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

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Foreword

Publishing information

This part of PD 6682 is published by BSI Standards Limited, under licence from The British Standards Institution and came into effect on 30 November 2009. It was prepared by Technical Committee B/502 *Aggregates*. A list of organizations represented on this committee can be obtained on request to its secretary.

Supersession

PD 6682-1:2009+A1:2013 supersedes PD 6682-1:2009, which is withdrawn.

Information about this document

Text introduced or altered by Amendment No. 1 is indicated in the text by tags **A1** **A1**. Minor editorial changes are not tagged.

Relationship with other publications

This part of PD 6682 gives guidance on the use of BS EN 12620:2002+A1 which specifies requirements for aggregates for concrete.

Attention is drawn to the fact that BS EN 12620:2002+A1 fully takes into account the requirements of the European Commission mandate M125, *Aggregates* [1], given under the EU Construction Products Directive (89/106/EEC) [2].

This part of PD 6682 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. BS EN 12620:2002+A1 superseded BS 882:1992 and BS 1047:1983, which were withdrawn in June 2004.

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

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

Presentational conventions

The word "should" is used to express recommendations of this standard. The word "may" is used in the text to express permissibility, e.g. as an alternative to the primary recommendation of the Clause. The word "can" is used to express possibility, e.g. a consequence of an action or an event.

Contractual and legal considerations

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

Compliance with a Published Document cannot confer immunity from legal obligations.

Introduction

This part of PD 6682 provides guidance on the use of BS EN 12620:2002+A1 in the UK. BS EN 12620:2002+A1 superseded the corresponding conflicting British Standards for concreting aggregates, BS 882:1992 and BS 1047:1983. However, whilst BS EN 12620:2002+A1 describes concreting aggregates in a different manner to established UK practice (and in some cases with different test methods to evaluate aggregate properties), there is no change to the essential character of the aggregates in actual use in the UK.

BS EN 12620:2002+A1 has been amended twice since it was first published in 2002. In 2004, Corrigendum No. 1 corrected the CE Marking information in Annex ZA and amended a note about national regulations for dangerous substances. Amendment No. 1 introduced additional requirements for recycled aggregates and was published in June 2008.

This UK guidance recommends limiting values for aggregate properties within the ranges permitted in BS EN 12620:2002+A1. Where possible, these recommended values are equivalent to those previously specified in the superseded standards. This has ensured that there has been no change to the essential characteristics of the aggregates in actual use in the UK.

BS EN 12620:2002+A1 covers aggregates with an oven-dried particle density greater than 2.00 Mg/m^3 (2000 kg/m^3) for all concrete, including concrete conforming to BS EN 206-1:2000+A3. It also covers recycled aggregate with densities between 1.50 Mg/m^3 (1500 kg/m^3) and 2.00 Mg/m^3 (2000 kg/m^3) with appropriate caveats and fine recycled aggregate ($D = 4 \text{ mm}$ or less; see 4.1) with appropriate caveats. It is intended that BS EN 206-1:2000+A3 be used in conjunction with its complementary British Standards, BS 8500-1 and BS 8500-2, which gives national provisions where they are permitted in BS EN 206-1:2000+A3.

An example specification listing recommended BS EN 12620:2002+A1 aggregate designations for particular properties is provided in Annex A. It can be applied to most general uses of aggregates in concrete. For particular aggregate sources and/or end uses, specifiers might need to specify additional properties. Some recommended BS EN 12620:2002+A1 aggregate designations for particular aggregate sources and/or end uses in the UK are given in Annex B. Where requirements vary dependent on the particular end use, appropriate values need to be inserted for the particular properties.

BS EN 12620:2002+A1 now includes requirements for classification of the constituents of coarse recycled aggregate within its scope and indicates that their suitability needs to be assessed in accordance with the regulatory requirements in the place of use. In the UK, this can include compliance with the WRAP Quality Protocol for the production of aggregates from inert waste [3].

For concrete conforming to BS EN 206-1:2000+A3, there is further guidance in BS 8500-1 and BS 8500-2 on the use of recycled aggregates. BS 8500-1 uses two definitions of recycled aggregate that are not listed in BS EN 12620:2002+A1:

- RA: recycled aggregate principally comprising crushed masonry (brickwork and blockwork);
- RCA: recycled aggregate principally comprising crushed concrete.

NOTE Both parts of BS 8500 will be amended in due course to align the definition of RA and RCA with the categories now used in BS EN 12620:2002+A1.

1 Scope

It also covers recycled aggregate with densities between 1.50 Mg/m³ (1 500 kg/m³) and 2.00 Mg/m³ (2 000 kg/m³) with appropriate caveats and fine recycled aggregate ($D = 4$ mm or less) with appropriate caveats.

2 Normative references

BS EN 932-3:1997, *Tests for general properties of aggregates – Part 3: Procedure and terminology for simplified petrographic description*

BS EN 12620:2002+A1:2008, *Aggregates for concrete*

BS EN 16236, Evaluation of conformity of aggregate

3 Overview of BS EN 12620:2002+A1

3.1 General requirements

3.1.1 General

- geometrical properties, including grading, shape and fines content;
- mechanical and physical properties, including resistance to fragmentation;

- weathering properties, including freeze-thaw resistance;
- chemical properties, including sulfate and chloride content.

BS EN 12620:2002+A1 specifies the provision of data, when required by the purchaser, on other aggregate properties, but without limiting values.

3.1.2 Geometrical properties

The requirements specified in BS EN 12620:2002+A1 for the following geometrical properties are usually considered appropriate for aggregates used in concrete in the UK.

- a) Grading, measured by the washing and sieving test method specified in BS EN 933-1.
- b) Shape of coarse aggregate, measured by determining the flakiness index as specified in BS EN 933-3.
- c) Shell content of coarse aggregate, measured by the test method specified in BS EN 933-7.
- d) Fines content, measured as part of the washing and sieving test method specified in BS EN 933-1.

Further details are given in 4.2.

3.1.3 Mechanical and physical properties

The requirements specified in BS EN 12620:2002+A1 for the following mechanical and physical properties are usually considered appropriate for aggregates used in concrete in the UK.

- a) Resistance to fragmentation, measured by the Los Angeles test method as specified in BS EN 1097-2.
- b) Resistance to polishing of coarse aggregate to be used for surface courses, measured in accordance with BS EN 1097-8.
- c) Resistance to surface abrasion of coarse aggregate to be used for surface courses, measured in accordance with BS EN 1097-8.
- d) Particle density and water absorption, measured in accordance with BS EN 1097-6 and declared on request.
- e) Bulk density, measured in accordance with BS EN 1097-3 and declared on request.

