

Coated macadam for roads and other paved areas —

Part 1: Specification for constituent materials and for mixtures

Committees responsible for this British Standard

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- British Aggregate Construction Materials Industries
- British Civil Engineering Test Equipment Manufacturers' Association
- British Tar Industry Association
- County Surveyor's Society
- Department of the Environment (Property Services Agency)
- Department of Transport (Highways)
- Department of Transport (Transport Research Laboratory)
- Institute of Asphalt Technology
- Institute of Petroleum
- Institution of Civil Engineers
- Institution of Highways and Transportation
- Mastic Asphalt Council and Employers' Federation
- Mastic Asphalt Producers' Association
- Refined Bitumen Association Ltd.
- Sand and Gravel Association Limited
- Society of Chemical Industry
- Coopted members

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Foreword

This Part of BS 4987 has been prepared under the direction of Technical Committee B/510, Road materials. It supersedes BS 4987-1:1988, which is withdrawn.

This edition introduces technical changes but it does not reflect a full review or revision of the standard, which will be undertaken in due course.

The standard comprises two Parts:

- *Part 1: Specification for constituent materials and for mixtures;*
- *Part 2: Specification for transport, laying and compaction.*

Over the years, many coated macadam compositions have evolved, as will be seen from section 2. To encourage some rationalization a range of “Preferred mixtures” has been identified. Mixtures suitable for most uses can be selected from this reduced range and purchasers are encouraged to adopt their use wherever possible.

Three versions of dense bitumen macadam roadbase and basecourse mixture are now included in this standard. The traditional mixture (DBM), incorporating 100 or 200 pen bitumen, is retained. Two developments of this are heavy duty macadam with a higher filler content and harder binder (identified as HDM), and the traditional mixture with harder binder only, identified as DBM 50.

Tests for certain aggregate properties are still under development and will be included in this standard when they are fully developed and proven.

The requirements for transporting coated macadam mixtures and for site work are included in BS 4987-2.

It is recognized that different properties can be imparted to coated macadam mixtures by the use of modified binders instead of bitumen or tar. Such modified materials are usually proprietary and several are already in limited use. Officially supervised road trials are in progress to determine the advantages, if any, of such binders in different circumstances, and when the results of these trials are available, steps will be taken to include the binders in this standard, where appropriate. The requirements for the composition of all mixtures are based on the testing of the constituents and of the mixture by methods described in BS 598.

Provision is made to measure the compaction of macadam on the road in terms of the percentage refusal density (PRD) as described in BS 598-104.

It has been assumed in the drafting of this Part of BS 4987 that the execution of its provisions is entrusted to appropriately qualified and experienced people.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 16, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Section 1. General

1 Scope

This Part of BS 4987 specifies the requirements for all types of coated macadam to be laid as roadbase (group one), basecourse (group two), wearing course (group three) or porous asphalt course (group four) for roads and other paved areas excluding heavy duty airfield pavements. The standard does not include requirements for macadams incorporating bitumen emulsions as binders; for these see BS 434.

NOTE The titles of the publications referred to in this Part of BS 4987 are listed on the inside back cover.

2 Definitions

For the purposes of this Part of BS 4987, the definitions given in BS 6100 apply, together with the following.

2.1

test sieve

a sieve complying with BS 410

2.2

traffic category

the volume of commercial vehicles travelling in one direction counted over a 16 h period and expressed in commercial vehicles per day (c.v.d.)

the categories are:

- a) category A: more than 250 c.v.d.;
- b) category B: up to 250 c.v.d.

NOTE These categories refer to existing traffic levels, not projected levels.

2.3

commercial vehicle

a vehicle with an unladen mass exceeding 1 500 kg

3 Sampling and testing

NOTE The tolerances and ranges specified in this Part of BS 4987 are intended to provide for errors in sampling and testing when carried out by a skilled operator as well as for variations in the macadam due to plant inconsistencies and fluctuations in the grading of the aggregates. Attention is drawn to the difficulties inherent in obtaining representative samples of coated macadam for analysis and to the further (usually smaller) errors in the reduction of the sample and its analysis in the laboratory. It should be realized that when any sampling and testing procedure is used complete compliance with the specification may not always be achieved with every sample tested even when the material is satisfactory (see BS 598-102).

3.1 Binder

3.1.1 Bitumens and tar bitumen mixtures shall be sampled and tested in accordance with BS 3690-1 and BS 3690-3, respectively.

3.1.2 Tars shall be sampled and tested in accordance with BS 76.

3.2 Aggregates and fillers

Coarse and fine aggregates and fillers shall be sampled and tested in accordance with BS 812.

3.3 Coated macadam

Coated macadams shall be sampled and tested in accordance with the relevant methods given in BS 598. The grading of the mineral aggregate fraction of the mixture shall be determined by means of “wet” sieving and therefore no wet/dry sieving correction shall be employed.

3.4 Coated chippings

Coated chippings shall be sampled from the stockpile when their temperature is below 130 °C and tested in accordance with the methods given in BS 598.

4 Constituent materials

4.1 Binder

4.1.1 The binder shall be one of the following types:

- a) petroleum bitumen complying with BS 3690-1, excluding 450 penetration grade;
- b) cut back bitumen complying with BS 3690-1;
- c) road tar complying with BS 76;

NOTE The terms “high temperature tar” and “low temperature tar” relate to the relative temperatures of carbonization of the coal during production of the tar. Both types are permitted by BS 76 but the different density of each dictates that different binder contents for the mixes be used as specified in section 2 of this standard.

d) mixture of tar and bitumen complying with BS 3690-3, and which shall thereafter be treated as though it were bitumen.

e) For 20 mm size porous asphalt wearing course the binder shall be petroleum bitumen complying with BS 3690-1 with suitable modifier where necessary.

