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Aggregates —

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

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Contents

Foreword

This Published Document has been prepared under the direction of Subcommittee B/502/5, Lightweight 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 Conflicting British Standards relating to aggregates will be withdrawn at the latest by June 2004.

This part of PD 6682 gives guidance on the use of BS EN 13055-1 which specifies requirements for lightweight aggregates for concrete, mortar and grout. BS EN 13055-1 supersedes BS 3797:1990 which will be withdrawn in June 2004.

NOTE Users of BS 3797:1990 should contact BSI Customer Services for confirmation of withdrawal.

Attention is drawn to the fact that BS EN 13055-1 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 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 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: Armourstone — Guidance on the use of BS EN 13383 (all parts).*

— *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 10, 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 13055-1 which supersedes BS 3797:1990, the corresponding conflicting British Standard for lightweight aggregates for masonry units and structural concrete.

Compared to BS 3797, BS EN 13055-1 describes lightweight aggregates for the wider range of concrete, mortar and grout, describing them in a different manner and in some cases using different test methods to evaluate properties. Despite the wider field of application and different test methods there is no change to the essential character of lightweight aggregates in use in the UK.

BS 3797 specifies requirements for aggregates of pumice, expanded clay, shale and slate, clinker and furnace bottom ash and those based on pulverized fuel ash and blast-furnace slag. BS EN 13055-1 does not give such a prescriptive list of aggregates but instead defines lightweight aggregates in terms of an upper density limit. This means that perlite and vermiculite, which are not covered in BS 3797, fall within the scope of BS EN 13055-1.

BS EN 13055-1 specifies no limiting values other than requiring that lightweight aggregates have an upper particle density limit of 2 000 kg/m^3 or an upper loose bulk density limit of 1 200 kg/m^3. Tolerances for the declared values of both particle density and loose bulk density are specified in BS EN 13055-1:2002, **4.2**.

Aggregate sizes in BS EN 13055-1 are described in a different manner to BS 3797. The prescriptive grading tables in BS 3797 have been replaced by a table of sieve sizes from which upper and lower sieve sizes can be selected to designate the aggregate supplied. The requirement in BS EN 13055-1:2002, **4.4** specifies that particle size distribution shall be determined and declared. This provides purchasers with the necessary information on the gradation of aggregate sizes not otherwise provided by the upper and lower sieve sizes. Tolerances for the declared values of aggregate size are specified in BS EN 13055-1:2002, **4.3**.

Aggregate users should establish any limiting values of chemical properties appropriate to the application. The selection of a lightweight aggregate should be made by considering their combination with other constituents on the basis of values for specific chemical properties. Guidance on the effect of some chemical constituents of lightweight aggregates on the durability of concrete, mortar and grout is given in BS EN 13055-1:2002, Annex E. A procedure for converting chemical contents measured by mass to chemical contents by volume, to take account of the lower density of lightweight aggregates, is given in BS EN 13055-1:2002, Annex D.

BS EN 13055-1 includes recycled aggregates within its scope and indicates that their suitability should be assessed in accordance with the regulations valid in the place of use.

In response to the range of regulatory requirements for aggregates found in other CEN Member States, BS EN 13055-1 contains more requirements than BS 3797. BS EN 13055-1 is written in such a way that allows these additional requirements to be invoked only in those Member States where regulatory requirements exist, in addition to when they are appropriate to the end use of the aggregate.

BS EN 13055-1 includes three test methods as annexes. These are BS EN 13055-1:2002, Annex A, Annex B and Annex C. It is intended that these test methods will be published as separate European Standards when BS EN 13055-1 is revised. All other test methods specified in BS EN 13055-1 are described in separate European test method standards.

1 Scope

This part of PD 6682 gives guidance on the use of BS EN 13055-1 in the UK. BS EN 13055-1 which specifies the properties of lightweight aggregates and lightweight filler aggregates obtained by processing natural, manufactured, by-product or recycled materials and mixtures of these aggregates for use in concrete, mortar and grout in buildings, roads and civil engineering works.

BS EN 13055-1 covers lightweight aggregates of mineral origin having particle densities not exceeding 2 000 kg/m^3 (2.00 Mg/m^3) or loose bulk densities not exceeding 1 200 kg/m^3 (1.20 Mg/m^3), including:

a) natural aggregates;

b) aggregates manufactured from natural materials and/or from by-products of industrial processes;

c) by-products of industrial processes;

d) recycled aggregates.