Further details are given in 4.3.

3.1.4 Weathering ("durability") properties

Weathering properties are usually grouped under a characteristic known as "durability". Requirements for these weathering properties specified in BS EN 12620:2002+A1 are usually considered appropriate for aggregates used in concrete in the UK.

- a) Resistance to weathering, determined using the magnesium sulfate soundness test in accordance with BS EN 1367-2.
- b) Volume stability, determined using the drying shrinkage test in accordance with BS EN 1367-4.

Further details are given in 4.4.

3.1.5 Chemical requirements

The requirements specified in BS EN 12620:2002+A1 for the following chemical properties are usually considered appropriate for aggregates used in concrete in the UK, when tested in accordance with BS EN 1744-1:

- a) water-soluble chloride content (declared upon a request from the purchaser);
- b) acid-soluble chloride content of recycled aggregate (declared upon a request from the purchaser);
- c) acid-soluble sulfate content (declared upon a request from the purchaser);
- d) total sulfur content;
- e) water-soluble sulfate content of recycled aggregate;
- f) constituents which alter the rate of setting and hardening of concrete, measured by their effect on stiffening time and compressive strength;
- g) constituents which affect the volume stability (disintegration) of air-cooled blast-furnace slag.

Further details are given in 4.5.

3.2 Constituents of recycled aggregate

BS EN 12620:2002+A1 specifies requirements for the proportions of constituent materials in coarse recycled aggregate. These requirements are based on the sorting test specified in BS EN 933-11, with the results to be declared on request by the purchaser.

For recycled aggregates in the UK, the sorting test is also a requirement of the WRAP Quality Protocol [3].

Further details are given in 4.6.

3.3 Evaluation of conformity

A1 BS EN 12620 requires that producers undertake initial type tests and factory production control in accordance with BS EN 16236 to ensure that the product conforms to BS EN 12620 and to declared values as appropriate.

BS EN 16236 requires that producers undertake initial type tests relevant to the intended use to show conformity with BS EN 12620 in the following circumstances:

- a) to characterize properties for new sources of aggregates;
- b) where there is a major change in raw materials or processing which can affect the properties of the aggregates.

The results of the initial type tests are documented as the starting point of the factory production control for that material. Factory production control is used to monitor conformity of the aggregates with the relevant requirements and the producer's declared values.

For recycled aggregates in the UK, evaluation of conformity can also include compliance with the WRAP Quality Protocol [3].

BS EN 16236 specifies the minimum frequencies of tests in the requirements for factory production control. Further details are given in 4.7. **A1**

Guidance on the requirements for attestation of conformity and compliance with the provisions of the EU Construction Products Directive [2] is given in Clause 5.

4 Requirements of BS EN 12620:2002+A1

4.1 General

Each clause in BS EN 12620:2002+A1 that specifies aggregate properties starts with a general subclause which draws attention to the necessity to specify only those properties relevant to the particular aggregate and the end use of the aggregate. Where this is the case, the wording “when required” is used.

The tables of requirements in BS EN 12620:2002+A1 allow the purchaser to choose an appropriate “category” for each property. The style of the category designation is intended to be self-explanatory and related to the specified limiting value. For example, category Fl_{25} means that aggregates having a flakiness index with a maximum value of 25 are required.

BS EN 12620:2002+A1 describes the aggregate size in millimetres with the designation d/D , where d is the lower limiting sieve size and D is the upper limiting sieve size. Most of the particle size distribution of an aggregate lies between these two values and requirements for this are specified in BS EN 12620:2002+A1.

NOTE Whilst aggregate descriptions are identified as d/D in BS EN 12620:2002+A1, 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 $G_{C85/20}$.

A careful understanding of the grading requirements tables in BS EN 12620:2002+A1 is necessary. For example, $G_{C85/20}$ is the grading designation for a coarse aggregate with a minimum 85% passing the D size sieve and a maximum of 20% passing the d size sieve.

BS EN 12620:2002+A1 gives an option to use a “no requirement” category. For example, a fines content category of f_{NR} is included in BS EN 12620:2002+A1, which means that there is no specified requirement for fines content. A category f_3 , on the other hand, would require a limiting value of 3% by mass passing a 0.063 mm sieve. A different approach is normally adopted 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.

When the value obtained for a particular property is outside the indicated limit or categories, the producer can provide a declared value. For example, if the resistance to fragmentation of coarse aggregate measured by the Los Angeles (LA) 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.

4.2 Geometrical requirements

4.2.1 Aggregate sizes

BS EN 12620:2002+A1 specifies the following three options for sieve size ranges for use in the description of aggregate sizes:

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

In the UK, aggregates are generally supplied to the basic set plus set 2. The fine aggregate fraction described in BS EN 12620:2002+A1 is linked to a 4 mm size or less, with an oversize tolerance. Table 1 lists the recommended aggregate size designations for use in the UK.

Table 1 UK aggregate size

Aggregate type	Recommended BS EN 12620:2002+A1 designation
	mm
Graded aggregate	4/40 4/20 2/14
Single sized aggregate	20/40 10/20 6.3/14 4/10 2/6.3
All-in aggregate	0/40 0/20 0/10 0/6.3
Fine aggregate (sand)	0/4 (CP) ^{A)} 0/4 or 0/2 (MP) ^{A)} 0/2 or 0/1 (FP) ^{A)}

^{A)} The 0/4, 0/2 and 0/1 aggregate size designations conforming to BS EN 12620:2002+A1 provide concreting aggregates equivalent to Type C, M and F sands conforming to BS 882. For a further description of the coarseness or fineness of C, M and F sands, the designations CP, MP and FP described in BS EN 12620:2002+A1 may be used.

4.2.2 Sieve sizes

BS EN 12620:2002+A1 specifies 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 12620:2002+A1 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 12620:2002+A1 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 12620:2002+A1 basic set plus set 2 range.

The sieve sizes given in Table 2 are recommended for use in the UK for aggregates for concrete. The grading tables in Annex C, Annex D and Annex E use these sieve sizes.

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

Recommended sieves for the UK ^{A)} mm	Sieve sizes in the BS EN 12620:2002+A1 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	—	40	—	—
40	20	—	—	—
31.5	14	20	—	—
20	10	14	40	—
16	—	—	—	—
14	6.3	10	—	—
10	—	6.3	20	20
8	4	—	—	—
6.3	—	4	14	—
4	2	—	10	10
2.8	—	2	6.3	6.3
2	1	—	—	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 12620:2002+A1 basic set plus set 2 range of sieve sizes. However, where the sieves calculated are not exact sieve numbers in the ISO 565 R 20 series, the next nearest sieve size has been used.

