
Standard Practice for Emulsified Asphalt Content of Full-Depth Reclamation Mixture Design

AASHTO Designation: R 109-22¹

Adopted with Revisions: 2022

Technical Subcommittee: 5b, Bridge and Pavement Preservation



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1. SCOPE

- 1.1. This standard practice for mix design evaluation is used to determine the amount and composition of emulsified asphalt and other additives when using full-depth reclamation (FDR) of asphalt mixtures. The mix design is based on strength and other performance properties.

2. REFERENCED DOCUMENTS

- 2.1. *AASHTO Standards:*
- M 85, Portland Cement
 - M 216, Quicklime and Hydrated Lime for Soil Stabilization
 - M 339M/M 339, Thermometers Used in the Testing of Construction Materials
 - M 347, Materials for Full-Depth Reclamation Mixtures with Emulsified Asphalt
 - T 11, Materials Finer Than 75- μ m (No. 200) Sieve in Mineral Aggregates by Washing
 - T 27, Sieve Analysis of Fine and Coarse Aggregates
 - T 89, Determining the Liquid Limit of Soils
 - T 90, Determining the Plastic Limit and Plasticity Index of Soils
 - T 166, Bulk Specific Gravity (G_{mb}) of Compacted Asphalt Mixtures Using Saturated Surface-Dry Specimens
 - T 176, Plastic Fines in Graded Aggregates and Soils by Use of the Sand Equivalent Test
 - T 180, Moisture–Density Relations of Soil Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop
 - T 209, Theoretical Maximum Specific Gravity (G_{mm}) and Density of Asphalt Mixtures
 - T 269, Percent Air Voids in Compacted Dense and Open Asphalt Mixtures
 - T 283, Resistance of Compacted Asphalt Mixtures to Moisture-Induced Damage
 - T 312, Preparing and Determining the Density of Asphalt Mixture Specimens by Means of the Superpave Gyratory Compactor
 - T 331, Bulk Specific Gravity (G_{mb}) and Density of Compacted Asphalt Mixtures Using Automatic Vacuum Sealing Method
- 2.2. *ASTM Standards:*
- D3549/D3549M, Standard Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens

- D6857, Standard Test Method for Maximum Specific Gravity and Density of Asphalt Mixtures Using Automatic Vacuum Sealing Method
- E1, Standard Specification for ASTM Liquid-in-Glass Thermometers
- E230, Standard Specification for Temperature-Electromotive Force (emf) Tables for Standardized Thermocouples
- E879, Standard Specification for Thermistor Sensors for General Purpose and Laboratory Temperature Measurements
- E1137/E1137M, Standard Specification for Industrial Platinum Resistance Thermometers
- E2877, Standard Guide for Digital Contact Thermometers

2.3. *International Electrotechnical Commission Standards:*

- IEC 60584-1:2013, Thermocouples - Part 1: EMF Specifications and Tolerances
- IEC 60751:2008, Industrial Platinum Resistance Thermometers and Platinum Temperature Sensors

2.4. *Other References:*

- LTPP Seasonal Asphalt Concrete Pavement Temperature Models, LTPPBind 3.0/3.1
- *Basic Asphalt Recycling Manual*, Asphalt Recycling and Reclaiming Association and FHWA-HIF-14-001, Annapolis, MD

3. TERMINOLOGY

- 3.1. *full-depth reclamation (FDR)*—on-site rehabilitation technique in which the full thickness of the asphalt pavement and a predetermined portion of the underlying materials (base, subbase, subgrade, or some combination of the three) is uniformly pulverized and blended with a stabilizing agent, with or without a combination of additives, generating and reusing 100 percent of the reclaimed material, with the resulting pavement serving as a base layer overlaid with a wearing surface.

Note 1—Typical stabilizing agents for FDR include emulsified asphalt, foamed asphalt, Portland cement, and lime. Typical additives include lime, Portland cement and aggregate.

- 3.2. *Type 1 FDR*— mixtures containing less than 8 percent passing No. 200 (0.075-mm) sieve of the combined material.
- 3.3. *Type 2 FDR*— mixtures containing greater than or equal to 8 percent passing No. 200 (0.075-mm) sieve of the combined material.
- 3.4. *reclaimed asphalt pavement (RAP)*—removed, processed, or removed and processed pavement materials containing asphalt binder and aggregate.

4. SIGNIFICANCE AND USE

- 4.1. The procedure described in this standard practice is used to produce FDR that satisfies mix design requirements.
- 4.2. Specifying an emulsified asphalt alone for FDR may not be satisfactory in producing a good-performing mixture. This method has successfully been vetted and is the baseline design procedure employed on numerous projects.