2 Overview of BS EN 13055-1

2.1 General requirements

2.1.1 *General*

BS 3797 specifies requirements for the following properties:

a) grading;

b) loose bulk density (oven dry materials);

c) sulfate content;

d) loss on ignition.

Compared to BS 3797, BS EN 13055-1 gives requirements for different properties, including different test methods for determining these properties. The physical and chemical properties specified in BS EN 13055-1 are listed in **2.1.2** and **2.1.3**, respectively. These properties are only required to be declared when regulatory requirements exist for the application in the country of use or when specified by the aggregate user.

2.1.2 *Physical properties*

BS EN 13055-1:2002, Clause **4** specifies requirements for the following physical properties:

a) loose bulk density;

b) aggregate size;

c) grading;

d) particle density;

e) particle shape;

f) fines;

g) grading of fillers;

h) water absorption;

i) water content;

j) crushing resistance;

k) percentage of crushed particles;

l) resistance to disintegration;

m) freezing and thawing resistance.

In the UK it is expected that requirements to declare loose bulk density, aggregate size and grading will be adopted for aggregates for all end uses. Table 1 lists the relevant BS EN 13055-1 requirements for these physical properties alongside any limiting values. More detailed guidance on the BS EN 13055-1 requirements for loose bulk density, aggregate size and grading is given in **3.2.1**, **3.2.2** and **3.2.3**, respectively.

NOTE It has been proposed that BS EN 13055-1 is amended to make the declaration of loose bulk density, aggregate size and grading a requirement for all aggregate and aggregate end uses.

Table 1 — Values for physical properties to be declared in the UK

Physical property	BS EN 13055-1 subclause	Limiting value
Loose bulk density	**4.2.1**	$\leq 1\,200$ kg/m^3
Aggregate size	**4.3**	—
Grading	**4.4**	—

2.1.3 *Chemical properties*

BS EN 13055-1:2002, Clause **5** specifies requirements for the following chemical properties:

a) chloride ion content;

b) sulfur containing compounds (acid-soluble sulfate and total sulfur content);

c) loss on ignition (for ashes only);

d) presence of organic contaminators;

e) alkali-silica reactivity.

2.2 Evaluation of conformity

BS EN 13055-1:2002, Clause **7** requires that producers undertake and on request declare the results from:

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

b) factory production control to monitor conformity of aggregates with the relevant requirements and the producer's declared values.

Minimum frequencies of tests are specified in BS EN 13055-1:2002, Annex F.

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 13055-1

3.1 General

Each clause in BS EN 13055-1 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 the end use of the aggregate. This qualification allows the aggregate user to request declared values applicable to the aggregates for which regulatory requirements for the intended applications exist in the place of use.

NOTE 1 It was intended that the wording "when required" would be added to each sentence in BS EN 13055-1:2002, Clause **5** in order to indicate the necessity only to specify those properties relevant to the particular aggregate and end use of the aggregate. This wording has been omitted in several instances and this is an error. It has been proposed that BS EN 13055-1 is amended to correct this error.

NOTE 2 Many of the requirements are worded to indicate that the results of tests shall be declared. In the UK it is intended that limiting values should also be declared for those properties relevant to the particular aggregate and the end use of the aggregate. BS EN 13055-1 does not require the declaration of limiting values for any properties and this omission is an error. It has been proposed that BS EN 13055-1 is amended to correct this error.

3.2 Physical requirements (BS EN 13055-1:2002, Clause 4)

3.2.1 *Density (BS EN 13055-1:2002, 4.2)*

BS EN 13055-1:2002, **4.2** specifies that loose bulk density shall be determined in accordance with BS EN 1097-3 and declared for all lightweight aggregates for all applications covered by BS EN 13055-1. The loose bulk density is required to be within a range of ±15 % of the declared value, up to a maximum of ±100 kg/m^3. When the particle density is also required by the aggregate user to be declared, the particle density is required to be within a range of ±15 % of the declared value, up to a maximum of ±150 kg/m^3.

