SLOVENSKI STANDARD
SIST EN 1436:1999

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Materiali za oznaļevanje voziġļa ï Lastnosti oznaļb

Road marking materials - Road marking performance for road users

Straßenmarkierungsmaterialien - Anforderungen an Markierungen auf Straßen

Produits de marquage routier - Performances des marques appliquées sur la route

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CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart,36 B-1050 Brussels

Contents

Foreword

This European Standard has been prepared by Technical Committee CEN/TC 226 "Road equipment", the secretariat of which is held by AFNOR.

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of an identical text or by endorsement, at the latest by February 1998, and conflicting national standards shall be withdrawn at the latest by February 1998.

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, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

Road markings together with road studs form the means for horizontal signalization.

Road markings include longitudinal markings, arrows, transverse markings, text and symbols on the surface of the highway etc.

Road markings can be provided by the application of paint, thermoplastics materials, cold hardening materials, pre-formed lines and symbols or by other means.

Most road markings are white or yellow, but in special cases other colours are used.

Road markings are either permanent or temporary. The functional life of temporary road markings is limited by the duration of the road works. For permanent road markings it is best for reasons of safety to have a functional life that is as long as possible.

Road markings can be applied with or without the addition of glass beads. With glass beads the retroreflection of the marking is achieved when the marking is illuminated by vehicle headlamps.

The retroreflection of a marking, in wet or rainy conditions, can also be enhanced by special properties. The properties can be produced by surface texture (as with profiled markings), large glass beads or other means. In the case of surface texture, the passage of wheels can produce acoustic or vibration effects.

1 Scope

This standard specifies the performance for road users of white and yellow road markings, as expressed by their reflection in daylight and under road lighting, retroreflection in vehicle headlamp illumination, colour and skid resistance.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at 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.

ISO 48	1994	Testing of elastomers - Determination of indentation hardness of soft rubber (IRHD)
ISO 4662	1986	Rubber - Determination of rebound resilience of vulcanizates
ISO/CIE 10526	1991	Colorimetric illuminants
CIE 17.4		International lighting vocabulary 1986

3 Definitions, symbols and abbreviations

For the purposes of this standard, the following definitions apply together with the definitions for the CIE 2 ° standard observer in CIE 17.4.

3.1 luminance coefficient under diffuse illumination (of a field of a road marking) Qd ($mcd \cdot m^{-2}\ lx^{-1}$) : Quotient of the luminance of the field of the road marking in the given direction by the illuminance on the field.

3.2 coefficient of retroreflected luminance (of a field of a road marking) R_L ($mcd \cdot m^{-2} \cdot lx^{-1}$) : Quotient of the luminance L of the field of the road marking in the direction of observation by the illuminance $E_\perp$ at the field perpendicular to the direction of the incident light.

3.3 skid resistance tester value (of a road marking) : Skid resistance quality of a wet road surface measured by the friction at a low speed of a rubber slider upon this surface. The abbreviation SRT applies.

3.4 functional life (of a road marking) : Period during which the road marking fulfils all the requirements initially specified by the responsible road authority.

4 Requirements

4.1 General

The requirements specified aim primarily at the performance of road markings during their functional life. The requirements are expressed by several parameters representing different aspects of the performance of road markings and for some of these in terms of classes of increasing performance.

NOTE 1 : The length of the functional life depends on whether the road marking is of short or long durability, on whether or not the road marking is run on by traffic (e.g. symbols on the carriageway compared to continuous edgelines), on the traffic density, on the roughness of the road surface and on matters relating to local conditions such as the use of studded tyres in some countries.

NOTE 2 : The classes enable different priorities to be given to the different aspects of performance of road markings depending on particular circumstances. Classes of high performance cannot always be achieved for two or more of the parameters simultaneously.

4.2 Reflection in daylight or under road lighting

For the measurement of reflection in daylight or under road lighting the luminance coefficient in diffuse illumination Qd is used.
It shall be measured in accordance with annex A and is expressed in $mcd \cdot m^{-2} \cdot lx^{-1}$.

Road markings in the dry condition shall conform to table 1.

NOTE : The luminance coefficient under diffuse illumination represents the brightness of a road marking as seen by drivers of motorized vehicles in typical or average daylight or under road lighting conditions.

Table 1 : Classes of Qd for dry road markings

Road marking colour	Road surface type	Class	Minimum luminance coefficient in diffuse illumination Qd $mcd \cdot m^{-2} \cdot lx^{-1}$
White	Asphaltic	Q0 Q2 Q3	No requirement Qd ≥ 100 Qd ≥ 130
	Cement concrete	Q0 Q3 Q4	No requirement Qd ≥ 130 Qd ≥ 160
Yellow		Q0 Q1 Q2	No requirement Qd ≥ 80 Qd ≥ 100
NOTE : The class Q0 applies when daytime visibility is achieved through the value of the luminance factor β, see 4.4.			