4.2.3 Grading

4.2.3.1 General

Annex C, Annex D and Annex E detail the grading requirements of BS EN 12620:2002+A1 for coarse, fine and all-in aggregates in a tabulated form. The requirements listed in these annexes are given for each of the BS EN 12620:2002+A1 aggregate designations recommended in Table 1.

4.2.3.2 Coarse aggregates

General grading requirements for coarse aggregates are specified in BS EN 12620:2002+A1. Additional requirements for graded aggregates are also specified. To ensure consistency, these give overall limits for the percentage passing the mid-size sieve and the tolerances to be applied about a typical declared value passing the mid-size sieve.

4.2.3.3 Fine aggregates

BS EN 12620:2002+A1 specifies the oversize/undersize requirements to which fine aggregates are required to conform. Additional requirements in the form of tolerances to be applied about a declared typical grading are also given. These tolerances are recommended for use in normal concrete applications.

4.2.3.4 All-in aggregate

BS EN 12620:2002+A1 specifies the oversize/undersize requirements to which all-in aggregates are required to conform.

Additional requirements for all-in aggregates are also specified; these give overall limits for the percentage passing two intermediate sieves appropriate to the aggregate size.

4.2.3.5 Filler aggregate

In some European countries, minimum fines contents have been specified for concrete and the addition of a fine filler aggregate is permitted to minimize voids and/or bleeding in concrete. BS EN 12620:2002+A1 specifies grading requirements for filler aggregates that are finer than a 0.125 mm sieve.

4.2.3.6 Special use aggregate

BS EN 12620:2002+A1 specifies the requirements for special aggregate gradings, but it should be appreciated that these gradings will not normally be achievable without special processing.

4.2.4 Shape of coarse aggregates

BS EN 12620:2002+A1 specifies the shape of coarse aggregates; these are determined in terms of the flakiness index in accordance with BS EN 933-3. The BS EN 12620:2002+A1 categories for flakiness are listed in Table 3.

NOTE This flakiness index test differs from the superseded test specified in BS 812-105.1 because it is based on different dimensional ratios.

An option to use the shape index specified in BS EN 933-4 is given in BS EN 12620:2002+A1. It is not anticipated that this will be adopted in the UK.

Table 3 Limits for the flakiness of coarse aggregates

Type of aggregate/use	Recommended BS EN 12620:2002+A1 category
Uncrushed gravel	Fl_{50}
Crushed rock or crushed gravel	Fl_{35}
Special circumstances, e.g. pavement surface courses	Fl_{20}, Fl_{15}

4.2.5 Shell content of coarse aggregate

BS EN 12620:2002+A1 specifies two categories for shell content, i.e. < 10% by mass and > 10% by mass.

4.2.6 Fines content

The fines content specified in BS EN 12620:2002+A1 relates to the percentage passing a 0.063 mm sieve; the fines content categories recommended in the UK are listed in Table 4.

Table 4 Recommended BS EN 12620:2002+A1 categories for fines content

Type of aggregate	Recommended BS EN 12620:2002+A1 category
Uncrushed, partially crushed or crushed gravel coarse aggregate	$f_{1.5}$
Crushed rock coarse aggregate	f_4
Uncrushed, partially crushed or crushed gravel sand	f_3
Crushed rock sand	f_{16} (f_{10} for heavy duty floor finishes)
Gravel all-in aggregate	f_3
Crushed rock all-in aggregate	f_{11}

4.2.7 Fines quality

BS EN 12620:2002+A1 specifies requirements to ensure no harmful fines, e.g. swelling clay, are present. In the UK, fines contents are considered non-harmful provided the materials have been processed and conform to the fines content given in Table 4.

BS EN 12620:2002+A1 gives the option to assess harmful fines content using the sand equivalent or methylene blue tests. These tests are not considered sufficiently precise for the purpose of determining harmful fines content in fine aggregates for concrete in the UK. It is recommended that aggregates and filler aggregates should be assessed for harmful fines using either a fines content limit as specified in BS EN 12620:2002+A1 or evidence of satisfactory use.

4.3 Mechanical and physical requirements

4.3.1 Resistance to fragmentation of coarse aggregate

BS EN 12620:2002+A1 specifies, when required by the purchaser, the determination of resistance to fragmentation in terms of the Los Angeles coefficient in accordance with BS EN 1097-2.

A maximum Los Angeles coefficient value of 40 is recommended for normal concrete to ensure adequate aggregate quality.

The performance of concrete is not wholly dependent upon aggregate properties, but for these more demanding applications or high strength concrete it can be appropriate to specify a lower value of the Los Angeles coefficient, e.g. 30 or 35, unless experience of satisfactory performance is available. However, current evidence in the UK suggests that the specification of categories lower than LA_{30} is not usually justified or practicable.

Aggregates having Los Angeles coefficient values above 40 might also perform satisfactorily in normal concrete, but their strength and performance should be established in concrete trials before use.

4.3.2 Resistance to wear of coarse aggregate

BS EN 12620:2002+A1 specifies, when required by the purchaser, determination of resistance to wear in terms of the micro-Deval coefficient in accordance with BS EN 1097-1. This micro-Deval test is used particularly when interlocking particles rub together in an unbound pavement. It is not considered relevant to concrete other than cement bound pavement bases, e.g. cement bound granular mixtures, or where unusually weak aggregates are likely to break down and change grading during mixing or transportation of fresh concrete. In this latter case, experience of use can often be sufficient.

4.3.3 Resistance to polishing and abrasion of coarse aggregate to be used for surface courses

BS EN 12620:2002+A1 specifies, when required by the purchaser, the selection of a polished stone value (PSV) and/or an aggregate abrasion value (AAV), determined in accordance with the test methods in BS EN 1097-8. The minimum PSV and maximum AAV are dependent on the site category and traffic level. Guidance on appropriate values is given in the Highways Agency design manual for roads and bridges (DMRB) [4].

The requirements for resistance to abrasion by studded tyres in BS EN 12620:2002+A1 were specifically introduced for the testing of very hard aggregates that are used in countries that use studded tyres in winter. These requirements do not apply in the UK.

4.3.4 Particle density and water absorption

BS EN 12620:2002+A1 specifies, when required by the purchaser, the particle density and water absorption of the aggregate are determined in accordance with BS EN 1097-6 and the results declared. The individual clauses and annexes of BS EN 1097-6 contain different test methods that reflect the traditions of a number of countries.

The wire basket method for large coarse aggregate and the pycnometer method for coarse aggregate and fine aggregate are appropriate for use in the UK.