3.2.2 *Aggregate size (BS EN 13055-1:2002, 4.3)*

BS EN 13055-1:2002, **4.3** specifies that aggregate sizes shall be given as an upper limiting sieve size and a lower limiting sieve size. The quantity passing the lower sieve (undersize) is limited to 15 % by mass and the quantity retained on the upper sieve (oversize) is limited to 10 % by mass. BS EN 13055-1 also specifies that the sieve size through which 100 % of the aggregate passes shall be declared when required by the aggregate user.

BS EN 13055-1:2002, Table 1 specifies the following three options of 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.

The convention adopted in the series of European Standards for normal weight aggregates is to express aggregate sizes in reverse order to BS 3797, i.e. the lower sieve size is given before the upper sieve size. It is expected that producers of lightweight aggregates conforming to BS EN 13055-1 will adopt the same approach. Thus the equivalent BS EN 13055-1 aggregate to a (14 to 5) mm graded aggregate conforming to BS 3797 is given the designation 4/14. The equivalent BS EN 13055-1 aggregate to a 14 mm single-sized aggregate conforming to BS 3797 is also given the designation 4/14.

3.2.3 *Grading (BS EN 13055-1:2002, 4.4)*

BS EN 13055-1:2002, **4.4** specifies that the particle size distribution shall be determined and declared using BS EN 933-1. A note warns that care needs to be taken to avoid degradation of lower density/friable aggregates during sieving.

3.2.4 *Particle shape (BS EN 13055-1:2002, 4.5)*

Lightweight aggregates have material specific distinctive shapes. BS EN 13055-1:2002, **4.5** specifies that particle shape is described and declared when required by the aggregate user. Shapes are normally conveyed to aggregate users by samples or photographs in product literature. No test methods exist for determining the shape of lightweight aggregate particles.

The determination of particle shape is not a regulatory requirement for application in the UK.

3.2.5 *Fines (BS EN 13055-1:2002, 4.6)*

BS EN 13055-1:2002, **4.6** specifies the determination of fines content in accordance with BS EN 933-1 when required by the aggregate user. However, it is not envisaged that this characteristic would need to be determined in addition to particle size distribution for applications in the UK. As with grading, a note advises that friable aggregates such as perlite and vermiculite can degrade during sieving if care is not taken.

The determination of fines content is not a regulatory requirement for application in the UK.

3.2.6 *Grading of fillers (BS EN 13055-1:2002, 4.7)*

BS EN 13055-1:2002, **4.7** specifies the determination of the particle size distribution of fillers in accordance with the test method in BS EN 933-10 when required by the aggregate user. This test method differs from the BS EN 933-1 method of particle size distribution determination referred to in BS EN 13055-1:2002, **4.4** because the BS EN 933-1 method is used for coarser aggregates.

3.2.7 *Water absorption (BS EN 13055-1:2002, 4.8)*

There are no requirements for water absorption in BS 3797, the existing UK specification for lightweight aggregates. BS EN 13055-1:2002, **4.8** specifies the determination of a water absorption value in accordance with BS EN 1097-6 when required by the aggregate user. The value is intended to provide guidance on the water absorption of lightweight aggregates but it does not take into account the water content at delivery or time of use. Therefore, it is not expected that a requirement to test for water absorption will be adopted in the UK.

The determination of water absorption is not a regulatory requirement for application in the UK.

3.2.8 *Water content (BS EN 13055-1:2002, 4.9)*

There are no requirements for water content in BS 3797, the existing UK specification for lightweight aggregates. BS EN 13055-1:2002, **4.9** specifies the determination of water content in accordance with BS EN 1097-5 when required by the aggregate user. However, unless supplied in sealed containers, the water content of lightweight aggregate at the time of delivery cannot be guaranteed. Therefore, it is not expected that a requirement to test for water content will be adopted in the UK.

The determination of water content is not a regulatory requirement for application in the UK.

3.2.9 ***Crushing resistance (BS EN 13055-1:2002, 4.10)***

There are no requirements for crushing resistance in BS 3797, the existing UK specification for lightweight aggregates. However, crushing resistance is used by some producers as a quality control tool. Therefore, BS EN 13055-1:2002, **4.10** specifies the determination of crushing resistance in accordance with BS EN 13055-1:2002, Annex A when required by the aggregate user.

