



# SLOVENSKI STANDARD

## SIST EN 13863-4:2005

01-maj-2005

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Concrete pavements - Part 4: Test methods for the determination of wear resistance of concrete pavements to studded tyres

Fahrbahnbefestigungen aus Beton - Teil 4: Prüfverfahren zur Bestimmung des Widerstandes gegen Verschleiß durch Spikereifen von Fahrbahnbefestigungen aus Beton

SIST EN 13863-4:2005

Revetements en béton - Partie 4: Méthodes d'essai pour la détermination de la résistance a l'usure des chaussées béton par abrasion provoquée par les pneus a crampons

Ta slovenski standard je istoveten z: EN 13863-4:2004

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### ICS:

93.080.20      Materiali za gradnjo cest      Road construction materials

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EUROPEAN STANDARD

**EN 13863-4**

NORME EUROPÉENNE

EUROPÄISCHE NORM

November 2004

ICS 93.080.20

English version

## Concrete pavements - Part 4: Test methods for the determination of wear resistance of concrete pavements to studded tyres

Fahrbahnbefestigungen aus Beton - Teil 4: Prüfverfahren zur Bestimmung des Widerstandes gegen Verschleiß durch Spikereifen von Fahrbahnbefestigungen aus Beton

This European Standard was approved by CEN on 2 September 2004.

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 Central Secretariat 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 Central Secretariat has the same status as the official versions.

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

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## Foreword

This document (EN 13863-4:2004) has been prepared by Technical Committee CEN/TC 227 "Road materials", the secretariat of which is held by DIN.

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 May 2005, and conflicting national standards shall be withdrawn at the latest by May 2005.

This European Standard is one of a series concerned with test methods for the functional requirements for concrete pavements.

EN 13863-1, *Concrete pavements — Part 1: Test method for the determination of the thickness of a concrete pavement by survey method.*

EN 13863-2, *Concrete pavements — Part 2: Test method for the determination of the bond between two layers.*

EN 13863-3, *Concrete pavements — Part 3: Test methods for the determination of the thickness of a concrete pavement from cores.*

EN 13863-4, *Concrete pavements — Part 4: Test methods for the determination of wear resistance of concrete pavements to studded tyres.*

No European Standard is superseded.

This document includes a Bibliography.

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

**EN 13863-4:2004 (E)****1 Scope**

This document describes a test method for the determination of the wear resistance to studded tyres of specimens cut from hardened concrete pavements or moulded laboratory specimens.

NOTE The test method is applicable for the finished concrete (end product testing) and not only for the aggregate as described in EN 1097-9. In the report from Swedish Road and Transport Research Institute (1996) "Ring Analysis of Nordic Road Simulators: Proposal for a common test method for the determination of the wear resistance of concrete pavements" more information of the methods precision is given (see Bibliography).

This document describes three proceedings for testing.

**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.

EN 196-6, *Methods of testing cement — Determination of fineness.*

EN 197-1, *Cement — Part 1: Composition, specifications and conformity criteria of common cements.*

EN 1097-9, *Tests for mechanical and physical properties of aggregate — Part 9: Determination of the resistance to wear by abrasion from studded tyres - Nordic test.*

EN 12504-1, *Testing concrete in structures — Part 1: Cored specimens — Testing, examining and testing in compression.*

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**3 Test specimen**

The sample shall consist of at least two specimens. Specimens shall conform to the dimensions in Table 1 according to road testing machines used.

**Table 1 — Dimension of specimens**

Method	Thickness mm	Width mm	Edge-length mm
<b>Method 1</b> <sup>a</sup> Trapezoid specimens	250	900	$L_1 = 1\,340$ $L_2 = 1\,810$
<b>Method 2</b> <sup>a</sup> Half trapezoid specimens	40	480	$L_1 = 580$ $L_2 = 680$
<b>Method 3</b> <sup>a</sup> Segment	90	300	1 760 (middle line length)

<sup>a</sup> See example of road testing machines in the paper referred to in the Bibliography

## 4 Test equipment

Measuring apparatus to determine depth of rut shall have an accuracy  $\pm 0,1$  mm.

The test configuration for method 1 to method 3 shall be in accordance with Tables 2, 3 and 4.