4.3.5 Bulk density

BS EN 12620:2002+A1 specifies, when required by the purchaser, the bulk density of the aggregate to be determined in accordance with BS EN 1097-3 and the results declared. The reference test method in BS EN 1097-3 determines the loose bulk density without compaction.

4.4 Weathering (durability) requirements

4.4.1 Freeze-thaw resistance

BS EN 12620:2002+A1 specifies that the determination of freeze-thaw resistance is only required when the aggregate is to be used in concrete subjected to a wet and freezing environment. An annex in BS EN 12620:2002+A1 gives guidance on the use of aggregates in an environment that is subject to freezing and thawing and indicates that the freeze-thaw resistance of concrete is related to the concrete mix proportions and the degree of air entrainment. The Annex recommends assessment by testing samples of concrete.

BS EN 12620:2002+A1 specifies the determination of freeze-thaw resistance in accordance with the test methods in BS EN 1367-1 or BS EN 1367-2. These test methods assess the resistance to freezing and thawing in terms of the size of the aggregate.

The magnesium sulfate soundness test specified in BS EN 1367-2 is recommended due to the availability of test equipment and experience in the UK. In this test method the 10 mm to 14 mm aggregate fraction from the same aggregate source is tested.

However, neither test method is sufficiently discriminating in the case of certain susceptible microporous flint aggregates. In such cases, the only guide is a knowledge of the source, experience of concrete made with the aggregate in question and knowledge of the effect of exposure to freeze-thaw conditions over several years.

For concrete exposed to freezing and thawing, BS EN 12620:2002+A1 lists categories for a range of climates. In most cases, the UK climate may be considered to be linked to an "Atlantic" climate although, exceptionally for terrain where very severe winter conditions are experienced, the "Continental" climate might be more appropriate.

BS EN 12620:2002+A1 suggests that a freeze-thaw test using salt solution might be appropriate for extreme situations: these circumstances are unlikely to occur in the UK. The test method is now published as BS EN 1367-6.

4.4.2 Volume stability – Drying shrinkage

BS EN 12620:2002+A1 specifies that the drying shrinkage of aggregates used in structural concrete is not greater than 0.075%, when required by the purchaser. Advice is also given on the use of aggregates with higher drying-shrinkage values.

4.5 Chemical requirements

4.5.1 Chlorides

BS EN 12620:2002+A1 specifies the determination and declaration of water-soluble chloride ion content in accordance with BS EN 1744-1. Where the water-soluble chloride ion content is known to be 0.01% or lower, this value may be used in calculations for the chloride ion content of the concrete.

BS EN 12620:2002+A1 specifies, when required by the purchaser, the determination and declaration of the acid-soluble chloride ion content of recycled aggregates in accordance with BS EN 1744-5.

4.5.2 Sulfur containing compounds

4.5.2.1 Acid-soluble sulfate

Categories are specified in BS EN 12620:2002+A1 for the acid-soluble sulfate content of an aggregate. Different categories are specified for air-cooled blast-furnace slag. Recommended categories for UK aggregates are given in Table 5.

Table 5 Recommended categories for acid-soluble sulfate content

Aggregate	Recommended BS EN 12620:2002+A1 category for UK
Aggregates other than air-cooled blast-furnace slag	AS _{0,8}
Air-cooled blast-furnace slag	AS _{1,0}

4.5.2.2 Total sulfur

Pyrrhotite is not usually found in UK aggregates and, unless specific information on its presence is known, the normal requirements for total sulfur in BS EN 12620:2002+A1 may be adopted.

BS EN 12620:2002+A1 specifies a limit on the total sulfur content to 1% by mass for aggregates other than blast-furnace slag. A limit of 2% by mass is required if blast-furnace slag is to be used.

For current UK aggregate sources where the measured value of total sulfur content during initial testing is 0.1% by mass or less, it is not necessary to undertake further testing. In this case, the total sulfur content can be assumed to conform to the 1% limit unless there is a significant change in the source quarry deposit.

4.5.2.3 Water-soluble sulfate content of recycled aggregate

BS EN 12620:2002+A1 specifies, when required by the purchaser, the determination and declaration of the water-soluble sulfate content of recycled aggregates in accordance with BS EN 1744-1. It is unlikely that this requirement will be used in the UK for aggregates used in concrete because the requirement for acid-soluble sulfate content provides an adequate level of control.

The “hot water” test method for the water-soluble sulfate content of recycled aggregate is different to that for natural and manufactured aggregates. The two methods can be expected to give different results.

NOTE This requirement was introduced by Amendment No. 1 to BS EN 12620:2002.

4.5.3 Other constituents

4.5.3.1 Rate altering constituents

Where the presence of constituents which alter the rate of setting and hardening of concrete is suspected, the requirements of BS EN 12620:2002+A1 apply. However, with current processing in the

UK the significant presence of such substances is likely to be rare and testing is not normally necessary.

BS EN 12620:2002+A1 specifies, when required by the purchaser, the determination and declaration of the influence of water-soluble materials from recycled aggregates on the initial setting time of cement paste, using the test method specified in BS EN 1744-6.

4.5.3.2 Constituents which affect the volume stability of air-cooled blast-furnace slag

BS EN 12620:2002+A1 specifies requirements for constituents which affect the volume stability of air-cooled blast-furnace slag.

4.5.4 Carbonate content of fine aggregates for concrete pavement surface courses

BS EN 12620:2002+A1 specifies, when required by the purchaser, testing in accordance with BS EN 196-21 to determine calcium carbonate content in fine aggregate, including any filler aggregates, for use in surface courses. Any limits required by the purchaser on carbonate content should be detailed in the aggregate specification, an example of which is given in Annex A.

4.6 Constituents of coarse recycled aggregates

BS EN 12620:2002+A1 requires the proportions of constituent materials in coarse recycled aggregate to be determined in accordance with a visual sorting test in accordance with BS EN 933-11. This allows the producer to declare conformity with the categories for constituents of coarse recycled aggregate in BS EN 12620:2002+A1.

The constituents of coarse recycled aggregate are divided into the groups listed in Table 6. The list of groups is similar but not identical to the established UK method in clause 710 of the Highways Agency's Specification for Highway Works (SHW) [5].

NOTE This requirement was introduced by Amendment No. 1 to BS EN 12620:2002.

Table 6 Constituents of coarse recycled aggregate

Constituent	Description
Rc	Concrete, concrete products, concrete masonry units, mortar
Ru	Unbound aggregates, natural stone, hydraulically bound aggregate
Rb	Clay masonry units (brick and tile), calcium silicate masonry units, aerated non-floating concrete
Ra	Bituminous materials
Rg	Glass
X	Other, including: cohesive clay and soil, wood, plastic and rubber, gypsum plaster and miscellaneous, including metals
FL	Floating materials (measured by volume)

Some examples of how the categories may be used are given in Annex F.

