Designation: D2399 – 21

Standard Practice for Selection of Cutback Asphalts[1]

This standard is issued under the fixed designation D2399; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice covers the selection of cutback asphalts of the slow, medium, and rapid curing types for various paving and allied uses. Slow-curing cutback asphalts are also called road oils.

1.2 The values stated in either SI units or English units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in nonconformance with the standard.

1.3 The text of this standard references notes and footnotes which provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of the standard.

1.4 *This standard 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 standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D2026/D2026M Specification for Cutback Asphalt (Slow-Curing Type)

D2027/D2027M Specification for Cutback Asphalt (Medium-Curing Type)

D2028/D2028M Specification for Cutback Asphalt (Rapid-Curing Type)

3. Terminology

3.1 *Definitions:*

3.1.1 *bitumen-aggregate applications*—the spraying of liquid bitumen on prepared aggregate or pavement surfaces, which subsequently are covered with graded aggregate.

3.1.2 *bitumen-aggregate mixture*—a combination of bituminous material and aggregate that is physically mixed by mechanical and thermal means, spread on the job site, and compacted.

3.1.3 *bitumen applications*—the uses of sprayed bituminous coatings not involving the use of aggregates. Uses of liquid bitumen in this group are all classed as treatments. (See *surface treatments*.)

3.1.4 *cold-laid plant mix*—a mixture of liquid bitumen and mineral aggregate prepared in a central bituminous mixing plant and spread and compacted at the job site when the mixture is at or near ambient temperature.

3.1.5 *dense-graded aggregate*—aggregate that is graded from the maximum size down to filler with the object of obtaining a bituminous mix with a controlled void content and high stability.

3.1.6 *dust binder*—a light application of bituminous material for the express purpose of laying and bonding loose dust.

3.1.7 *mixed-in-place (road mix)*—a bituminous course produced by mixing mineral aggregate and liquid bitumen at the job site by means of travel plants, motor graders, drags, or special road-mixing equipment. Pavement base and surfaces, mixed in place, may utilize open-graded aggregates (3.1.10), dense-graded aggregates (3.1.5), sand (3.1.14), or sandy soil (3.1.16).

3.1.8 *mulch treatment*—a spray application of bituminous material used to temporarily stabilize a recently seeded area. The bitumen can also be applied to straw or hay mulch as a tie-down.

3.1.9 *multiple surface treatment*—two or more surface treatments placed one on the other. The maximum aggregate size of each successive treatment is usually one half that of the previous one, and the total thickness is about the same as the nominal maximum size aggregate particles of the first course.

[1] This practice is under the jurisdiction of ASTM Committee D04 on Road and Paving Materials and is the direct responsibility of Subcommittee D04.40 on Asphalt Specifications.

Current edition approved Nov. 1, 2021. Published November 2021. Originally approved in 1965. Last previous edition approved in 2017 as D2399 – 12 (2017). DOI: 10.1520/D2399-21.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

3.1.10 *open-graded aggregate*—one containing little or no mineral filler and in which the void spaces in the compacted aggregate are relatively large.

3.1.11 *pavement base and surfaces*—the lower or underlying pavement course atop the subbase or subgrade and the top or wearing course. Cold-laid mixtures that are bound together with liquid bitumens use either open or dense aggregate gradations.

3.1.12 *penetration macadam*—a pavement construction using essentially one-size coarse aggregate, which is penetrated in place by a heavy application of high-viscosity bituminous material. This application is followed by an application of a smaller size coarse aggregate (to reduce the void space) then is rolled thoroughly. This procedure is usually followed another time with a still smaller coarse aggregate and roller compaction.

3.1.13 *prime coat*—an application of a low-viscosity bituminous material to an absorptive surface, designed to penetrate, bond, and stabilize the existing surface and to promote adhesion between it and the construction course that follows.

3.1.14 *sand*—a clean, mineral aggregate material passing a No. 4 (4.75-mm) sieve, but only about 5 % passing the No. 200 (75-µm) sieve.

3.1.15 *sand seal*—a thin layer of spray-applied bitumen uniformly covered with sand (see 3.1.14), which waterproofs and improves the texture of a pavement surface.

3.1.16 *sandy soil*—a material consisting essentially of fine aggregate particles smaller than No. 10 (2.00-mm) sieve and usually containing up to 20 % passing a No. 200 (75-µm) sieve. This material usually exhibits plasticity characteristics.

3.1.17 *single-surface treatment*—a single application of bitumen to any kind of road surface followed immediately by a single layer of aggregate of as uniform a size as practicable. The thickness of the treatment is about the same as the nominal maximum size aggregate particles. A single-surface treatment is used as a wearing and waterproofing course.

3.1.18 *surface treatments*—applications of bituminous materials to any type of road or pavement surface that produce an increase in thickness of less than 25 mm (1 in.).

3.1.19 *tack coat*—an application of bituminous material applied to an existing, relatively nonabsorbent surface to provide a thorough bond between old and new surfacing.

4. Significance and Use

4.1 This practice defines various types of bituminous paving construction for which cutback asphalt may be used. In addition, it delineates the types and grades recommended for each specific use.

4.2 This practice provides the basic concepts on which the use recommendations have been made. It also provides a rationale by which the user may judiciously select a material for a specific job application from among those generally recommended.

5. Precautions

5.1 For some of the uses recommended in Table 1, the cutback asphalt may be applied at temperatures above its flash point. Caution must therefore be exercised at all times in handling these materials to prevent fire or an explosion.

6. Recommended Uses

6.1 The recommendations shown in Table 1 are for use only as a guide in paving and road construction. Several cutback materials may be recommended in the table for a general construction procedure. Selection of a particular material will depend on local practice, availability, traffic, and environmental conditions for the specific project being considered.

6.2 Cutback asphalts are constituted from a base asphalt of selected hardness or viscosity dissolved in a solvent of high, medium, or low volatility to provide distinct differences for construction purposes among the types. Slow-curing cutbacks alternatively may be made directly by distillation. Upon exposure to atmospheric conditions, the highly volatile naphtha-type solvent in rapid-curing blends evaporates quickly and leaves a hard, viscous base asphalt to function with aggregate in the road. A less volatile kerosine-type solvent evaporates more slowly from medium-curing blends and leaves a base asphalt of medium hardness or viscosity. Slow-curing blends contain a low-volatility fuel-oil type solvent and thus require the longest curing period. They leave a soft, low-viscosity asphalt on the aggregate. Both the curing rate and characteristics of the residual asphalt are factors to be considered in the selection of liquid asphalts for various uses. However, primary consideration should be given to hardness or viscosity of the remaining asphalt in relation to gradation of the aggregate with which it is used. One-size aggregates, or open-graded ones deficient in fines, require harder asphalts while softer materials may be used with dense-graded aggregates.

6.3 The choice of cutback asphalt grade (viscosity) within any given type is generally controlled by the method of construction (application or mix type and method of mixing) and by climatic conditions during construction. Applications that require infiltration of the aggregate necessitate a low enough viscosity to penetrate (prime coat) and a viscosity high enough to be retained on the aggregate (penetration macadam). Tack coats require low viscosity to achieve coverage with a thin film of residual asphalt. Surface treatment and seal coat types require a viscosity low enough to achieve wetting but high enough to prevent run-off from road crown or grade. With regard to mix types, higher viscosity materials may be used when the method is positive and efficient (plant mix) and the weather is warm. With less efficient mixing methods (road mix) and in cooler weather, lower viscosity materials may be needed.