Crushing resistance does not provide a useful guide to the properties of a lightweight aggregate for any end use covered by BS EN 13055-1, as indicated by the Note to BS EN 13055-1:2002, **4.10**. Therefore, it is not expected that a requirement to test for crushing resistance will be adopted in the UK.

The determination of crushing resistance is not a regulatory requirement for application in the UK.

3.2.10 ***Percentage of crushed particles (BS EN 13055-1:2002, 4.11)***

The proportion of crushed particles can be material specific and for some aggregates, such as pumice, can be 100 %. The proportion of crushed particles can also be related to whether a secondary process has been used to reduce aggregate size.

BS EN 13055-1:2002, **4.11** specifies the determination of the percentage of crushed particles in accordance with BS EN 933-5 when required by the aggregate user. It is not expected that a requirement to test for the percentage of crushed particles will be adopted in the UK.

The determination of the percentage of crushed particles is not a regulatory requirement for application in the UK.

3.2.11 ***Resistance to disintegration (BS EN 13055-1:2002, 4.12)***

There are no requirements for resistance to disintegration in BS 3797, the existing UK specification for lightweight aggregates. However, resistance to disintegration is used by some producers to assess the stability of lightweight aggregates. Therefore, BS EN 13055-1:2002, **4.12** specifies the determination of resistance to disintegration in accordance with BS EN 13055-1:2002, Annex B when required by the aggregate user.

The Note to BS EN 13055-1:2002, **4.12** points out that the test method given in BS EN 13055-1:2002, Annex B (an autoclave test) is not suitable for aggregates such as perlite and vermiculite. It is not expected that a requirement to test for resistance to disintegration will be adopted in the UK.

The determination of resistance to disintegration is not a regulatory requirement for application in the UK.

3.2.12 ***Freezing and thawing resistance (BS EN 13055-1:2002, 4.13)***

BS EN 13055-1:2002, Annex C specifies a test procedure for determining the freezing and thawing resistance of lightweight aggregates. It relates only to lightweight aggregates with a particle size of not less than 4 mm and a bulk density of not less than 150 kg/m^3. There are no requirements for freezing and thawing resistance in BS 3797, the existing UK specification for lightweight aggregates, because it is recognized that such a test on a lightweight aggregate does not provide a useful guide to its performance in concrete. The Note to BS EN 13055-1:2002, **4.13** acknowledges that a satisfactory service record or tests on concrete, mortar or grout incorporating the lightweight aggregate can be used in place of the test given in BS EN 13055-1:2002, Annex C. It is not expected that a requirement to test for this property will be adopted in the UK.

The determination of freezing and thawing resistance is not a regulatory requirement for application in the UK.

3.3 Chemical requirements

3.3.1 *General (BS EN 13055-1:2002, 5.1)*

The tests specified in BS EN 13055-1:2002, Clause **5** to determine the chemical properties of lightweight aggregates are carried out in accordance with BS EN 1744-1. These tests give results for the chemical contents of the lightweight aggregate expressed in terms of mass. Such test values need to be converted to chemical contents by volume, to allow for the density of lightweight aggregates, before comparison with any regulatory limiting values. A simple procedure and formula for correcting the measurements is specified in BS EN 13055-1:2002, **5.1**. BS EN 13055-1:2002, Annex D gives further guidance and a worked example.

The selection of a lightweight aggregate should be made by considering their combination with other constituents on the basis of values for specific chemical properties. BS EN 13055-1:2002, Annex E gives guidance on the effects of chemical constituents in lightweight aggregates on the durability of concrete, mortar and grout.

3.3.2 *Chloride (BS EN 13055-1:2002, 5.2)*

There are no requirements for chloride ion content in BS 3797, the existing UK specification for lightweight aggregates. BS EN 13055-1:2002, **5.2** specifies the determination of chloride content in accordance with BS EN 1744-1. Lightweight aggregates generally have very low chloride contents that may be considered as negligible when calculating the total chloride ion content in concrete, mortar or grout. Therefore, it is not expected that a requirement to test for chloride content will be adopted in the UK.

The determination of chloride content is not a regulatory requirement for application in the UK.