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4.7 Evaluation of conformity

4.7.1 General

BS EN 12620 contains requirements for the evaluation of conformity necessary for producers to demonstrate that their products conform to BS EN 12620. These requirements are specified in BS EN 16236 and are divided into:

- a) initial type tests;
- b) factory production control.

The procedures described in this subclause are part of the procedure for attestation of conformity to be used for demonstrating compliance with the requirements of the EU Construction Products Directive [2].

As is explained in the scope to BS EN 12620:2002+A1, unfamiliar materials from secondary sources when placed on the market as aggregates might be covered by national regulations for dangerous substances.

4.7.2 Initial type tests

Initial type testing is a series of tests carried out on the aggregate, relevant to its intended end use, before it is first placed on the market. This testing is used to identify the categories specified within BS EN 12620 and BS EN 16236 to which the aggregate conforms.

Initial type testing is required for new sources, if there is a major change in raw materials or when the aggregate is to conform to a new requirement for which it has not previously been tested.

Where aggregate users require additional data or properties for particular uses of the aggregate, these should be requested prior to ordering, allowing sufficient time for testing.

4.7.3 Factory production control

Factory production control is the means of defining the quality system which producers are required to operate to demonstrate ongoing conformity of their product to the relevant European Standard, in this case, BS EN 12620. Detailed requirements for factory production control are given in BS EN 16236.

For recycled aggregate, factory production control is also part of the WRAP Quality Protocol [3].

NOTE The WRAP Quality Protocol [3] requires the delivery documentation to state that the aggregate was produced under a system for factory production control conforming to the Protocol.

4.8 Designation and description

Aggregates should be identified in the following terms.

- a) Source and producer: where an aggregate is rehandled in a depot, both the original source and depot should be given.
- b) Type of aggregate: BS EN 932-3 should be consulted for specific guidance as required by BS EN 12620:2002+A1. Essentially, when a rock or mineral is predominant (more than 50%), its presence is reflected in the name of the material, e.g. "quartzose" sand and "basaltic" gravel. When no single type is predominant, the

material is said to be heterogeneous and its name can include the most frequent types, e.g. heterogeneous "siliceous" gravel and heterogeneous "quartzo-feldspathic" sand. For the UK, shortened local versions continue to be adopted and full petrographic descriptions made available on request to the producer. Use the phrase "recycled aggregate" for recycled aggregate.

- c) Constituent categorization for recycled aggregate.
- d) Aggregate size.

4.9 Marking and labelling

Delivery tickets are required by BS EN 12620:2002+A1 to contain their serial number, the aggregate designation, date of dispatch and the European Standard identifier, i.e. BS EN 12620:2002+A1.

For recycled aggregate, the delivery documents should also confirm that the aggregate was produced to a quality protocol for the production of aggregates from inert waste (for example, the WRAP Quality Protocol [3]).

5 Provisions of the EU Construction Products Directive

BS EN 12620:2002+A1 addresses the provisions of the EU Construction Products Directive [2]. Both BS EN 12620:2002+A1 and its annex addressing essential requirements or other provisions of EU Directives have been produced under a Mandate [1] given by the European Commission and the European Free Trade Association to CEN.

BS EN 12620:2002+A1 Annex ZA addressing essential requirements or other provisions of EU Directives is described as "informative" but its requirements become mandatory to ensure conformity to the Mandate [1] and/or where CE marking is applicable to aggregates.

BS EN 12620:2002+A1 indicates the characteristics that are subject to regulatory requirements for the specified application in one or more European Member States. There is no obligation to determine or declare a value for a characteristic in a Member State where there is no regulatory requirement for that characteristic unless it is subject to a "threshold" value.

Conformity to these identified requirements confers a prescription of fitness of the aggregate and fillers for the intended uses indicated in the scope of BS EN 12620:2002+A1. However, to meet the provisions of the EU Construction Products Directive [2] fully, aggregates are also required to conform to any transposed European legislation and national laws relating to any dangerous substances referred to in the clauses of BS EN 12620:2002+A1.

BS EN 12620:2002+A1 makes reference to the type of compliance requirement, for example:

- pass/fail threshold value;
- categories;
- declared value.

BS EN 12620:2002+A1 also details the allowed levels for attestation of conformity as "2+" or "4". The requirements of the two levels are summarized in Table 7.

Table 7 Levels of attestation of conformity in accordance with the EU Construction Products Directive and referred to in BS EN 12620:2002+A1

	Conformity attestation EU numbering system	
	2+	4
Tasks for the producer		
Factory production control	Yes	Yes
Further testing of samples taken at a factory according to a prescribed test plan	Yes	No
Initial type testing	Yes	Yes
Tasks for third party notified accreditation body		
Certification of factory production control	Yes	No
Surveillance of factory production control	Yes	No

In the UK, the level of attestation for aggregates is “4”, with the exception of aggregates for use in skid resistant surfacings.

Coarse aggregates for use in skid resistant surfacings have been defined as high specification aggregates with an influence on road safety. As a consequence of this status, aggregates with a declared PSV of 58 or higher, are subject to a level of attestation of “2+”.

When the purchaser has particular concerns that the integrity of the aggregate will have a major impact on either of the following, they should adopt appropriate contract specific quality assurance procedures or acceptance testing regimes for other applications to give the required degree of confidence in:

- a) safety when in use;
- b) other performance properties of an installation (for example, concrete applications involving the storage or containment of dangerous substances).

It is not appropriate to expect higher attestation of conformity requirements, as these are general national requirements related to the demonstration of fitness to be placed on the market for general use and are not readily flexible to meet specific contract needs. However, wherever possible such additional requirements should follow the same basic format as those in BS EN 12620:2002+A1.

BS EN 12620:2002+A1 Annex ZA describes the requirements for CE marking and labelling.

The UK and two other EU Member States do not currently consider that there is a mandatory requirement to CE mark products. Consequently there is no current legal requirement to CE mark aggregates supplied within the UK or to or from Ireland and Sweden. CE marking will be required for aggregates supplied to or within other Member States translated into the language of the Member State supplied.

If producers decide to CE mark their aggregates, they need to comply with the indicated requirements. Where the CE mark identifies a particular characteristic, the supplier is required to indicate the category or declared value appropriate to the aggregate. The purchaser is responsible for confirming that the declaration of properties on the CE mark conforms to their particular requirements.

It should also be noted that, where aggregates are placed on the market in a European Member State where there is no regulatory requirement for a particular characteristic, the supplier is not required to determine the performance for this characteristic. In this case "No performance determined" may be stated in the CE mark information.