**Table 2 — Test configuration to method 1**

Specification	Value
Diameter of testing machine	6 m
Wheel load	2,5 t
Contact pressure	0,7 MPa
Speed	60 km/h
Four truck-wheels with studs	400 pieces, 12/17 g, on each wheel
Air-temperature in room	+10 °C to +25 °C

**Table 3 — Test configuration for method 2**

Specification	Value
Diameter of testing machine	5,25 m
Wheel load	0,45 t
Contact pressure	0,2 MPa
Speed	85 km/h
Four car-wheels with studs 185/70 R14	110 pieces, 1,8 g, on each wheel
Air-temperature in room	$\pm 0$ °C to +10 °C

**Table 4 — Test configuration for method 3**

Specification	Value
Diameter of testing machine	3,36 m
Wheel load	0,40 t
Contact pressure	0,22 MPa
Speed	31 km/h
Four car-wheels with studs 165/82 R13	90 pieces, 1,8 g kometa P8-110/1,8, or similar, on each wheel
Air-temperature in room	$\pm 0$ °C to +10 °C

Two reference segments shall always be used in every wear test. The segments shall conform to the specifications in Table 5.

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Table 5 — Material specification of the reference segment

Binder	Cement	390,0 kg/m <sup>3</sup>
Binder	Silica fume	15,0 kg/m <sup>3</sup>
Sand	0 mm to 14 mm	797,5 kg/m <sup>3</sup>
Crushed aggregate	8 mm to 12 mm	582,0 kg/m <sup>3</sup>
Crushed aggregate	12 mm to 16 mm	582,0 kg/m <sup>3</sup>
Water to (cement + silica)		0,40
Slump		20 mm to 60 mm
Material < 4 mm		32 % to 25 %
Fineness modulus FM		~ 5,5
Compressive strength		(85 ± 2) MN/m <sup>2</sup>

Sand shall be of an uncrushed type.

Crushed aggregate shall have a Nordic abrasion value between 7 and 8 (for sieve 12 mm to 16 mm) in accordance with EN 1097-9.

Cement shall be of type CEM I – 52,5 LA in accordance with EN 197-1, the Blaine value shall be between 3 400 cm<sup>2</sup>/g to 3 800 cm<sup>2</sup>/g in accordance with EN 196-6.

Compressive strength value shall be based on EN 12504-1.

Aggregate shall have an even grading curve.

## 5 Preparation of samples

Elements taken from the concrete pavements shall have an age corresponding to (10 ± 2) weeks at a temperature of +20 °C when testing, or as specified in place of use. Elements shall be stored in the same way as for moulded specimens.

The surface shall be trowelled.

Moulded specimens shall first be moist cured for 2 days, remaining curing time of moulded specimens shall be at (+20 ± 2) °C, (50 ± 10) % RH.

Moulded specimens shall be (10 ± 2) weeks old when testing.

## 6 Procedure

Install the concrete elements in the road testing-machine (method 1, 2 or 3), and perform a zero drive. The road testing-machine shall be driven in 1 000 revolutions and the zero measurement taken.

Testing sequence shall be carried out in accordance with Table 6 (method 1 and 2) and Table 7 (method 3).



Table 6 — Testing sequence for method 1 and 2

Testing sequence	Type of wear	Method 1	Method 2
1. Number of revolutions	dry	10 000 <sup>a</sup>	30 000 <sup>a</sup>
2. Number of revolutions	dry	10 000	30 000
3. Number of revolutions	wet	10 000	30 000
4. Number of revolutions	dry	10 000	30 000
5. Number of revolutions	wet	10 000	30 000
6. Number of revolutions	dry	10 000	30 000
7. Number of revolutions	wet	10 000	30 000
Total		70 000	210 000
<sup>a</sup> Initial wear			

Table 7 — Testing sequence for method 3

Testing sequence	Type of wear	Method 3
1. Number of revolutions	wet	30 000 <sup>a</sup>
2. Number of revolutions	wet	30 000
3. Number of revolutions	dry	60 000
4. Number of revolutions	wet	120 000
5. Number of revolutions	dry	120 000
6. Number of revolutions	wet	180 000
7. Number of revolutions	dry	180 000
Total		750 000
<sup>a</sup> Initial wear		

The depth of wear shall be measured for each testing sequence. The wear profile shall be measured at least in eight points across the wear track.

The result from the test shall be presented in Relative Wear Index (*RWI*). The Relative Wear Index shall be calculated accordingly to equation 1.

$$RWI = \frac{S}{S_r} \times 100 \quad (1)$$

where

*RWI* is the Relative Wear Index

*S* is the total wear of testing specimens (with initial wear), in millimetres (mm);

*S<sub>r</sub>* is the total wear of reference specimens (with initial wear), in millimetres (mm).

The *RWI* value shall be expressed as a whole number.