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**Preskusi geometričnih lastnosti agregatov – 11. del: Klasifikacija sestavin  
grobega recikliranega agregata**

Tests for geometrical properties of aggregates - Part 11: Classification test for the  
constituents of coarse recycled aggregate

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February 2004

ICS 91.100

English version

## Tests for geometrical properties of aggregates - Part 11: Classification test for the constituents of coarse recycled aggregate

Essais relatifs aux caractéristiques géométriques des  
granulats - Partie 11: Essai de classification des gravillons  
recyclés selon leur composition

Prüfverfahren für geometrische Eigenschaften von  
Gesteinskörnungen - Teil 11: Prüfung zur Einteilung der  
Bestandteile von rezyklierter grober Gesteinskörnung

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 154.

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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## Foreword

This document prEN 933-11 has been prepared by Technical Committee CEN/TC 154, "Aggregates", the secretariat of which is held by BSI.

This document is currently submitted to the CEN Enquiry.

This European Standard is one of a series of standards for tests for geometrical properties of aggregates. Test methods for other properties of aggregates are covered by Parts of the following European Standards:

EN 932	Tests for general properties of aggregates
EN 1097	Tests for mechanical and physical properties of aggregates
EN 1367	Tests for thermal and weathering properties of aggregates
EN 1744	Tests for chemical properties of aggregates
EN 13179	Tests for filler aggregate used in bituminous mixtures

The other parts of EN 933 are:

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- Part 1: Determination of particle size distribution - Sieving method
- Part 2: Determination of particle size distribution - Test sieves, nominal size of apertures
- Part 3: Determination of particle shape - Flakiness index
- Part 4: Determination of particle shape - Shape index
- Part 5: Assessment of surface characteristics - Percentage of crushed and broken surfaces  
in coarse aggregate particles
- Part 6: Assessment of surface characteristics - Flow coefficient of aggregates
- Part 7: Determination of shell content - Percentage of shells in coarse aggregates
- Part 8: Assessment of fines - Sand equivalent test
- Part 9: Assessment of fines - Methylene blue test
- Part 10: Assessment of fines - Grading of fillers (air jet sieving)

## 1 Scope

This European Standard specifies a method for the examination of coarse recycled aggregates for the purpose of identifying and estimating the relative proportions of constituent materials.

NOTE If dangerous substances are found in while carrying out this method, they should be dealt with in accordance with regulations in the place of use

## 2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to applies.

- EN 932-2 *Tests for general properties of aggregate – Part 2 - Methods for reducing laboratory samples*
- EN 932-5 *Tests for general properties of aggregates – Part 5 - Common equipment and calibration*
- EN 933-1 *Tests for geometrical properties of aggregates – Part 1 - Determination of particle size distribution – Sieving method*
- EN 933-2 *Tests for geometrical properties of aggregates – Part 2: Determination of particle size distribution – Test sieves, nominal size of apertures*
- EN 933-3 *Tests for geometrical properties of aggregates – Part 3: Determination of particle shape – Flakiness index*
- EN 1097-6 *Tests for mechanical and physical properties of aggregates – Part 6: Determination of particle density and water absorption*

## 3 Definitions

For the purposes of this standard, the following definitions apply:

### 3.1

#### **aggregate size**

designation of aggregate in terms of lower ( $d$ ) and upper ( $D$ ) sieve sizes expressed as  $d/D$

NOTE This designation accepts the presence of some particles which will be retained on the upper sieve (oversize) and some which will pass the lower sieve (undersize)

### 3.2

#### **particle size fraction $d_i/D_i$**

fraction of an aggregate passing the larger ( $D_i$ ) of two sieves and retained on the smaller ( $d_i$ )

### 3.3

#### **test portion**

sample used as a whole in a single test

### 3.4

#### constant mass

successive weightings after drying at least 1 h apart not differing by more than 0,1 %

NOTE In many cases constant mass can be achieved after a test portion has been dried for a pre-determined period in a specified oven at  $(110 \pm 5)$  °C. Test laboratories can determine the time required to achieve constant mass for specific types and sizes of sample dependent upon the drying capacity of the oven used.

## 4 Principle

The test consists of sorting particles from a test portion of coarse recycled aggregate by hand into six classes:

- 4.1 bituminous materials;
- 4.2 masonry;
- 4.3 concrete and concrete products;
- 4.4 lightweight particles;
- 4.5 unbound aggregates;
- 4.6 other.

The mass of each of these classes is determined and expressed as a percentage of the test portion mass. When required, classes 4.2 and 4.6 may be divided into subclasses, as shown in table 3, to provide additional information for some potential end uses.

## 5 Apparatus

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Unless otherwise stated, all apparatus shall conform to the general requirements of EN 932-5.

- 5.1 Test sieves, 63 mm and 8 mm conforming with EN 933-2:2004  
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- 5.2 Tightly fitting pan and lid, for the sieves.
- 5.3 Ventilated oven, thermostatically controlled to maintain a temperature of  $(110 \pm 5)$  °C or  $(40 \pm 5)$  °C.
- 5.4 Balance or scale, of suitable capacity and readable to  $(\pm 0.1)$  % of the mass to be weighted.
- 5.5 Trays
- 5.6 Brushes
- 5.7 Sieving machine, optional.