The Annex in BS EN 12620:2002+A1 that addresses essential requirements or other provisions of EU Directives also provides a link with national regulations for dangerous substances. Procedures to ensure compliance with national regulations are still being developed.

6 Additional considerations

In addition to BS EN 12620:2002+A1, particular attention should be given to the following.

- a) Advice on alkali aggregate reaction is given in CR 1901, Concrete Society Technical Report No. 30 [6], BRE Digest 330 [7], BS 8500-1 and BS 8500-2.
- b) The presence of materials in aggregates, such as iron pyrites, particles of coal and lightweight contaminators can mar the surface of the concrete. Where the appearance of the concrete is important, a knowledge of the aggregate source and of similar work that has been carried out with the aggregate in question can be more helpful than setting any particular limits on the content of such contaminators. Any limits should be agreed between the purchaser and supplier.
- c) Deterioration of building blocks and some other concrete made using mine waste, generally known as mundic, has occurred in Cornwall and Devon. This is apparently caused by instability of some pyritic and/or slaty rock constituents. Further information is given in a Royal Institution of Chartered Surveyors guide on the mundic problem [8]. It recommends sampling, examination and classification procedures for suspect concrete building materials in Cornwall or parts of Devon.
- d) Advice on the thaumasite form of sulfate attack is included in BRE Special Digest 1 on concrete in aggressive ground [9] and BS 8500-1.
- e) Unstable sulfide minerals are unusual constituents of aggregates in the UK. Some forms of pyrite (or related phases) are reactive and in some circumstances can give rise to problems in concrete, e.g. mundic or thaumasite sulfate attack.
- f) Marine aggregates and some inland aggregates can contain chlorides. Chlorides can also be contained in other constituents of concrete. It is the responsibility of the concrete producer to calculate the total chloride content of a concrete from the chloride contents of the various constituents and to ensure that an appropriate maximum value is not exceeded. Such maximum values are given in BS 8500-2 and other relevant codes of practice.

Annex A (informative) Example specification

An example specification, which can be applied to most general uses of aggregates in concrete, is given in Table A.1.

Table A.1 Recommended BS EN 12620:2002+A1 designations for concreting aggregates for general uses

Properties	BS EN 12620:2002+A1 category
Grading:	
Coarse aggregate	See Annex C
Fine aggregate	See Annex D
All-in aggregate	See Annex E
Filler aggregate	See BS EN 12620:2002+A1
Flakiness index:	
Uncrushed gravel	FI_{50}
Crushed rock or crushed gravel	FI_{35}
Shell content of coarse aggregate	< 10% by mass
Fines content:	
uncrushed, partially crushed or crushed gravel coarse aggregate	$f_{1.5}$
Crushed rock coarse aggregate	f_4
Uncrushed, partially crushed or crushed gravel sand	f_3
Crushed rock sand	f_{16} (f_{10} for heavy duty floor finishes) ^{A)}
Gravel all-in aggregate	f_3
Crushed rock all-in aggregate	f_{11}
Resistance to fragmentation	LA_{40}
Acid-soluble sulfate content:	
aggregates other than air-cooled blast-furnace slag	$AS_{0.8}$
air-cooled blast-furnace slag	$AS_{1.0}$
Total sulphur:	
aggregates other than air-cooled blast-furnace slag	< 1% by mass ^{B)}
air-cooled blast-furnace slag	< 2% by mass ^{B)}
Volume stability of air-cooled blast-furnace slag	Free from dicalcium silicate and iron disintegration

^{A)} Where options occur when identifying particular uses, delete non-applicable properties or requirements.

^{B)} If pyrrhotite is present in the aggregate, limit the maximum total sulfur content to 0.1% by mass.
See also Clause 5, item e) for further considerations regarding unstable sulfide minerals.

Annex B (informative) Recommended BS EN 12620:2002+A1 aggregate designations for particular aggregate sources and/or end uses in the UK

The recommended BS EN 12620:2002+A1 aggregate designations for particular sources and/or end uses are given in Table B.1.

Table B.1 Additional recommended BS EN 12620:2002+A1 designations for particular aggregate sources and/or end uses

End use ^{A)}	Property ^{A)}	BS EN 12620:2002+A1 category
Exposed aggregate surface courses	Polishing resistance	$PSV_{xx}^{B)}$
	Resistance to wear	$M_{DExx}^{B)}$
	Resistance to abrasion	$AAV_{xx}^{B)}$
Concrete subject to freeze-thaw environment:		
Frost free or continuously dry or moderate water saturation ^{C)} (BS EN 206-1:2000+A3 exposure classes XF1 and XF2)	Magnesium sulfate soundness	— No requirement (MS_{NR})
High water saturation ^{C)} without de-icing agent (BS EN 206-1:2000+A3 exposure class XF3)		MS_{25}
High water saturation ^{C)} with de-icing agent (BS EN 206-1:2000+A3 exposure class XF4)		MS_{18}
Structural concrete	Drying shrinkage	< 0.075
Pavement surface courses and heavy duty concrete floor finishes	Los Angeles co-efficient	$LA_{xx}^{B)}$
Fine aggregates for concrete pavement surface courses	Carbonate content	$< 25\%$

^{A)} Where options occur when identifying particular uses, delete non-applicable properties or requirements i.e., not to be included in the aggregate specification.

^{B)} Values for these properties, appropriate for the end use, to be inserted from available categories in BS EN 12620:2002+A1. Further guidance is available in the Highways Agency design manual for roads and bridges (DMRB) [4].

^{C)} The degree of water saturation is taken as reflecting the relative frequency of the likely occurrence of freezing whilst wet, i.e. moderate = occasional freezing when wet, and high = frequent freezing when wet.

Annex C (informative)

Recommended BS EN 12620:2002+A1 overall grading limits for coarse aggregate

The recommended BS EN 12620:2002+A1 overall grading limits for coarse aggregate for concrete for general uses are given in Table C.1.