3.3.3 *Sulfur containing compounds (BS EN 13055-1:2002, 5.3)*

3.3.3.1 *Acid-soluble sulfate (BS EN 13055-1:2002, **5.3.1**)*

BS 3797, the existing UK specification for lightweight aggregates, specifies a limit for acid-soluble sulfate. However, BS EN 13055-1:2002, **5.3.1** which specifies the determination of acid-soluble sulfate content in accordance with BS EN 1744-1, does not specify a limit.

The determination of acid-soluble sulfate content is not a regulatory requirement for application in the UK.

3.3.3.2 *Total sulfur (BS EN 13055-1:2002, **5.3.2**)*

BS 3797, the existing UK specification for lightweight aggregates, does not specify a requirement to declare a value for total sulfur. However, BS EN 13055-1:2002, **5.3.2** specifies the determination of total sulfate content in accordance with BS EN 1744-1. It is not expected that a requirement to test for total sulfur content will be adopted in the UK.

The determination of total sulfur is not a regulatory requirement for application in the UK.

3.3.4 *Loss on ignition (BS EN 13055-1:2002, 5.4)*

BS 3797, the existing UK specification for lightweight aggregates, specifies specific limits for loss on ignition of expanded clay, shale and slate, pyroprocessed pulverized fuel ash, pulverized fuel ash stabilized by other means and for clinker and furnace bottom ash.

BS EN 13055-1:2002, **5.4** specifies the determination of loss on ignition in accordance with the test method in BS EN 1744-1. However, unlike BS 3797, no limits for loss of ignition are specified and the test method is limited to ashes only.

NOTE Reference to "ashes" in BS EN 13055-1 is interpreted as including furnace bottom ash and clinker.

The determination of loss on ignition is not a regulatory requirement for application in the UK.

3.3.5 *Organic contaminators (BS EN 13055-1:2002, 5.5)*

There are no requirements for organic contaminators in BS 3797, the existing UK specification for lightweight aggregates. Lightweight aggregates would not normally contain such compounds. However, BS EN 13055-1:2002, **5.5** specifies the determination of organic contaminators in accordance with BS EN 1744-1. It is not expected that a requirement to test for organic contaminators will be adopted in the UK.

The determination of the existence of organic contaminators is not a regulatory requirement for application in the UK.

3.3.6 *Alkali-silica reactivity of natural lightweight aggregates (BS EN 13055-1:2002, 5.6)*

There are no requirements for alkali-silica reactivity in BS 3797, the existing UK specification for lightweight aggregates. Lightweight aggregates would not normally display such reactivity.
BS EN 13055-1:2002, **5.6** does not specify any methods for the determination of alkali-silica reactivity, however, BS EN 13055-1:2002, Annex E does give some guidance. It is not expected that a requirement to test for the alkali-silica reactivity of natural lightweight aggregates will be adopted in the UK.

The determination of alkali-silica reactivity is not a regulatory requirement for application in the UK.

3.4 Evaluation of conformity (BS EN 13055-1:2002, Clause 7)

3.4.1 *General*

BS EN 13055-1:2002, Clause **7** contains requirements for the evaluation of conformity necessary for producers to demonstrate that their products conform to BS EN 13055-1. The procedures described here are called up by BS EN 13055-1:2002, Annex ZA as part of the procedure for attestation of conformity to be used for demonstrating compliance with the requirements of the EU Construction Products Directive [1].

3.4.2 *Initial type tests (BS EN 13055-1:2002, 7.2)*

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.

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.

For concrete, mortar and grout applications in the UK initial type testing will normally cover:

a) loose bulk density;

b) aggregate size;

c) grading (or grading of fillers).

3.4.3 *Factory production control (BS EN 13055-1:2002, 7.3)*

Factory production control is the means by which producers demonstrate conformity of their product to the relevant requirements of a European Standard, in this case BS EN 13055-1.

BS EN 13055-1:2002, **7.3** requires that producers operate a factory production control system that conforms to the requirements of BS EN 13055-1:2002, Annex F. Producers are required to keep records of assessments made of raw materials, production processes and finished products as appropriate.

BS EN 13055-1:2002, Annex F specifies a factory production control system which producers can use as a model when preparing a scheme tailored to suit their products and processes.

3.5 Designation, supply, marking and labelling (BS EN 13055-1:2002, Clause 8)

BS EN 13055-1:2002, Clause **8** specifies the information required to be provided on each delivery note.

