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Aggregates –

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

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Summary of pages

This document comprises a front cover, an inside front cover, pages i to ii, pages 1 to 28, an inside back cover and a back cover.

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PD 6682-6:2009+A1:2013 supersedes PD 6682-6:2009, which is withdrawn.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.

This part of PD 6682 gives guidance on the use of BS EN 13242:2002+A1, which specifies requirements for aggregates for unbound and hydraulically-bound materials.

Attention is drawn to the fact that BS EN 13242:2002+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. Conflicting British Standards relating to aggregates were withdrawn in June 2004.

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 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 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 Published Document. 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. Purchasers 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 13242:2002+A1 in the UK.

BS EN 13242:2002+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 May 2008.

BS EN 13242:2002+A1 only covers aggregates and does not refer to other constituents of unbound and hydraulically-bound materials, e.g. selected cohesive materials or fly ash used for fill. BS EN 13242:2002+A1 therefore refers to the constituent aggregates that can be purchased separately and not to the end use product. Accordingly, the specification of aggregates in accordance with BS EN 13242:2002+A1 will only be appropriate in particular cases when not already required by the end use product standard, for example, the Highways Agency's Specification for Highway Works (SHW) [3].

BS EN 13242:2002+A1 specifies a range of categories for properties to enable purchasers to select appropriate limiting values for the wide range of aggregates used in unbound and hydraulically-bound materials produced in Europe. In most instances, provision is also made for producers to identify a declared value for properties when the value is outside indicated categories.

This Published Document recommends limiting values for aggregate properties within the ranges permitted in BS EN 13242:2002+A1. Where possible, these recommended values are equivalent to those specified in the SHW [3].

Specifiers need to define BS EN 13242:2002+A1 categories for properties that are relevant to the particular end use of an aggregate. Some example specifications listing recommended BS EN 13242:2002+A1 aggregate categories for properties of aggregates with particular different end uses are provided in Annex A, Annex B, Annex C, Annex D and Annex E.

BS EN 13242:2002+A1 now includes requirements for classification of the constituents of coarse recycled aggregates and indicates that their suitability be assessed in accordance with the regulatory requirements in the place of use. In the UK, this can include conformity with the WRAP Quality Protocol [4].

BS EN 13242:2002+A1 specifies grades in terms of the consistency of the aggregate, with the supplier declaring the typical grading for the aggregate and working to tolerances specified in BS EN 13242:2002+A1. These tolerances are restricted by BS EN 13242:2002+A1 to given values.

1 Scope

This part of PD 6682 gives recommendations and guidance on the use in the UK of BS EN 13242:2002+A1, which specifies the properties of aggregates obtained by processing natural, manufactured or recycled materials for hydraulically-bound and unbound materials for civil engineering work and road construction.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

BS EN 13242:2002+A1:2007, *Aggregates for unbound and hydraulically-bound materials for use in civil engineering work and road construction*

BS EN 16236, *Evaluation of conformity of aggregate*

3 Overview of BS EN 13242:2002+A1

3.1 General requirements

3.1.1 General

BS EN 13242:2002+A1 specifies requirements using the following groups of properties:

- 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 13242:2002+A1 also requires, when requested by the purchaser, the provision of data on other aggregate properties, but without limiting values.

3.1.2 Geometrical properties

The following geometrical properties are specified in BS EN 13242:2002+A1 and are usually considered appropriate for aggregates used in hydraulically-bound and unbound materials in the UK.

Grading, measured by the washing and sieving test method in BS EN 933-1.

Shape of coarse aggregate, measured by determining the flakiness index as specified in BS EN 933-3.

Shell content of coarse aggregate, measured by the test method in BS EN 933-7.

Fines content, measured as part of the washing and sieving test method in BS EN 933-1.

Further details are given in 4.2.

3.1.3 Physical requirements

BS EN 13242:2002+A1 specifies requirements for the following physical properties.

- a) Resistance to fragmentation, measured in accordance with the Los Angeles test method in BS EN 1097-2.

- b) Resistance to wear of coarse aggregate, measured by determining the micro-Deval coefficient in accordance with BS EN 1097-1.
- c) Particle density, measured in accordance with BS EN 1097-6 and declared on request.

Further details are given in 4.3.