Table C.1 Overall grading limits for coarse aggregates classified by BS EN 12620:2002+A1 categories $G_{C90/15}$, $G_{C85/20}$ or $G_{C80/20}$

Sieve size mm	Percentage by mass passing ISO 565 sieve for coarse aggregate size (d/D)							
	Graded aggregates ^{A)}			Single sized aggregates				
	4/40 ^{B)}	4/20 ^{B)}	2/14 ^{B)}	20/40 ^{C)}	10/20 ^{C)}	6.3/14 ^{C)}	4/10 ^{C)}	2/6.3 ^{D)}
80	100	—	—	100	—	—	—	—
63	98 to 100	—	—	98 to 100	—	—	—	—
40	90 to 99 ^{E)}	100	—	85 to 99 ^{E)}	100	—	—	—
31.5	—	98 to 100	100	—	98 to 100	100	—	—
20	25 to 70 ^{A)}	90 to 99 ^{E)}	98 to 100	0 to 20	85 to 99 ^{E)}	98 to 100	100	—
16	—	—	—	—	—	—	—	—
14	—	—	90 to 99 ^{E)}	—	—	85 to 99 ^{E)}	98 to 100	100
10	—	25 to 70 ^{A)}	—	0 to 5	0 to 20	—	85 to 99 ^{E)}	98 to 100
8	—	—	—	—	—	—	—	—
6.3	—	—	25 to 70 ^{A)}	—	—	0 to 20	—	80 to 99 ^{E)}
4	0 to 15	0 to 15	—	—	0 to 5	—	0 to 20	—
2.8	—	—	—	—	—	0 to 5	—	—
2	0 to 5	0 to 5	0 to 15	—	—	—	0 to 5	0 to 20
1	—	—	0 to 5	—	—	—	—	0 to 5

A) BS EN 12620:2002+A1 specifies that for certain graded aggregates, the producer is required to document and, on request, declare the typical grading passing the mid-size sieve. BS EN 12620:2002+A1 specifies tolerance categories of G_{T15} and $G_{T17.5}$. The tolerance category, $G_{T17.5}$, applies to 4/40, 4/20 and 2/14 graded aggregates, i.e. a tolerance of $\pm 17.5\%$ is allowed on the producer's declared typical grading, within the overall grading.

B) Category $G_{C90/15}$.

C) Category $G_{C85/20}$.

D) Category $G_{C80/20}$.

E) The inclusion of 99% in lieu of 100% is to ensure consistency and to prevent smaller size aggregate being classified as D sized aggregate. However, BS EN 12620:2002+A1 permits the percentage passing D to be greater than 99% by mass, but in such cases the producer is required to document and declare the typical grading including the sieves D , d , $d/2$ and sieves in the basic set plus set 2 intermediate between d and D .

Annex D (informative)

Recommended BS EN 12620:2002+A1 overall grading limits for fine aggregates

The recommended BS EN 12620:2002+A1 overall grading limits for fine aggregates for concrete for general uses are given in Table D.1.

Table D.1 Overall grading limits for fine aggregates classified by BS EN 12620:2002+A1 category G_F85

Sieve size mm	Percentage by mass passing ISO 565 sieve for fine aggregate size (<i>d/D</i>)				
	0/4 (CP) ^{A)}	0/4 (MP) ^{A)}	0/2 (MP) ^{A)}	0/2 (FP) ^{A)}	0/1 (FP) ^{A)}
8	100	100	—	—	—
6.3	95 to 100	95 to 100	—	—	—
4	85 to 99 ^{B)} (±5)	85 to 99 ^{B)} (±5)	100	100	—
2.8	—	—	95 to 100	95 to 100	—
2	—	—	85 to 99 ^{B)} (±5)	85 to 99 ^{B)} (±5)	100
1	(±20)	(±20)	(±20)	(±20)	85 to 99 ^{B)} (±5)
0.5	5 to 45	30 to 70	30 to 70	55 to 100	55 to 100
0.250	(±20)	(±20)	(±25)	(±25)	(±25)
0.063	(±3)	(±3)	(±5)	(±5)	(±5)

NOTE The producer should document and, on request, declare the typical grading for which the required tolerances are given in brackets.

^{A)} Category G_F 85.

^{B)} The inclusion of 99% in lieu of 100% is to ensure consistency and to prevent smaller size aggregate being classified as *D* sized aggregate. However, BS EN 12620:2002+A1, Table 2 specifies that the percentage passing *D* may be greater than 99% by mass, but in such cases the producer is required to document and declare the typical grading including the sieves *D*, *d*, *d/2* and sieves in the basic set plus set 2 intermediate between *d* and *D*.

Annex E (informative)

Recommended BS EN 12620:2002+A1 overall grading limits for all-in aggregates

The recommended BS EN 12620:2002+A1 overall grading limits for all-in aggregates for concrete for general uses are given in Table E.1.

Table E.1 Overall grading limits for all-in aggregates classified by BS EN 12620:2002+A1 category G_{A90}

Sieve size mm	Percentage by mass passing ISO 565 sieve for all-in aggregate size (d/D)			
	0/40 ^{A)}	0/20 ^{A)}	0/10 ^{A)}	0/6.3 ^{A)}
80	100	—	—	—
63	98 to 100	—	—	—
40	90 to 99 ^{B)}	100	—	—
31.5	—	98 to 100	—	—
20	50 to 90	90 to 99 ^{B)}	100	—
16	—	—	—	—
14	—	—	98 to 100	100
10	—	50 to 90	90 to 99 ^{B)}	98 to 100
8	—	—	—	—
6.3	—	—	—	90 to 99 ^{B)}
4	20 to 60	—	50 to 90	50 to 90
2	—	20 to 60	—	—
1	—	—	20 to 60	20 to 60
0.250	—	—	—	—
0.125	—	—	—	—
0.063	—	—	—	—

^{A)} Category G_{A90} .

^{B)} The inclusion of 99% in lieu of 100% is to ensure consistency and to prevent smaller size aggregate being classified as D sized aggregate. However, BS EN 12620:2002+A1 specifies that the percentage passing D may be greater than 99% by mass, but in such cases the producer is required to document and declare the typical grading including the sieves D , d , $d/2$ and sieves in the basic set plus set 2 intermediate between d and D . Sieves with a ratio of less than 1.4 times the next lower sieve may be excluded.

Annex F (informative)

Examples of specifications using categories for the constituents of coarse recycled aggregates

F.1 Recycled aggregate (RA) for use in concrete

Recycled aggregate is defined in BS 8500-1 as "aggregate resulting from the reprocessing of inorganic material previously used in construction". BS 8500-2:2006, Table 2 gives requirements for the maximum proportion of a number of constituents. An equivalent categorization for recycled aggregate is given in Table F.1.

