



# SLOVENSKI STANDARD

## SIST EN 13450:2003

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### Agregati za grede železniških prog

Aggregates for railway ballast

Gesteinskörnungen für Gleisschotter

Granulats pour ballasts de voies ferrées

Ta slovenski standard je istoveten z: EN 13450:2002

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English version

## Aggregates for railway ballast

Granulats pour ballasts de voies ferrées

Gesteinskörnungen für Gleisschotter

This European Standard was approved by CEN on 7 November 2002.

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. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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## Foreword

This document EN 13450:2002 has been prepared by Technical Committee CEN /TC 154, "Aggregates", the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 2003, and conflicting national standards shall be withdrawn at the latest by June 2004.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative annex ZA, which is an integral part of this document.

Requirements for other end uses of aggregates will be specified in the following European Standards:

- EN 12620      *Aggregates for concrete.*
  - EN 13043      *Aggregates for bituminous mixtures and surface treatments for roads, airfields and other trafficked areas.*
  - EN 13055-1   *Lightweight aggregates - Part 1: Lightweight aggregates for concrete, mortar and grout.*
  - prEN 13055-2 *Lightweight aggregates - Part 2: Lightweight aggregates for bituminous mixtures and surface treatments and for bound and unbound applications, excluding concrete, mortar and grout.*
  - EN 13139      *Aggregates for mortar.*
  - EN 13242      *Aggregates for unbound and hydraulically bound materials for use in civil engineering work and road construction.*
  - EN 13383-1   *Armourstone - Part 1: specification.*
- SIST EN 13450:2003  
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Annexes A, B and H are informative and annexes C, D, E, F, G and I are normative.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard : Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

## 1 Scope

This European Standard specifies the properties of aggregates obtained by processing natural or manufactured materials or recycled crushed unbound aggregates for use in construction of railway track. For the purposes of this standard, the aggregate is referred to as railway ballast.

It provides for the evaluation of conformity of the products to this European Standard.

**NOTE** The requirements in this European Standard are based upon experience with aggregate types with an established pattern of use. Care should be taken when considering the use of aggregates from sources with no such pattern of use, e.g., recycled aggregates and aggregates arising from certain industrial by-products. Such aggregates, that should comply with all the requirements of this European Standard, could have other characteristics not included in Mandate M 125 (as amended) that do not apply to the generality of aggregate types with an established pattern of use and when required, provisions valid at the place of use can be used to assess their suitability.

## 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 (including amendments).

- EN 932-1:1996, *Tests for general properties of aggregates — Part 1: Methods for sampling.*
- EN 932-2, *Tests for general properties of aggregates — Part 2: Methods for reducing laboratory samples.*
- EN 932-3, *Tests for general properties of aggregates — Part 3: Procedure and terminology for simplified petrographic description.*
- EN 932-5, *Tests for general properties of aggregates — Part 5: Common equipment and calibration.*
- EN 933-1:1997, *Tests for geometrical properties of aggregates — Part 1: Determination of particle size distribution - Sieving method.*
- EN 933-3, *Tests for geometrical properties of aggregates — Part 3: Determination of particle shape - Flakiness index.*
- EN 933-4, *Tests for geometrical properties of aggregates — Part 4: Determination of particle shape - Shape index.*
- EN 1097-1:1996, *Tests for mechanical and physical properties of aggregates - Part 1: Determination of the resistance to wear (micro-Deval).*
- EN 1097-2:1998, *Tests for mechanical and physical properties of aggregates — Part 2: Methods for the determination of resistance to fragmentation.*
- EN 1097-6:2000, *Tests for mechanical and physical properties of aggregates — Part 6: Determination of particle density and water absorption.*
- EN 1367-1:1999, *Tests for thermal and weathering properties of aggregates — Part 1: Determination of resistance to freezing and thawing.*
- EN 1367-2:1998, *Tests for thermal and weathering properties of aggregates — Part 2: Magnesium sulfate test.*
- EN 1367-3, *Tests for thermal and weathering properties of aggregates — Part 3: Boiling test for "Sonnenbrand basalt".*

### 3 Terms and definitions

For the purposes of this European Standard the following terms and definitions apply.

#### 3.1

##### **aggregate**

granular material used in construction. Aggregate may be natural, manufactured or re-cycled

#### 3.2

##### **railway ballast**

aggregate where 100 % of the surface of the particles can be described as totally crushed used in the construction of railway track

#### 3.3

##### **natural railway ballast**

aggregate for railway ballast from mineral sources which have been subjected to nothing more than mechanical processing

#### 3.4

##### **manufactured railway ballast**

railway ballast (of mineral origin) resulting from an industrial process involving thermal or other modifications

#### 3.5

##### **recycled railway ballast**

railway ballast resulting from the processing of previously used railway ballast

#### 3.6

##### **railway ballast size**

designation of railway ballast in terms of lower ( $d$ ) and upper ( $D$ ) sieve sizes. This designation accepts the presence of some particles which will be retained on the upper sieve (oversize) and some will pass the lower sieve (undersize)

#### 3.7

##### **fine particles**

particle size fraction of railway ballast which passes the 0,5 mm sieve

#### 3.8

##### **finer**

particle size fraction of railway ballast which passes the 0,063 mm sieve

#### 3.9

##### **category**

level of a property of an aggregate expressed as a range of values or a limiting value

NOTE There is no relationship between the categories of different properties.

