

Aggregates —

Part 2: Aggregates for bituminous mixtures and surface treatments for roads, airfields and other trafficked areas — Guidance on the use of BS EN 13043

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- Institution of Highways and Transportation
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Foreword

This Published Document has been prepared under the direction of Subcommittee B/502/3, Bituminous bound aggregates. It is one of nine parts that give guidance on the use and application of a series of European Standards for aggregates. These European Standards were prepared by CEN/TC 154, Aggregates, and have been adopted as British Standards. Conflicting British Standards relating to aggregates will be withdrawn in June 2004.

This part of PD 6682 gives guidance on the use of BS EN 13043 which specifies requirements for aggregates for bituminous mixtures and surface treatments for roads, airfields and other trafficked areas. BS EN 13043 supersedes BS 63-1:1987, BS 63-2:1987, and BS 1047:1983 which will be withdrawn in June 2004.

NOTE Users of BS 63-1:1987, BS 63-2:1987 and BS 1047:1983 should contact BSI Customer Services for confirmation of withdrawal.

BS EN 13043 also supersedes the conflicting requirements for aggregates for bituminous mixtures and surface treatments in British Standards for asphalt, BS 594:2002, BS 4987:2001 and BS 5273:1975. They will be amended to remove these conflicting requirements at the latest by June 2004.

NOTE Users of BS 594:2002, BS 4987:2001 and BS 5273:1975 should contact BSI Customer Services for confirmation of amendment.

Attention is drawn to the fact that BS EN 13043 fully takes into account the requirements of the European Commission mandate M125, Aggregates, given under the EU Construction Products Directive (89/106/EEC) [1].

Guidance on the other European Standards in the series is given in the following parts of PD 6682.

Part 1: Aggregates for concrete — Guidance on the use of BS EN 12620.

Part 3: Aggregates for mortar — Guidance on the use of BS EN 13139.

Part 4: Lightweight aggregates for concrete, mortar and grout — Guidance on the use of BS EN 13055-1.

Part 5: Lightweight aggregates for bituminous mixtures and surface treatments and for unbound and bound applications excluding concrete, mortar and grout — Guidance on the use of BS EN 13055-2.¹⁾

Part 6: Aggregates for unbound and hydraulically bound materials for use in civil engineering work and road construction — Guidance on the use of BS EN 13242.

Part 7: Armourestone — Guidance on the use of BS EN 13383.

Part 8: Aggregates for railway track ballast — Guidance on the use of BS EN 13450.

Part 9: Guidance on the use of European test method standards.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

This Published Document is not to be regarded as a British Standard.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 18, an inside back cover and a back cover.

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¹⁾ Both BS EN 13055-2 and PD 6682-5 are in preparation.

Introduction

This document provides guidance on the use of BS EN 13043 which supersedes the corresponding conflicting British Standards for aggregates for use in bituminous mixtures and surface treatments, BS 63 and BS 1047.

Current British Standards for asphalt, BS 594, BS 4987 and BS 5273, contain requirements for aggregates. Guidance is given on how these requirements conflict with BS EN 13043.

NOTE The term “asphalt” has been adopted in the UK as the generic term that refers to the range of bituminous mixtures used on roads and other paved areas. This terminology has been adopted in the UK because it is understood that it will be adopted in all new European Standards. Even though BS EN 13043 has retained the term “bituminous mixtures” this Published Document will refer to “asphalt”. Both terms should be considered as synonymous.

BS EN 13043 specifies a range of categories for properties to enable users to select appropriate limiting values for the wide range of aggregates in bituminous mixtures and surface treatments within Europe. In most instances, provision is also made for producers to identify a declared value for properties when the value is outside indicated categories.

Specifiers will need to define BS EN 13043 categories for properties that are relevant to the particular end use of an aggregate. Some example specifications listing recommended BS EN 13043 aggregate designations for particular properties for aggregates with different end uses are provided in Annex A, Annex B, Annex C, Annex D and Annex E.

BS EN 13043 includes recycled aggregates within its scope and indicates that their suitability should be assessed in accordance with the regulatory requirements in the place of use. In the UK there is further guidance on recycled aggregates in the Highways Agency’s specification for highway works [2].

1 Scope

This part of PD 6682 gives guidance on the use of BS EN 13043 in the UK. BS EN 13043 specifies the properties of aggregates and filler aggregates obtained by processing natural, manufactured or recycled materials for use in bituminous mixtures and surface treatments for roads, airfields and other trafficked areas.

2 Overview of BS EN 13043

2.1 General requirements

2.1.1 General

Previously, British Standards relating to aggregates for bituminous mixtures and surface treatments, BS 63, BS 594, BS 1047, BS 4987 and BS 5273, have specified requirements for the following aggregate properties:

- a) grading;
- b) flakiness;
- c) fines content;
- d) mechanical properties as 10 % fines.

Additionally, BS 63, BS 594, BS 1047, BS 4987 and BS 5273, specify the following properties for blast-furnace slag:

- 1) bulk density;
- 2) stability;
- 3) water absorption;
- 4) sulfur content.