Table F.1 Categorization for recycled aggregate for use in concrete

Description	Constituent code	BS 8500-2:2006 requirement (by mass)	BS EN 12620:2002+A1 category
Concrete, concrete products, mortar	Rc + Ru	100% max.	Rcu_{50} (greater than 50%)
Unbound aggregates, natural stone etc.			
Masonry units (brick and tile), aerated non-floating concrete etc.	Rb		Rb_{50-} (less than 50%)
Bituminous materials	Ra	10% max.	Ra_{10-}
Other + glass	X + Rg	1.0% max.	XRg_{1-}
Floating materials (measured by volume)	FL	1.0% max.	FL_{2-} (measured as cm ³ /kg)

F.2 Recycled concrete aggregate (RCA) for use in concrete

Recycled concrete aggregate is defined in BS 8500-1 as "recycled aggregate principally comprising crushed concrete". BS 8500-2:2006, Table 2 gives requirements for the maximum proportion of a number of constituents. An equivalent categorization for recycled concrete aggregate is given in Table F.2.

Table F.2 Categorization for recycled concrete aggregate for use in concrete

Description	Constituent code	BS 8500-2:2006 requirement (by mass)	BS EN 12620:2002+A1 category
Concrete, concrete products, mortar	Rc	Not defined	Rc_{80} (greater than 80%)
Unbound aggregates, natural stone etc.	Ru	Not defined	—
Masonry units (brick and tile), aerated non-floating concrete etc.	Rb	5% max.	Rb_{10-} (less than 10%)
Bituminous materials	Ra	5% max.	Ra_{5-}
Other + glass	X + Rg	1.0% max.	XRg_{1-}
Floating materials (measured by volume)	FL	1.0% max.	FL_{2-} (measured as cm ³ /kg)

Bibliography

Standards publications

For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 812-105.1, *Testing aggregates – Part 105: Methods for the determination of particle shape – Section 105.1: Flakiness index*

BS 882:1992, *Specification for aggregates from natural sources for concrete* (withdrawn)

BS 1047:1983, *Specification for air-cooled blastfurnace slag aggregate for use in construction* (withdrawn)

BS 8500-1, *Concrete – Complementary British Standard to BS EN 206-1 – Part 1: Method of specifying and guidance for the specifier*

BS 8500-2:2006, *Concrete – Complementary British Standard to BS EN 206-1 – Part 2: Specification for constituent materials and concrete*

BS EN 196-21, *Methods of testing cement – Part 21: Determination of the chloride, carbon dioxide and alkali content of cement*

BS EN 206-1:2000+A3:2006, *Concrete – Part 1: Specification, performance, production and conformity*

BS EN 933-1, *Tests for geometrical properties of aggregates – Part 1: Determination of particle size distribution – Sieving method*

BS EN 933-3:1997, *Tests for geometrical properties of aggregates – Part 3: Determination of particle shape – Flakiness index*

BS EN 933-4, *Tests for geometrical properties of aggregates – Part 4: Determination of particle shape – Shape index*

BS EN 933-7, *Tests for geometrical properties of aggregates – Part 7: Determination of shell content – Percentage of shells in coarse aggregates*

BS EN 933-11, *Tests for geometrical properties of aggregates – Part 11: Classification test for the constituents of coarse recycled aggregate*

BS EN 1097-1, *Tests for mechanical and physical properties of aggregates – Part 1: Determination of the resistance to wear (micro-Deval)*

BS EN 1097-2, *Tests for mechanical and physical properties of aggregates – Part 2: Methods for the determination of resistance to fragmentation*

BS EN 1097-3, *Tests for mechanical and physical properties of aggregates – Part 3: Determination of loose bulk density and voids*

BS EN 1097-6, *Tests for mechanical and physical properties of aggregates – Part 6: Determination of particle density and water absorption*

BS EN 1097-8, *Tests for mechanical and physical properties of aggregates – Part 8: Determination of the polished stone value*

BS EN 1367-1, *Tests for thermal and weathering properties of aggregates – Part 1: Determination of resistance to freezing and thawing*

BS EN 1367-2, *Tests for thermal and weathering properties of aggregates – Part 2: Magnesium sulfate test*

BS EN 1367-4, *Tests for thermal and weathering properties of aggregates – Part 4: Determination of drying shrinkage*

BS EN 1367-6, *Tests for thermal and weathering properties of aggregates – Part 6: Determination of resistance to freezing and thawing in the presence of salt (NaCl)*

BS EN 1744-1, *Tests for chemical properties of aggregates – Part 1: Chemical analysis*

BS EN 1744-5, *Tests for chemical properties of aggregates – Part 5: Determination of acid soluble chloride salts*

BS EN 1744-6, *Tests for chemical properties of aggregates – Part 6: Determination of the influence of recycled aggregate extract on the initial setting time of cement*

BS EN 13055-1, *Lightweight aggregates – Part 1: Lightweight aggregates for concrete, mortar and grout*

ISO 565, *Test sieves – Metal wire cloth, perforated metal plate and electroformed sheet – Nominal sizes of openings*

CR 1901, *Regional specifications and recommendations for the avoidance of damaging alkali-silica reactions in concrete*

Other publications

- [1] COUNCIL OF THE EUROPEAN COMMUNITIES. M/125: Mandate to CEN and CENELEC concerning the execution of standardisation work for harmonised standards on aggregates, Brussels: 1998.
- [2] EUROPEAN COMMUNITIES. Council Directive 89/106/EEC. of 21 December 1988 on the approximation of laws, regulations and administrative provisions of the Member States relating to construction products. Luxembourg: Office for Official Publications of the European Communities (EUR-OP), 1988.
- [3] WASTE RESOURCES ACTION PROGRAMME. *The Quality Protocol for the production of aggregates from inert waste*. 2005.¹⁾
- [4] HIGHWAYS AGENCY, *Design manual for roads and bridges, Volume 7: Pavement design and maintenance*. London: TSO.²⁾
- [5] HIGHWAYS AGENCY, *Specification for Highway Works*. London: TSO.²⁾
- [6] CONCRETE SOCIETY. Concrete Society Technical Report No. 30, *Alkali-silica reaction: minimizing the risk of damage to concrete*, 3rd edition. Crowthorne: Concrete Society, 1999.³⁾
- [7] BUILDING RESEARCH ESTABLISHMENT. BRE Digest 330, *Alkali-silica reaction in concrete*, Watford: BRE, 1999.⁴⁾

¹⁾ Available from www.wrap.org.uk

²⁾ Available from www.tso.co.uk for www.standardsforhighways.co.uk

³⁾ Available from www.concrete.org.uk

⁴⁾ Available from www.bre.co.uk

- [8] ROYAL INSTITUTION OF CHARTERED SURVEYORS, *The mundic problem: a guidance note*, 2nd edition, London: RICS Books, 1997.⁵⁾
- [9] BUILDING RESEARCH ESTABLISHMENT. BRE Special Digest 1, *Concrete in aggressive ground*, Watford: BRE, 2001.⁶⁾

⁵⁾ Available from www.rics.org.uk

⁶⁾ Available from www.bre.co.uk