### 4 Sampling

Sampling shall be carried out in accordance with EN 932-1.

NOTE 1 Advice on sampling from a wagon or the track at the laying site is given in annex A.

NOTE 2 Guidance on interpretation of results when samples of railway ballast have been taken from railway wagon or out of track is given in annex B.

## 5 Production

Natural railway ballast shall be produced without blending material from different geological sources.

## 6 Geometrical requirements

### 6.1 General

The necessity for testing and declaring all properties specified in this clause shall be limited according to the particular application at end use or origin of the aggregate. When required, the tests specified shall be carried out to determine appropriate properties.

NOTE 1 When the value of a property is required but not defined by specified limits the value should be declared by the producer as an  $XX_{\text{Declared}}$  category, e.g., in Table 4 a value of flakiness index of say 40 corresponds to  $FI_{40}$  (Declared value).

NOTE 2 When a property is not required, a "No requirement" category can be used.

NOTE 3 Guidance on selection of appropriate categories for specific applications can be found in national provisions in the place of use of the railway ballast.

### 6.2 Railway ballast size

Railway ballast size shall be designated by a pair of sieve sizes in millimetre with  $d$  as the lower limit designation sieve and  $D$  as the upper limit designation sieve between which most of the particle size distribution lies.

For railway ballast  $D$  is 50 mm or 63 mm and  $d$  is 31,5 mm.

### 6.3 Grading

The grading of the railway ballast determined in accordance with EN 933-1 shall be declared in accordance with the relevant category specified in Table 1.

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**Table 1 — Categories for grading**

Sieve size  mm	Railway ballast size 31,5 mm to 50 mm			Railway ballast size 31,5 mm to 63 mm		
	Percentage passing by mass					
	Grading category					
	A	B	C	D	E	F
80	100	100	100	100	100	100
63	100	97 to 100	95 to 100	97 to 99	95 to 99	93 to 99
50	70 to 99	70 to 99	70 to 99	65 to 99	55 to 99	45 to 70
40	30 to 65	30 to 70	25 to 75	30 to 65	25 to 75	15 to 40
31,5	1 to 25	1 to 25	1 to 25	1 to 25	1 to 25	0 to 7
22,4	0 to 3	0 to 3	0 to 3	0 to 3	0 to 3	0 to 7
31,5 to 50	≥ 50	≥ 50	≥ 50	-	-	-
31,5 to 63	-	-	-	≥ 50	≥ 50	≥ 85

NOTE 1 The requirement for passing the 22,4 mm sieve applies to railway ballast sampled at the place of production.

NOTE 2 In certain circumstances a 25 mm sieve may be used as an alternative to the 22,4 mm sieve when a tolerance of 0 to 5 would apply (0 to 7 for category F).

### 6.4 Fine particles

The content of fine particles determined in accordance with EN 933-1 shall be declared in accordance with the relevant category specified in Table 2.



Table 2 — Categories for fine particles content

Sieve size  mm	Maximum percentage passing by mass			
	Fine particle category			
	A	B	Declared	C
0,5	0,6	1,0	> 1,0	No requirement
NOTE The requirement applies to railway ballast sampled at the place of production.				

## 6.5 Fines

The fines content determined in accordance with EN 933-1 shall be declared in accordance with the relevant category specified in Table 3.

When required cleanliness shall be assessed from the fines content. Fines shall be considered non-harmful if the total fines content is less than the relevant category specified in Table 3 in accordance with the provisions valid in the place of use of the aggregate.

Table 3 — Categories for fines content

Sieve size  mm	Maximum percentage passing by mass				
	Fines content category				
	A	B	C	Declared	D
0,063	0,5	1,0	1,5	> 1,5	No requirement
NOTE The requirement applies to railway ballast sampled at the place of production.					

## 6.6 Particle shape

### 6.6.1 Flakiness index

When required the shape of coarse railway ballast shall be determined in terms of the flakiness index as specified in EN 933-3.

Flakiness index shall be the reference test for the determination of shape of railway ballast. The Flakiness index shall be declared in accordance with the relevant category specified in Table 4.

Table 4 — Categories for maximum values of flakiness index

Flakiness Index	Category <i>FI</i>
$\leq 15$	$FI_{15}$
$\leq 20$	$FI_{20}$
$\leq 35$	$FI_{35}$
$> 35$	$FI_{\text{Declared}}$
No requirement	$FI_{\text{NR}}$

### 6.6.2 Shape index

Where required, the shape index of the railway ballast determined in accordance with EN 933-4 shall be declared in accordance with the relevant category specified in Table 5.

Table 5 — Categories for maximum values of shape index

Shape Index	Category <i>SI</i>
$\leq 10$	$SI_{10}$
$\leq 20$	$SI_{20}$
$\leq 30$	$SI_{30}$
5 to 30	$SI_{5/30}$
$> 30$	$SI_{\text{Declared}}$
No requirement	$SI_{\text{NR}}$

### 6.7 Particle length

Particle length shall be assessed by measuring with an appropriate gauge or calipers.

