

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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Foreword

This Published Document has been prepared under the direction of Subcommittee B/502/4, Aggregates for unbound and hydraulically bound materials. It is one of nine parts that give guidance on the use and application of a series of European Standards for aggregates. These European Standards were prepared by CEN/TC 154, Aggregates, and have been adopted as British Standards. Conflicting British Standards relating to aggregates will be withdrawn in June 2004.

This part of PD 6682 gives guidance on the use of BS EN 13242 which specifies requirements for aggregates for unbound and hydraulically bound materials. BS EN 13242 does not supersede any British Standard but it does specify requirements that differ from those found in the Highways Agency's specification for highway works [1].

NOTE The Highways Agency's specification for highway works [1] will be amended to take into account the requirements of BS EN 13242.

Attention is drawn to the fact that BS EN 13242 fully takes into account the requirements of the European Commission mandate M125, Aggregates, given under the EU Construction Products Directive (89/106/EEC) [2].

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 13055-2.¹⁾*
- *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.*

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 19 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 13242 in the UK. BS EN 13242 specifies requirements for aggregates for use in unbound and hydraulically bound materials that differ from the requirements contained in the Highways Agency's specification for highway works (SHW) [1].

NOTE This Guide extensively uses the SHW as a basis against which to compare the requirements of BS EN 13383. This has been done in the absence of any other UK guidance on aggregates for unbound and hydraulically bound materials for use in civil engineering works and road construction. It is important to highlight that BS EN 13383 is not solely dedicated to the specification of road construction, however, the majority of usage will be within this general area.

Whilst BS EN 13242 describes aggregates for unbound and hydraulically bound materials in a different manner to established UK practice and in some cases uses different test methods to evaluate their properties, there is no change to the essential character of the aggregates in actual use in the UK.

BS EN 13242 only covers aggregates and does not refer to other constituents of unbound and hydraulically bound materials, e.g. selected cohesive materials or pulverized fly ash used for fill. Therefore, BS EN 13242 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 will only be appropriate in particular cases when not already required by the end-use product standard, i.e. the SHW.

BS EN 13242 specifies a range of categories for properties to enable users 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 UK guidance recommends limiting values for aggregate properties within the ranges permitted in BS EN 13242. Where possible, these recommended values are equivalent to those specified in the SHW.

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

BS EN 13242 includes recycled aggregates within its scope and indicates that their suitability should be assessed in accordance with the regulatory requirements in the place of use. In the UK, further guidance on the use and testing of recycled concrete aggregates (RCA) and recycled aggregates (RA) is given in the SHW.

NOTE This Guide does not give explicit advice on the use of recycled (and manufactured) aggregates because BS EN 13383 does not include extensive requirements on the subject. It is intended that a second generation of European Standards for aggregates will be developed to include more explicit requirements for recycled (and manufactured) aggregates.

The grading of coarse, fine and all-in aggregates in BS EN 13242 is based on different principles to the SHW. BS EN 13242 specifies grades in terms of the consistency of the aggregate with the supplier declaring the typical grading for the aggregate and working to tolerances given in BS EN 13242. These tolerances are restricted by BS EN 13242 to given values.

1 Scope

This part of PD 6682 gives guidance on the use of BS EN 13242 in the UK. BS EN 13242 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 Overview of BS EN 13242

2.1 General

The UK specification relating to aggregates for hydraulically bound and unbound materials, the SHW, specifies requirements for the aggregate properties given in Table 1 for particular end-uses.

Table 1 — Aggregate end-use and properties specified in the SHW

End-use	Properties
Pipe bedding, backfilling pipes and filler drains	Aggregate size Grading Sulfate content 10 % fines value Non-plastic fines (only for backfilling pipes and filler drains)
Earthworks including fill material, starter layers capping, drainage layers, bedding and surround material, vibrated stone columns	Aggregate size Grading Sulfate content 10 % fines value Magnesium sulfate soundness Organic matter ^a Moisture content ^a Moisture condition values ^a Plasticity ^a pH value ^a Chloride ion content ^a Resistivity ^a Redox potential ^a Microbial activity index ^a Saturation moisture content of chalk ^a Shear test values ^a Permeability ^a Constrained soil modulus ^a
Unbound sub-base and filter layers	Aggregate size Grading Mechanical properties as 10 % fines value Magnesium sulfate soundness Particles with crushed or broken surfaces (gravel only) Moisture content ^a Plasticity ^a Frost susceptibility ^a California bearing ratio (CBR) ^a Trafficking trials (gravel only) ^a
Cement bound materials (CBM)	Aggregate size Grading 10 % fines value Magnesium sulfate soundness

^a The specification of requirements for this property is at the discretion of the aggregate user and is dependent on the end-use of the aggregate.

