
Standard Practice for Determination of Optimum Asphalt Content of Cold Recycled Mixture with Foamed Asphalt

AASHTO Designation: PP 94-22¹

Technically Revised: 2022

Editorially Revised: 2022

**Technical Subcommittee: 2d, Proportioning
of Asphalt–Aggregate Mixtures**



**American Association of State Highway and Transportation Officials
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1. SCOPE

- 1.1. This standard practice for cold recycling mix design is used to determine the amount of foamed asphalt, water, and other additives when using cold recycling (CR) of asphalt pavements, which includes cold in-place recycling (CIR) or cold central plant recycling (CCPR). The mix design is based on the strength properties of cold recycled mixture.
- 1.2. The values stated in SI units are to be regarded as the standard.
- 1.3. *This standard practice may involve hazardous materials, operations, and equipment. This standard practice does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*
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2. REFERENCED DOCUMENTS

- 2.1. *AASHTO Standards:*
- < MP 38, Materials Used in Cold Recycled Mixtures with Foamed Asphalt
 - < M 339M/M 339, Thermometers Used in the Testing of Construction Materials
 - < R 90, Sampling Aggregate Products
 - < R 97, Sampling Asphalt Mixtures
 - < 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 30, Mechanical Analysis of Extracted Aggregate
 - < T 164, Quantitative Extraction of Asphalt Binder from Asphalt Mixtures
 - < T 180, Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop
 - < T 245, Resistance to Plastic Flow of Asphalt Mixtures Using Marshall Apparatus
 - < T 283, Resistance of Compacted Asphalt Mixtures to Moisture-Induced Damage
 - < T 308, Determining the Asphalt Binder Content of Asphalt Mixtures by the Ignition Method
 - < T 312, Preparing and Determining the Density of Asphalt Mixture Specimens by Means of the Superpave Gyratory Compactor
- 2.2. *ASTM Standards:*
- < E1, Standard Specification for ASTM Liquid-in-Glass Thermometers

- < E230/E230M, 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 Reference:*

- < Wirtgen Cold Recycling Technology, Wirtgen GmbH, Windhagen, Germany, 2012.

3. TERMINOLOGY

- 3.1. *reclaimed asphalt pavement (RAP)*—removed and/or processed pavement materials containing asphalt binder and aggregate.
- 3.2. *cold in-place recycling (CIR)*—the on-site recycling process in which the existing asphalt pavement is recycled using a specialized train equipment (tanker trucks, cold planing machines, crushing/screening or sizing units, mixers, pavers, and compaction rollers). The CIR process uses 100 percent of the on-site generated RAP, and a foamed asphalt with or without a combination of additives (e.g., lime, cement, and aggregate) to produce CIR mixture, and typically treats an asphalt pavement with a depth of 75 to 100 mm (3 to 4 in.). The CIR mixture is used as a base layer overlaid with a surface treatment or asphalt overlay.
- 3.3. *cold central-plant recycling (CCPR)*—the process in which the asphalt recycling takes place at a central location using a stationary cold mix plant. The stationary plant could be a specifically designed plant or a CIR train minus the cold planing machine set up in a stationary configuration. The CCPR mixture is used as a base layer overlaid with a surface treatment or asphalt overlay.

4. SUMMARY OF THE PRACTICE

- 4.1. *Material Selection*—The provided in-place RAP must be representative of the materials to be recycled. The RAP, asphalt binder, additional aggregate, and other additives are selected that meet the environmental and traffic requirements applicable to the paving project.
- 4.2. *Design Mixing Water Content Selection*—Replicate RAP specimens are compacted using the modified proctor test method with at least three trial mixing water contents. The mixing water content corresponding to the maximum dry density of RAP specimen is selected as the design mixing water content.
- 4.3. *Design Foamed Asphalt Content Selection*—Replicate cold recycled mixture specimens are compacted in the Superpave gyratory compactor at 30 gyrations or in the Marshall compaction apparatus at 75 blows per side with at least three trial foamed asphalt contents. The design binder content is selected on the basis of satisfactory conformance with the requirements of MP 38.