Additional aggregate properties, such as polishing and abrasion resistance, have been called up in the UK in the Highways Agency’s specification for highway works [2].

BS EN 13043 gives requirements for different properties, including different test methods. These different geometrical, physical (mechanical) and chemical properties are listed in 2.1.2, 2.1.3, 2.1.4 and 2.1.5.

2.1.2 Geometrical requirements

Requirements for the following geometrical properties are specified for coarse and fine aggregates in BS EN 13043:2002, 4.1 but not in BS 63, BS 594, BS 1047, BS 4987 and BS 5273.

- a) Percentage of crushed and broken surfaces in coarse aggregate, measured in accordance with BS EN 933-5.
- b) Angularity of fine aggregate, measured in accordance with BS EN 933-6.

2.1.3 Physical requirements

The term “mechanical properties”, used in British Standards relating to aggregates for bituminous mixtures and surface courses, is replaced in BS EN 13043 by the term “physical properties”. Requirements for the following physical properties are specified for coarse and fine aggregates in BS EN 13043:2002, 4.2 but not in BS 63, BS 594, BS 1047, BS 4987 and BS 5273.

- a) Resistance to fragmentation, measured by the Los Angeles test method (reference method) as specified in BS EN 1097-2.

NOTE There is an option to specify resistance to fragmentation by declaring an impact value determined in accordance with BS EN 1097-2. It is derived from a German (DIN) test method that uses specialist equipment not currently available in the UK.

- b) Resistance to wear of coarse aggregate, measured by determining the micro-Deval coefficient in accordance with BS EN 1097-1. This test method is derived from a French (AFNOR) test method.
- c) Resistance to polishing of coarse aggregate for surface courses, measured by determining the polished stone value (PSV) in accordance with BS EN 1097-8. This test method is derived from BS 812-114.
- d) Resistance to surface abrasion, measured by determining the aggregate abrasion value (AAV) in accordance with BS EN 1097-8. This test method is derived from BS 812-113.
- e) Resistance to abrasion by studded tyres, in accordance with BS EN 1097-9.
- f) Durability in terms of freeze-thaw resistance determined by measuring the water absorption value, in accordance with BS EN 1097-6, as a screening test for freeze-thaw resistance. Where necessary further measurements are made using freeze-thaw tests in accordance with BS EN 1367-1, based on a German (DIN) test method, or BS EN 1367-2, based on a magnesium sulfate soundness test derived from BS 812-121.
- g) Bulk density and resistance to thermal shock, declared on request.

2.1.4 Chemical requirements

Requirements for the following chemical properties are specified for coarse and fine aggregates in BS EN 13043:2002, 4.3 but not in BS 63, BS 594, BS 1047, BS 4987 and BS 5273.

- a) Content of coarse lightweight contaminators.
- b) Volume stability of steel slag aggregate.

2.1.5 Requirements for filler aggregates

Requirements for filler aggregates are specified in BS EN 13043, Clause 5. They specify the use of test methods that are based on French (AFNOR) and Dutch (NNI) test methods. Only the grading test specified in BS EN 13043:2002, 5.2.1 and the test for loose bulk density in kerosene specified in BS EN 13043:2002, 5.5.5 have previously been used in the UK.

2.2 Evaluation of conformity

BS EN 13043:2002, Clause 6 requires that producers undertake and on request declare the results from:

- a) initial type tests used:
 - 1) to characterize properties for new sources of aggregates; or
 - 2) when there is a major change in the raw materials or processing which can affect the properties of the aggregate;
- b) factory production control to monitor conformity of the aggregates with the relevant requirements and the producer's declared values.

Minimum frequencies of tests are specified in BS EN 13043:2002, Annex B.

Guidance on the requirements for attestation of conformity and compliance with the provisions of the EU Construction Products Directive [1] is given in Clause 4.

3 Requirements of BS EN 13043

3.1 General

Each clause in BS EN 13043 that specifies aggregate properties, i.e. Clause 4 and Clause 5, starts with a general subclause which draws attention to the necessity only to specify those properties relevant to the particular aggregate and end use of the aggregate.

In BS EN 13043, tables of specified requirements allow the user to choose an appropriate “category” for each property. The style of category designation is intended to be self-explanatory and related to the specified limiting value. For example, category FI_{25} means that aggregates having a flakiness index with a maximum value of 25 are required. This style becomes more complex in the case of grading and a careful understanding of BS EN 13043:2002, Table 2 is necessary. For example, $G_{C85/15}$ is the grading designation for a coarse aggregate with a minimum 85 % passing the upper size sieve D and a maximum of 15 % passing the lower size sieve d .

NOTE Whilst aggregate descriptions are identified as d/D in BS EN 13043, 4.1.2 the d and D values appear in the grading categories in the reverse order giving the percentage passing D before giving the percentage passing d , e.g. a 10/20 aggregate with a grading category of $G_{C85/20}$.

