures to Moisture-Induced Damage
- 2.2. *Other References:*
  - LTPP Seasonal Asphalt Concrete Pavement Temperature Models, LTPPBind 3.1

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## 3. TERMINOLOGY

- 3.1. *Full-depth reclamation (FDR)*—the on-site rehabilitation technique in which the full thickness of the asphalt pavement and a predetermined portion of the underlying materials (base, subbase and/or subgrade) is uniformly pulverized and blended with an emulsified asphalt, with or without a combination of additives (lime, cement, aggregate), generating and reusing 100 percent of the milled material, with the resulting pavement serving as a base layer overlaid with a surface treatment or asphalt mixture overlay.
- 3.2. *Type 1 FDR*— mixtures containing <8 percent passing 0.075 mm (No.200) sieve of the combined material.
- 3.3. *Type 2 FDR*— mixtures containing ≥8 percent passing 0.075 mm (No.200) sieve of the combined material.

- 3.4. *reclaimed asphalt pavement (RAP)*—removed and / or processed pavement materials containing asphalt binder and aggregate.

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## 4. SIGNIFICANCE AND USE

- 4.1. This standard may be used to select and evaluate materials for full-depth reclamation mixture designs.
- 4.2. Specifying an emulsified asphalt alone for FDR may not be satisfactory in producing a good-performing mixture. The specifications here, along with the mix design described in PP XX, have been used successfully in many projects.

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## 5. RAP REQUIREMENTS

- 5.1. Process pavement cores according to PP XX to produce the gradation band shown in Table 1. Alternatively, if experience has demonstrated consistent field gradations from milling, process the RAP to that gradation.

**Table 1**—RAP Gradation Requirements

Sieve Size	
38.1 mm (1.5 in.)	100
25 mm (1 in.)	85-100
19 mm (3/4 in.)	75-95
4.75 mm (No. 4)	30-55
600- $\mu$ m (No. 30)	5-15

**Note 1**—Adjustment of the gradation bands to local conditions and construction equipment is recommended. The selected gradations shall be chosen to match the expected field gradation as closely as possible, with the exception that a greater top size on the project is expected. Gradations on a project will vary from sample to sample. Slight adjustments in the field to the design emulsified asphalt content are often necessary to obtain optimum mixture performance.

- 5.2. Ensure RAP meets agency requirements for an asphalt base mixture.

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## 6. EMULSIFIED ASPHALT AND ADDITIVE REQUIREMENTS

6.1. *Emulsified Asphalt:*

- 6.1.1. For engineered emulsified asphalt, use LTPPBind (version 3.1), the nearest weather station to the project, 98 percent reliability and the depth to the top of the FDR layer in the pavement structure to select the low temperature PG requirements from M 320 for the residue of the emulsified asphalt. A spread of 89 or less between the high PG and the low PG temperatures is normally acceptable in choosing a base asphalt for the emulsified asphalt. Determine the other properties of the emulsified asphalt to meet mixture requirements.

- 6.1.2. For cationic emulsified asphalt, use CSS-1 or CSS-1h from M 208. The same principles in 6.1.1 can be applied when selecting a CSS-1 or CSS-1h or remove “engineered” from 6.1.1

- 6.1.3. For anionic emulsified asphalt, use HFMS-2, HFMS-2h, or HFMS-2s from M 140.

**Note 2**—For example, for an overlay thickness of 50 mm (2 in.) determine the cold temperature requirement at 98 percent reliability at that thickness as the minimum requirement for the base asphalt of the emulsified asphalt. For a surface treatment, use 0 mm. The low temperature requirement can be more conservative in temperate climates or for an FDR layer with a thick overlay. For example, if LTPPBind determines a cold temperature minimum of  $-10^{\circ}\text{C}$  ( $14^{\circ}\text{F}$ ) in a temperate climate and the predominant grade for that climate is  $-16^{\circ}\text{C}$ , then a base asphalt for the emulsified asphalt of  $-16^{\circ}\text{C}$  ( $3^{\circ}\text{F}$ ) or  $-22^{\circ}\text{C}$  ( $-8^{\circ}\text{F}$ ) is acceptable.

**Note 3**—A general recommendation for any of the recycling emulsified asphalts is a minimum residue of 64 percent.

6.2. *Other Additives:*

6.2.1. If quicklime or hydrated lime is used it shall meet the requirements of M 216. If Type I or II cement is used it shall meet the requirements of M 85.

6.2.2. Ensure additional aggregate (i.e., add stone) meets agency requirements for at least an asphalt base mixture.

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## 7. EMULSION FULL-DEPTH RECLAMATION MIXTURE DESIGN REQUIREMENTS

7.1. The full-depth reclamation mixture design at optimum emulsified asphalt content shall meet the requirements specified in Table 2 when prepared in accordance with PP XX.

**Table 2**—Full-Depth Reclamation Mixture Design Requirements

Test Method	Criteria		Property
	FDR Type 1 <sup>1</sup>	FDR Type 2 <sup>2</sup>	
Indirect Tensile Strength, dry subset, T 283	Minimum 276 kPa (40 psi)	Minimum 241 kPa (35 psi)	Cured Strength
Indirect Tensile Strength, conditioned subset, T 283	Minimum 172 kPa (25 psi)	Minimum 138 kPa (20 psi)	Conditioned Strength
Ratio of Residual Emulsified Asphalt to Cement	Minimum 2.5:1.0	Minimum 2.5:1.0	Prevent Rigid Behavior

<sup>1</sup> – mixtures containing <8 percent passing 0.075 mm (No.200) sieve of the combined material

<sup>2</sup> – mixtures containing ≥8 percent passing 0.075 mm (No.200) sieve of the combined material

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## 8. KEYWORDS

8.1. Full-Depth Reclamation; FDR; RAP; emulsified asphalt.