4 Provisions of the EU Construction Products Directive

BS EN 13055-1:2002, Annex ZA addresses the provisions of the EU Construction Products Directive [1]. Both BS EN 13055-1:2002 and its Annex ZA have been produced under a Mandate given by the European Commission and the European Free Trade Association to CEN.

Annex ZA is described as “informative” but its requirements become mandatory to ensure compliance with the Mandate and/or where CE marking is applicable to aggregates.

Clauses in BS EN 13055-1:2002 identified in Table ZA.1a and Table ZA.1b indicate 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 for the intended uses indicated in the scope of BS EN 13055-1. However to meet the provisions of the Construction Products Directive [1] 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 13055-1.

Within the notes in BS EN 13055-1:2002, Table ZA.1a and Table ZA.1b, reference is made to the type of compliance requirement, for example:

— pass/fail threshold value;

— categories;

— declared value.

BS EN 13055-1:2002, Annex ZA also details the allowed levels for attestation of conformity as "2+" or "4". The requirements of the two levels are summarized in Table 2.

Table 2 — Levels of attestation of conformity in accordance with the EU Construction Products Directive and referred to in BS EN 13055-1

Tasks	Conformity attestation EU numbering system	
	2+	4
Tasks for the producer		
Factory production control	Yes	Yes
Further testing of samples taken at 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 lightweight aggregates is "4".

For other applications where the specifier or purchaser has particular concerns that the integrity of the aggregate will have a major impact on:

a) safety when in use; or

b) other performance properties of an installation (for example concrete applications involving the storage or containment of dangerous substances);

the specifier or purchaser should adopt appropriate contract specific quality assurance procedures or acceptance testing regimes to give the required degree of confidence. 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 13055-1.

BS EN 13055-1:2002, Annex ZA identifies 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 voluntarily or otherwise decide to CE mark their aggregates, the producers need to strictly comply with to the indicated requirements. Where the CE mark identifies a particular characteristic, the supplier is required to indicate the declared value appropriate to the aggregate. The user 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 marking information.

5 Additional considerations

In addition to conforming to the appropriate requirements of BS EN 13055-1 particular attention should be given to the following.

a) Advice on alkali aggregate reaction is given in CEN Report CR 1901, the Concrete Society Technical Report No. 30 [2], BRE Digest 330 [3] and BS 8500.

b) Where appearance is an essential feature of the concrete, aggregates should be selected with regard to the presence of materials such as iron pyrites, particles of coal and lightweight contaminators that can mar the surface. In such cases, 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) Advice on the thaumasite form of sulfate attack is included in BRE Special Digest 1 on concrete in aggressive ground [4] and BS 8500.

d) Some clinkers derived from lump coal burnt in older types of furnaces can contain nodules of free lime which, if they become damp, can cause local expansion. If the presence of unhydrated lime is suspected, a water slake test may be performed to confirm whether this is the case.

Bibliography

Standards publications

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BS EN 933-5:1998, *Tests for geometrical properties of aggregates — Part 5: Determination of percentage of crushed and broken surfaces in coarse aggregate particles.*

BS EN 933-10:2001, *Tests for geometrical properties of aggregates — Part 10: Assessment of fines — Grading of fillers (air-jet sieving).*

BS EN 1097-3:1998, *Tests for mechanical and physical properties of aggregates — Part 3: Determination of loose bulk density and voids.*

BS EN 1097-5:1999, *Tests for mechanical and physical properties of aggregates — Part 5: Determination of the water content by drying in a ventilated oven.*

BS EN 1097-6:2000, *Tests for mechanical and physical properties of aggregates — Part 6: Determination of particle density and water absorption.*

BS EN 1744-1:1998, *Tests for chemical properties of aggregates — Part 1: Chemical analysis.*

BS EN 12620:2002, *Aggregates for concrete.*

BS EN 13043:2002, *Aggregates for bituminous mixtures and surface treatments for roads, airfields and other trafficked areas.*

BS EN 13055-1:2002, *Lightweight aggregates — Part 1: Lightweight aggregates for concrete, mortar and grout.*

BS EN 13055-2, *Lightweight aggregates — Part 2: Lightweight aggregates for bituminous mixtures and surface treatments and for unbound and bound applications, excluding concrete, mortar and grout.*[2)]

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