An option to use a “no requirement” category is also provided. For example, a resistance to abrasion from studded tyres category of A_{NR} is included in BS EN 13043 and it means that there is no specified requirement for resistance to abrasion from studded tyres. Since studded tyres are not permitted on UK roads, this is the category that should normally be selected in the UK. The “no requirement” category should be selected in all cases where a property is not relevant or an alternative method is used to cover the end use requirement.

BS EN 13043 has provision for the use of “declared values”. When the value of a particular property falls outside the range of any specified categories, the producer may provide information about this property in the form of a declared value. For example, if the resistance to fragmentation of coarse aggregate measured by the Los Angeles coefficient exceeds 50, the producer can state the maximum value of LA_{declared} . Thus if the value were 55 the producer would state LA_{55} and the aggregate users should determine whether this is adequate for their purposes.

3.2 Geometrical requirements

3.2.1 Aggregate sizes (BS EN 13043:2002, 4.1.2)

BS EN 13043:2002, Table 1 specifies the following three options of sieve size ranges for use in the description of aggregate size:

- a) basic set;
- b) basic set plus set 1;
- c) basic set plus set 2.

In the UK, aggregates will generally be supplied to the basic set plus set 2.

The aggregate size is described in BS EN 13043 in millimetres with the designation d/D , where d is the lower limiting sieve size and D is the upper limiting sieve size. The majority of the particle size distribution of an aggregate should lie between these two values and requirements for this are specified in BS EN 13043:2002, 4.1.3.

Aggregate sizes in BS EN 13043 are described in a different manner to that described in current British Standards for aggregates. The fine aggregate fraction described in BS EN 13043 is linked to a 2 mm size or less, although with a greater oversize tolerance there will generally be little actual change in gradings in practice.

The sieve sizes used to describe aggregate sizes in BS EN 13043 are expressed in reverse order to that described in current British Standards for aggregates, i.e. the lower sieve size is given before the upper sieve size. For example, the equivalent BS EN 13043 aggregate to a 20 mm single-sized aggregate conforming to BS 63 is given the designation 10/20. Table 1 lists established BS 63 descriptions of aggregates for bituminous mixtures and surface treatments alongside their equivalent BS EN 13043 designations.

Table 1 — Established UK aggregate descriptions and their recommended equivalent European aggregate(s)

BS 63 single sized aggregates mm	Recommended BS EN 13043 aggregate mm
40	20/40 ^a
28	20/31.5 ^b
20	10/20 or 14/20 ^c
14	6.3/14 or 8/14 ^c
10	4/10 or 6.3/10 ^c
6	2.8/6.3 or 2/6.3 ^c
3	1/4 or 2/4 ^c

^a This is a poor fit, but is the best designation allowed by BS EN 13043.
^b This is the best designation allowed considering that BS EN 13043 does not specify a 28 mm size.
^c Where two alternative designations are recommended, the choice of which designation to select depends on the end use of the product.

3.2.2 Sieve sizes

BS EN 13043 expresses grading requirements in terms of percentages passing lower (d) and upper (D) sieve sizes and in percentages passing sieves with sizes which are multiples or fractions of d and D . When using the BS EN 13043 basic set plus set 2 range of sieve sizes, as has been adopted for use in the UK, some of these multiples and fractions are not exact sieve numbers from the ISO 565, R 20 series. Therefore, footnotes in BS EN 13043:2002, Table 2 and Table 3, give provision for the selection of next nearest sieve sizes in such circumstances.

For the UK, a selection of next nearest sieve sizes from the ISO 565, R 20 series is given in Table 2 to cover such eventualities. It shows how they relate back to the multiples or fractions of the d and D sieve sizes given in the BS EN 13043 basic set plus set 2 range.

The sieve sizes given in Table 2 have been recommended for use in the UK for aggregates for bituminous mixtures and surface treatments. Using these sieve sizes, the grading tables in 3.2.3 have been created.

Table 2 — Recommended sieves, including next nearest multiples and fractions from the ISO 565:1990, R 20 series

Recommended sieves for the UK ^a mm	Sieve sizes in the BS EN 13043 basic set plus set 2 range mm			
	$2D$ for $D =$	$1.4D$ for $D =$	$D/2$ for $D =$	$d/2$ for $d =$
80	40	—	—	—
63	31.5	40	—	—
40	20	31.5	—	—
31.5	14	20	—	—
20	10	14	40	—
16	—	—	—	—
14	6.3	10	31.5	—
10	—	6.3	20	20
8	4	—	—	—
6.3	2.8	4	14	—
4	2	—	10	10
2.8	—	2	6.3	6.3
2	—	—	—	4
1	—	—	—	2
0.500	—	—	—	—
0.250	—	—	—	—
0.125	—	—	—	—
0.063	—	—	—	—

^a These sieve sizes are multiples or fractions of the d and D sieve sizes given in the BS EN 13043 basic set plus set 2 range of sieve sizes. However, where the sieves calculated are not exact sieve numbers in the ISO 565:1990, R 20 series the next nearest sieve size has been used.