4.3 Retroreflection under vehicle headlamp illumination

For the measurement of retroreflection under car headlamp illumination, the coefficient of retroreflected luminance R_L is used.
It shall be measured in accordance with annex B and is expressed in $mcd \cdot m^{-2} \cdot lx^{-1}$.

Road markings in the dry condition shall conform to table 2 ; and shall conform to table 3 during wetness and to table 4 during rain.

NOTE : The coefficient of retroreflected luminance represents the brightness of a road marking as seen by drivers of motorized vehicles under the illumination by the driver's own headlamps.

Table 2 : Classes of R_L for dry road markings

Road marking type and colour		Class	Minimum coefficient of retroreflected luminance R_L $mcd \cdot m^{-2} \cdot lx^{-1}$
Permanent	White	R0 R2[1)] R4[1)] R5[1)]	No requirement $R_L \geq 100$ $R_L \geq 200$ $R_L \geq 300$
	Yellow	R0 R1[1)] R3[1)] R4[1)]	No requirement $R_L \geq 80$ $R_L \geq 150$ $R_L \geq 200$
Temporary		R0 R3[1)] R5[1)]	No requirement $R_L \geq 150$ $R_L \geq 300$

[1)] In some countries these classes cannot be maintained during a limited time period of the year during which the probability of lower performance of the road markings is high due to the presence of water, dust, mud etc.

NOTE : Class R0 is intended for conditions where the visibility of road markings is achieved without retroreflection under vehicle headlamp illumination.

Table 3 : Classes of R_L for road markings in conditions of wetness

Conditions of wetness	Class	Minimum coefficient of retroreflected luminance R_L $mcd \cdot m^{-2} \cdot lx^{-1}$
As obtained 1 min after flooding the surface with water in accordance with B.6	RW0 RW1 RW2 RW3	No requirement $R_L \geq 25$ $R_L \geq 35$ $R_L \geq 50$

NOTE : Class RW0 is intended for situations where this type of retroreflection is not required for economic or technological reasons.

Table 4 : Classes of R_L for road markings in conditions of rain

Conditions of rain	Class	Minimum coefficient of retroreflected luminance R_L $mcd \cdot m^{-2} \cdot lx^{-1}$
As obtained after at least 5 min exposure in accordance with B.7 during uniform rainfall of 20 mm/h	RR0 RR1 RR2 RR3	No requirement $R_L \geq 25$ $R_L \geq 35$ $R_L \geq 50$

NOTE : Class RR0 is intended for situations where this type of retroreflection is not required for economic or technological reasons.

4.4 Colour

The luminance factor β shall conform to table 5 for road markings in dry conditions. The x, y chromaticity co-ordinates for dry road markings shall lie within the regions defined by the corner points given in table 6 and illustrated in figure 1. Measurements shall be made in accordance with annex C.

NOTE : Measured values of the luminance factor β are not always valid for all road markings, see annex C.

Table 5 : Classes of luminance factor β for dry road markings

Road marking colour	Road surface type	Class	Minimum luminance factor β
White	Asphaltic	B0 B2[1)] B3[1)] B4[1)] B5[1)]	No requirement β ≥ 0,30 β ≥ 0,40 β ≥ 0,50 β ≥ 0,60
	Cement concrete	B0 B3[1)] B4[1)] B5[1)]	No requirement β ≥ 0,40 β ≥ 0,50 β ≥ 0,60
Yellow		B0 B1[1)] B2[1)] B3[1)]	No requirement β ≥ 0,20 β ≥ 0,30 β ≥ 0,40

[1)] In some countries these classes cannot be maintained during a limited period of the year during which the probability of lower performance of the road markings is high due to the presence of water, dust, mud etc.
NOTE : Class B0 applies when daytime visibility is achieved through the value of the luminance coefficient in diffuse illumination Qd.

Table 6 : Corner points of chromaticity regions for white and yellow road markings

Corner points		1	2	3	4
White road markings	x	0,355	0,305	0,285	0,335
	y	0,355	0,305	0,325	0,375
Yellow road markings class Y1	x	0,443	0,545	0,465	0,389
	y	0,399	0,455	0,535	0,431
Yellow road markings class Y2	x	0,494	0,545	0,465	0,427
	y	0,427	0,455	0,535	0,483

NOTE : Yellow road markings class Y1 and Y2 are intended for permanent and temporary road markings respectively.

4.5 Skid resistance

The skid resistance value, expressed in SRT units, shall conform to table 7. The skid resistance shall be measured in accordance with annex D.

NOTE : The test method is not valid for all types of road markings, see annex D.

Table 7 : Classes of skid resistance

Class	Minimum SRT value
S0	No requirement
S1	SRT ≥ 45
S2	SRT ≥ 50
S3	SRT ≥ 55
S4	SRT ≥ 60
S5	SRT ≥ 65