NOTE Limits should be selected from the specified range until such a time as there is more data available on aggregate properties related to performance.

When required, the particle length shall be declared in accordance with the relevant category specified in Table 6.

Table 6 — Categories for particle length

Percentage by mass with length $\geq 100$ mm in a greater than 40 kg sample					
Particle length category					
A	B	C	D	Declared	E
4	6	8	12	$> 12$	No requirement

## 7 Physical requirements

### 7.1 General

The necessity for testing and declaring all properties specified in this clause shall be limited according to the particular application at end use or origin of the aggregate. When required, the tests specified shall be carried out to determine appropriate properties.

NOTE 1 When the value of a property is required but not defined by specified limits the value should be declared by the producer as an  $XX_{\text{Declared}}$  category, e.g., in Table 6 a Los Angeles coefficient of say 30 corresponds to  $LA_{\text{RB}} 30(\text{Declared value})$ .

NOTE 2 When a property is not required, a “No requirement” category can be used.

NOTE 3 Guidance on selection of appropriate categories for specific applications can be found in national provisions in the place of use of the railway ballast.

### 7.2 Resistance to fragmentation

When required, the resistance to fragmentation of railway ballast (Los Angeles coefficient,  $LA_{\text{RB}}$ , using the conditions as specified in annex C), determined as specified in EN 1097-2:1998, clause 5, shall be declared in accordance with the relevant category specified in Table 7. The Los Angeles test method shall be the reference test for the determination of resistance to fragmentation of railway ballast.

**Table 7 — Categories for maximum values of Los Angeles coefficient**

Los Angeles coefficient	Category $LA_{\text{RB}}$
$\leq 12$	$LA_{\text{RB}} 12$
$\leq 14$	$LA_{\text{RB}} 14$
$\leq 16$	$LA_{\text{RB}} 16$
$\leq 20$	$LA_{\text{RB}} 20$
$\leq 24$	$LA_{\text{RB}} 24$
$> 24$	$LA_{\text{RB}} \text{ Declared}$
No requirement	$LA_{\text{RB}} \text{ NR}$

Where required, the impact value of railway ballast ( $SZ_{\text{RB}}$ , using the conditions as specified in annex D), determined in accordance with EN 1097-2:1998, clause 6, shall be declared in accordance with the relevant category specified in Table 8.

**Table 8 — Categories for maximum values of resistance to impact**

Impact value %	Category $SZ_{\text{RB}}$
$\leq 14$	$SZ_{\text{RB}} 14$
$\leq 18$	$SZ_{\text{RB}} 18$
$\leq 22$	$SZ_{\text{RB}} 22$
$> 22$	$SZ_{\text{RB}} \text{ Declared}$
No requirement	$SZ_{\text{RB}} \text{ NR}$

### 7.3 Resistance to wear

When required, the resistance to wear of railway ballast (micro-Deval coefficient,  $M_{DE}$  RB using the conditions as specified in annex E) determined in accordance with EN 1097-1, shall be declared in accordance with the relevant category specified in Table 9.

**Table 9 — Categories for maximum values of resistance to wear**

micro-Deval coefficient	Category $M_{DE}$ RB
$\leq 5$	$M_{DE}$ RB 5
$\leq 7$	$M_{DE}$ RB 7
$\leq 11$	$M_{DE}$ RB 11
$\leq 15$	$M_{DE}$ RB 15
$> 15$	$M_{DE}$ RB Declared
No requirement	$M_{DE}$ RB NR

### 7.4 Durability

#### 7.4.1 Resistance to freezing and thawing

When required, the durability of railway ballast in terms of freeze/thaw resistance, shall be assessed by either the freeze/thaw test in accordance with EN 1367-1 using the conditions as specified in annex F, or the magnesium sulphate soundness test in accordance with EN 1367-2, using the conditions as specified in annex G and the results declared.

NOTE There is limited experience of the use of either of these tests for assessing the durability of railway ballast. Advice on the applicability of the test methods and of using water absorption as a screening test is given in annex H.

#### 7.4.2 Particle density

When required the particle density shall be determined in accordance with EN 1097-6:2000, annex B and the results declared.

#### 7.4.3 Water absorption

When required the water absorption shall be determined in accordance with EN 1097-6:2000 annex B and the results declared.

### 7.5 Sonnenbrand

If signs of "Sonnenbrand" are known from a quarry of basalt or closely related rocks qualitative testing shall be carried out in accordance with EN 1367-3 and the results declared.

NOTE "Sonnenbrand" is a type of rock decay that can be present in some basalts and manifests itself under the influence of atmospheric conditions. It starts with the appearance of grey/white coloured spots. Usually hairline cracks are generated radiating out from the spots and interconnecting them. This reduces the strength of the mineral fabric, and as a result the rock decays to small particles. Depending on the source this process can take place within months of extraction or extend over several decades. In exceptional cases a rapid decay results in the formation of large cracks and the breaking of aggregate particles.

### 8 Harmful components

Railway ballast shall not contain other components or matter than specified in this standard.