The type and grade of binder shall be as given in the tables in section 2 for the individual mixtures.

NOTE 1 The recommended storage temperatures for binders are given in appendix A.

NOTE 2 The grades of binders specified in the tables are suitable for machine laid macadam. See **B.5.7** for guidance on grades of binders for hand laid mixtures.

NOTE 3 See **B.5.5** for guidance on binders for use in porous asphalts.

4.1.2 When the addition of tar or adhesion agents is made to bitumen, the mixtures shall have the relevant penetration or viscosity required for bitumen given by the individual tables in section 2.

NOTE The addition of not more than 10 % by mass of tar to bitumen can reduce the risk of water stripping the binder from some aggregates. This may also be achieved by the addition of adhesion agents to the bitumen or at the mixing stage (see also **B.2**).

4.2 Coarse aggregate

4.2.1 Type of coarse aggregate

The coarse aggregate shall be material substantially retained on a 3.35 mm test sieve and shall consist of one of the following.

- a) Crushed rock of one or more of the following groups: basalt, gabbro, granite, gritstone, hornfels, limestone, porphyry or quartzite.
- b) Gravel of one or more of the groups in a) or flint, crushed or uncrushed, or combinations of both types.

When gravel other than limestone gravel is used, 2 % by mass of the total aggregate of either hydrated lime or Portland cement shall be used as a filler.

- c) Blastfurnace slag complying with BS 1047.
- d) Steel slag, either electric arc furnace slag or basic oxygen slag, which shall be weathered until it is no longer susceptible to falling and the compacted bulk of density of which shall be between 1 700 kg/m³ and 1 900 kg/m³ when tested as for blastfurnace slag.

NOTE 1 It is recognized that certain aggregates may not belong to any of these groups. If it is proposed to use such an aggregate the approval of the purchaser should be obtained.

NOTE 2 The use of 2 % by mass of the total aggregate of hydrated lime or Portland cement filler reduces the risk of water stripping the binder from some aggregates. This may also be achieved by the addition of adhesion agents to the bitumen or at the mixing stage.

NOTE 3 Slags other than those referred to in c) and d) above may be suitable aggregates for coated macadams but are outside the scope of this standard.

4.2.2 Particle shape

With the exception of the porous asphalts specified in clause 8, for which lower values are specified, the overall flakiness index of the coarse aggregate shall not exceed 45 % for crushed rock and crushed gravels and 50 % for uncrushed gravels, when tested in accordance with the method described in BS 812.

4.2.3 Fraction passing 75 µm sieve

When gravel is used, the material passing the 75 µm sieve shall not exceed 1 % by mass of the coarse aggregate when determined in accordance with the washing and sieving method described in BS 812-103:1985.

NOTE 1 There is no acceptable method for determining clay content of coarse aggregate but an indication of quantity is given by using the sedimentation test described in BS 812-103.2:1989.

NOTE 2 This standard does not include requirements for all the properties of aggregates such as the polished stone value or the aggregate abrasion value that may be required to control skidding resistance or the 10 % fines value which indicates aggregate strength (see B.5.2).

4.3 Fine aggregate

4.3.1 Type of fine aggregate

The fine aggregate shall substantially pass a 3.35 mm test sieve and be of the following types:

- a) fines produced by crushing material from one of the groups specified in 4.2.1; or
- b) sand; or
- c) a mixture of a) and b).

4.3.2 Fraction passing 75 µm sieve

When sand is used, the material finer than 75 µm shall not exceed 8 % by mass of the fine aggregate when determined in accordance with the washing and sieving method described in BS 812-103.1:1985.

NOTE There is no acceptable method for determining clay content of fine aggregate but an indication of quantity is given by using the sedimentation test described in BS 812-103.2:1989.

4.4 Added filler

If added filler is used in the macadam it shall consist of crushed rock, crushed slag, hydrated lime, Portland cement or other material approved by the purchaser, and at least 75 % of it shall pass a 75 µm test sieve (but see note 2 in 4.2.1).

4.5 Composition of mixture

4.5.1 The binder content and aggregate grading of the freshly-mixed coated material when sampled and tested in accordance with BS 598 shall comply with the relevant requirements for groups one, two, three and four as specified in clauses 5, 6, 7 and 8 respectively of this standard.

NOTE 1 Advice on the selection of materials and mixtures, including hand-laid work, is given in appendix B.

NOTE 2 The binder contents given in the relevant tables are appropriate for most aggregates but it is not possible to cover the requirements of all aggregates in this way. Where the characteristics of the aggregates require a binder content other than those given in the tables a new target binder content should be agreed between the manufacturer and the purchaser based on trials and/or evidence of satisfactory performance. The tolerances as specified in the relevant table should apply.

NOTE 3 The binder content of dense basecourse may be reduced by up to 0.5 % if the compaction is controlled by the percentage refusal density test as described in BS 598-104 if agreed between manufacturer and purchaser; this would apply normally to roads carrying category A traffic.

NOTE 4 Where a roadbase is to be open to traffic before the basecourse is laid the upper layer of roadbase should conform to the dense basecourse specification.

4.5.2 Where the bulk density of the blastfurnace slag used is between those densities specified for the groups, a proportional change shall be made to the binder content.