3.1.4 Weathering properties

Weathering properties are usually grouped under a characteristic known as “durability”. BS EN 13242:2002+A1 specifies requirements for the following weathering properties, which are usually considered appropriate for aggregates used in hydraulically-bound and unbound materials concrete in the UK.

- a) Water absorption, determined using the appropriate test in BS EN 1097-6, used as a screening test.
- b) Resistance to weathering, determined using the magnesium sulfate soundness test in BS EN 1367-2.

Further details are given in 4.4.

3.1.5 Chemical requirements

BS EN 13242:2002+A1 specifies requirements for the following properties.

- a) Constituents which alter the rate of setting and hardening of hydraulically-bound mixtures, measured in accordance with BS EN 1744-1.
- b) Volume stability of steel slag aggregate, measured in accordance with BS EN 1744-1.
- c) Water-soluble constituents, measured in accordance with BS EN 1744-3.
- d) Water-soluble sulfate content, determined using the test specified in BS EN 1744-1

BS EN 13242:2002+A1 requires that producers declare the results on request.

Further details are given in 4.5.

3.2 Constituents of recycled aggregate

BS EN 13242:2002+A1 specifies requirements for the proportions of constituent materials in coarse recycled aggregate. Requirements are based on the sorting test specified in BS EN 933-11 and BS EN 13242:2002+A1 requires that producers declare the results on request.

For recycled aggregates in the UK, the sorting test is also a requirement of the WRAP Quality Protocol [4].

Further details are given in 4.6.

NOTE Categories for the proportions of constituent materials in coarse recycled aggregate were introduced into BS EN 13242:2002 by Amendment No. 1.

3.3 Evaluation of conformity

A1 BS EN 13242 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 13242 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 13242 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 conformity with quality protocols for the production of aggregates from inert waste (for example, the WRAP Quality Protocol [4]).

Minimum frequencies of test are specified in the requirements for factory production control in BS EN 16236. Further details about evaluation of conformity are given in 4.7. **A1**

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

4 Requirements of BS EN 13242:2002+A1

4.1 General

Each clause in BS EN 13242:2002+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 end use of the aggregate. Where this is the case the wording "when required" is used.

The aggregate size is described in BS EN 13242:2002+A1 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 13242:2002+A1.

NOTE Whilst aggregate descriptions are identified as d/D in BS EN 13242:2002+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 $G_{c85/20}$.

In BS EN 13242:2002+A1, tables of specified requirements allow the purchaser to choose an appropriate "category" for each property. The style of category designation is intended to be self-explanatory and related to the specified limiting value. For example, category F_{l35} means that aggregate with a maximum flakiness index value of 35 is required. The style becomes more complex in the case of grading, and careful understanding of the grading requirement tables in

BS EN 13242:2002+A1 is necessary. For example, category $G_{C85/15}$ is the grading designation for a coarse aggregate with a minimum 85% passing the D size sieve and a maximum of 15% passing the d size sieve.

An option to use a “no requirement” category is also provided. For example, a fines content category of f_{NR} is included in BS EN 13242:2002+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. 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 coefficient, LA] exceeds 60, the producer can state the maximum expected value of $LA_{Declared}$. Thus, if this value were 65, the producer would state LA_{65} and aggregate purchasers would then determine whether this is adequate for their purposes.

4.2 Geometrical requirements

4.2.1 Aggregate size

BS EN 13242:2002+A1 specifies the following three options for sieve size ranges for use in the description of aggregate size:

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

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

The aggregate size designations listed in Table 1 are recommended for use in the UK in unbound and hydraulically-bound materials.

Guidance on the grading associated with these aggregate size designations is given in 4.2.3, and guidance on the sieve sizes used to assess the grading is given in 4.2.2.

4.2.2 Sieve sizes

BS EN 13242:2002+A1 specifies grading requirements in terms of percentages passing lower d and upper D sieve sizes and in terms of percentages passing sieves with sizes that are multiples or fractions of d and D . When using the BS EN 13242:2002+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 the BS EN 13242:2002+A1 grading tables 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. Table 2 shows how they relate back to the multiples or fractions of the d and D sieve sizes given in the BS EN 13242:2002+A1 basic set plus set 2 range.

The sieve sizes given in Table 2 are recommended for use in the UK for aggregates for unbound and hydraulically-bound materials. The gradings in Table 3, Table 4 and Table 5 use these sieve sizes.