## 6 Preparation of test portion

Bulk samples shall be reduced in accordance with EN 932-2 to produce Laboratory samples of the required size.

NOTE 1 Table 1 provides guidance on the mass required to provide 500 particles. The actual mass depends upon the particle size distribution and particle density of the aggregate. Experience will allow test laboratories to estimate the mass required for materials that are tested routinely.

**Table 1 – Guidance on mass of test portions to give 500 particles**

Aggregate size D (maximum) mm	Test portion mass (minimum) kg
63	50
32	8
16	2

NOTE 2 The composition of aggregates often varies between size fractions. Hence, before carrying out the examination, it may be necessary to divide the aggregate into closely sized fractions that can be examined separately. The proportions of constituents can then be determined by sorting the particles in each size fraction.

NOTE 3 To assist in the visual examination of particles, it may be beneficial to wash the sample before drying. Washing may not be appropriate if the sample contains a significant number of water soluble particles.

Dry the sample at  $(110 \pm 5)$  °C to constant mass. For temperature sensitive materials it is necessary to limit the drying temperature to  $(40 \pm 5)$  °C, and record the drying temperature. Weigh and record the dry mass of the sample as  $M_0$ .

Sieve the sample on the test sieves, agitating with sufficient vigour to ensure complete separation of particles greater than 8 mm.

Weigh and record the mass of particles retained on the 63 mm sieve as  $M_{63}$ , and then discard them. Weigh and record the mass of particles passing the 8 mm sieve as  $M_8$ , and then discard them.

If necessary, further reduce the sample in accordance with EN 932-2 to produce a test portion consisting of not less than 500 particles. Weigh and record the mass of the test portion as  $M_1$ .

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## 7 Procedure

### 7.1 General

Spread the particles of the test portion on a flat surface and separate the particles by hand into the classes listed in Table 2. Weigh each class and record the mass using the symbols shown in Table 2.

**Table 2 – Classes for separating coarse recycled aggregate particles**

Class	Type	Mass symbol
A	Bituminous materials	$M_A$
B	Masonry	$M_B$
C	Concrete and concrete products. Mortars	$M_C$
L	Lightweight ( $<1.0$ Mg/m <sup>3</sup> )	$M_L$
U	Unbound aggregate	$M_U$
X	Other	$M_X$

### 7.2 Supplementary procedure

If it is considered appropriate for potential end uses of the coarse recycled aggregate, Class B and Class X may be further subdivided into the subclasses shown in Table 3.

Table 3 – Subclasses for masonry and other materials (optional)

Subclass	Type	Mass symbol
<b>Class B, Masonry</b>		
B <sub>1</sub>	Clay masonry i.e. ; bricks, tiles .. etc. ...	M <sub>B1</sub>
B <sub>2</sub>	Calcium silicate masonry	M <sub>B2</sub>
B <sub>3</sub>	Concrete masonry (with either lightweight or dense aggregate)	M <sub>B3</sub>
B <sub>4</sub>	Autoclaved aerated concrete	M <sub>B4</sub>
B <sub>5</sub>	Manufactured masonry stone	M <sub>B5</sub>
<b>Class X, Other materials</b>		
X <sub>1</sub>	Cohesive : i.e. ; clay, soil.	M <sub>X1</sub>
X <sub>2</sub>	miscellaneous : i.e. wood, glass, metals, rubber, plastics etc.	M <sub>X2</sub>
X <sub>3</sub>	gypsum, plaster	M <sub>X3</sub>

## 8 Calculation and expression of results

### 8.1 Calculations

Record the various masses on a test data sheet, an example of which is given in Annex A.

Calculate the percentage by mass P of particles in each class or subclass using the following equation :

$$P_{(class\ or\ subclass)} = \frac{M_{(class\ or\ subclass)}}{M_1} \times 100$$

where:

$M_{(class\ or\ subclass)}$  are the various masses detailed in Table 2 and, if required, Table 3, in grams ;

$M_1$  is the mass of the test portion, in grams.

Record the values of P to the nearest single decimal place for Class X and subclasses X<sub>1</sub>, X<sub>2</sub> and X<sub>3</sub>. Record the values P to the nearest whole number for all other classes and subclasses.

### 8.2 Validation of the results

If the sum of the masses of each class and/or subclass differs by more than 1% from the mass M<sub>1</sub>, the test shall be repeated.

## 9 Test report

### 9.1 Required data

The test report shall include the following information :

- reference to this European Standard ;
- identification of the sample ;
- identification of the laboratory ;
- sample reception date ;

- e) percentage P in each class, to the nearest single decimal place for Class X and to the nearest whole number for Classes A, B, C, L and U.

## **9.2 Optional data**

The test report may include the following information :

- a) name and location of the sample source ;
- b) description of the sample ;
- c) description of the sample reduction procedure ;
- d) sampling certificate, if available ;
- e) date of test ;
- f) if determined, percentage P in each subclass, to the nearest single decimal place for subclasses X<sub>1</sub>, X<sub>2</sub> and X<sub>3</sub> to the nearest whole number for subclasses B<sub>1</sub> through B<sub>5</sub> ;
- g) mass of sample, M<sub>0</sub>;
- h) mass of sample retained on the 63 mm sieve, M<sub>63</sub>;
- i) mass of sample passing the 8 mm sieve, M<sub>8</sub> ;
- j) mass of test portion, M<sub>1</sub>.

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