Additionally, BS 1047 specifies the following requirements for blast furnace slag:

- a) bulk density;
- b) stability;
- c) sulfur content;
- d) water absorption.

BS EN 13242 gives requirements for different properties, including different test methods. These different geometrical, physical (mechanical) and chemical properties are listed in **2.2**, **2.3**, **2.4** and **2.5**.

2.2 Geometrical requirements

Requirements for the following geometrical properties are specified for coarse, fine and all-in aggregates in BS EN 13242:2002, Clause 4 but not in the SHW.

- a) Shape of coarse aggregate, measured in accordance with BS EN 933-3.
- b) Percentage of crushed or broken particles and of totally rounded particles in coarse aggregates, measured in accordance with BS EN 933-5.
- c) Fines content, measured in accordance with the sieving method specified in BS EN 933-1.
- d) Fines quality, assessed in accordance with BS EN 13242:2002, Annex A.

2.3 Physical requirements

The term “mechanical properties” used in British Standards relating to aggregates for unbound and hydraulically bound materials is replaced in BS EN 13242 by the term “physical properties”. Requirements for the following physical properties are specified for coarse, fine and all-in aggregates in BS EN 13242:2002, Clause 5 but not in the SHW.

- a) Resistance to fragmentation, measured in accordance with the Los Angeles test method (reference method) specified 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. This test method is derived from a French (AFNOR) test method.
- c) Particle density, measured in accordance with BS EN 1097-6.

2.4 Chemical requirements

Requirements for the following chemical properties are specified for coarse, fine and all-in aggregates in BS EN 13242:2002, Clause 6 but not in the SHW.

- 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.

2.5 Durability requirements

Requirements for durability are specified for coarse, fine and all-in aggregates in BS EN 13242:2002, Clause 7 but not in the SHW.

BS EN 13242:2002, Clause 7 specifies the determination of durability in terms of freeze-thaw resistance by measuring the water absorption value, in accordance with BS EN 1097-6, as a screening test for freeze-thaw resistance. Where necessary further measurements are made using freeze-thaw tests in accordance with BS EN 1367-1, based on a German (DIN) test method, or BS EN 1367-2, based on a magnesium sulfate soundness test derived from BS 812-121.

2.6 Evaluation of conformity

In BS EN 13242:2002, Clause 8 requires that producers undertake and on request declare the results from:

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

Minimum frequencies of test are identified in BS EN 13242:2002, Annex C.

Guidance on the requirements for attestation of conformity to and compliance with the provision of the EU Construction Products Directive [2] is given in Clause 4.

3 Requirements of BS EN 13242

3.1 General

Each clause in BS EN 13242 that specifies aggregate properties, i.e. Clause 5, Clause 6 and Clause 7, 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.

In BS EN 13242, tables of specified requirements allow the user to choose an appropriate "category" for each property. The style of category designation is intended to be self explanatory and related to the specified limiting value. For example, category FI_{35} 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 BS EN 13242:2002, Table 2 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.

NOTE Whilst aggregate descriptions are identified as d/D in BS EN 13242:2002, 4.2, the d and D values appear in the grading categories in the reverse order giving the percentage passing D before giving the percentage passing d , e.g. a 10/20 aggregate with a grading category of $G_{C85/20}$.

An option to use a "no requirement" category is also provided. For example, a fines content category of f_{NR} is included in BS EN 13242 and it 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 exceeds 60, the producer can state the maximum expected value of $LA_{Declared}$. Thus if this value were 65 he would state LA_{65} and aggregate users should determine whether this is adequate for their purposes.

3.2 Geometrical requirements

3.2.1 Aggregate size (BS EN 13043:2002, 4.2)

BS EN 13242:2002, Table 1 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 will generally be supplied to the basic set plus set 2.