

## תמרורי דרך אנכיים קבועים: תמרורים קבועים

Fixed, vertical road traffic signs: Fixed signs

מסמך זה הוא הצעה בלבד

מכון התקנים הישראלי  
The Standards Institution of Israel



תקן זה הוכן על ידי ועדת המומחים 11806 – תמרורי דרך, בהרכב זה:  
בן-ציון דותן, מריה כהן-אתגר (יו"ר), קרולין מטר, לינה נסייר, קובי קרני ועמיר שטרן

כמו כן תרמו להכנת התקן: ג'ורג'י בירנבאום, יובל בלום, קרן הראל, אדי ליבוביץ', שי סגל, רוני עזרן,  
מנחם קניגסברג וישעיהו רונן.

יונתן נחמני ריכז את עבודת הכנת התקן.

טיוטה לת"י

**הודעה על רויזיה**

תקן ישראלי זה בא במקום  
התקנים הישראליים האלה:  
ת"י 2247 חלק 1.1 מיוני 2008,  
ת"י 2247 חלק 1.2 מדצמבר 2012  
ת"י 2247 חלק 2 מאוגוסט 1998

**הודעה על מידת התאמת התקן הישראלי לתקנים או  
למסמכים זרים**

תקן ישראלי זה, למעט השינויים והתוספות הלאומיים  
המצוינים בו, זהה לתקן של הוועדה האירופית לתקינה  
(CEN)  
EN 12899-1: November 2007

**מילות מפתח:**

סימון דרכים, קבוע, שלטים, אנכי, ביצועים, חומרים מחזירי-אור, צבע.

**Descriptors:**

road signs, fixed, signs, vertical, performance, retroreflective materials, colour.

**עדכניות התקן**

התקנים הישראליים עומדים לבדיקה מזמן לזמן, ולפחות אחת לחמש שנים, כדי להתאימם להתפתחות המדע והטכנולוגיה.  
המשתמשים בתקנים יוודאו שבידיהם המהדורה המעודכנת של התקן על גיליונות התיקון שלו.  
מסמך המתפרסם ברשומות כגיליון תיקון, יכול להיות גיליון תיקון נפרד או תיקון המשולב בתקן.

**תוקף התקן**

תקן ישראלי על עדכוני נכנס לתוקף החל ממועד פרסומו ברשומות.  
יש לבדוק אם המסמך רשמי או אם חלקים ממנו רשמיים. תקן רשמי או גיליון תיקון רשמי (במלואם או בחלקם) נכנסים לתוקף  
60 יום מפרסום ההודעה ברשומות, אלא אם בהודעה נקבע מועד מאוחר יותר לכניסה לתוקף.

**סימון בתו תקן**

כל המייצר מוצר, המתאים לדרישות התקנים הישראליים החלים עליו,  
רשאי, לפי היתר ממכון התקנים הישראלי, לסמנו בתו תקן:



**זכויות יוצרים**

© אין לצלם, להעתיק או לפרסם, בכל אמצעי שהוא, תקן זה או קטעים ממנו, ללא רשות מראש ובכתב ממכון התקנים הישראלי.

*The national standard SI 12899 part 1: .....is an implementation of EN 12899-1: November 2007 with modifications and is reproduced with the permission of CEN, Avenue Marnix 17, B-1000 Brussels. All exploitation rights of the European Standards in any form and by any means are reserved world-wide to CEN and its National Members, and no reproduction may be undertaken without expressed permission in writing by CEN through the Standards Institution of Israel.*

## הקדמה לתקן הישראלי

תקן ישראלי זה הוא התקן של הוועדה האירופית לתקינה EN 12899-1 (CEN) מנובמבר 2007, שאושר כתקן ישראלי בשינויים ובתוספות לאומיים.

התקן כולל, בסדר המפורט להלן, רכיבים אלה:

- תרגום סעיף חלות התקן האירופי בשינויים ובתוספות לאומיים (בעברית)
- פירוט השינויים והתוספות הלאומיים לסעיפי התקן האירופי (בעברית)
- התקן האירופי (באנגלית)

## חלות התקן (תרגום סעיף 1 של התקן האירופי בשינויים ובתוספות לאומיים)

### הערה:

השינויים והתוספות הלאומיים בסעיף זה מובאים בגופן שונה.

תקן זה מפרט דרישות עבור מכללי תמרורים שלמים (לרבות תומכים), תמרורים (לוח התמרור עם פני התמרור), לוחות התמרורים (ללא פני התמרור) או/וגם רכיבים מרכזיים אחרים [יריעות מחזירות אור, תומכים ואמצעי הארה (Luminaire)]

השימוש המיועד העיקרי של תמרורי דרך קבועים הוא עבור מתן אזהרות, הוראות והדרכה למשתמשים בדרכים.

### הערה:

בפסקה השנייה, המילים: "on public and private land" – אינן חלות

תקן זה אינו דן במפורט להלן:

- a. מבני שערים וזיזים (cantilever structures) המיועדים לשילוט;
- b. תמרורים הכוללים מסרים לא רציפים, כגון תמרורים המשתמשים בנורות דיודה פולטת אור (LED) או בסיבים אופטיים;
- c. הסעיף אינו חל;
- d. הסעיף אינו חל;
- e. תשתיות;
- f. בדיקות עבור טמפרטורות נמוכות במיוחד.

**פירוט השינויים והתוספות הלאומיים לסעיפי התקן האירופי**

**2. Normative references**

במקום חלק מן התקנים האירופיים והבין-לאומיים המאוזכרים בתקן והמפורטים בסעיף זה חלים תקנים ישראליים, כמפורט להלן:

הערות	התקן הישראלי החל במקומו	התקן האירופי או הבין-לאומי המאוזכר
התקן הישראלי זהה לתקן של הנציבות הבין-לאומית לאלקטרוטכניקה IEC 60529- Edition 2.1:2001-02	ת"י 981 – דרגות ההגנה שמספקות מעטפות (IP)	EN 60529
התקן הישראלי זהה, למעט שינויים ותוספות לאומיים, לתקן האירופי EN 13201-3: November 2003	ת"י 13201 חלק 3 – תאורת דרכים: חישובי ביצועים	EN 13201-3
התקן הישראלי זהה לתקן של הארגון הבין-לאומי לתקינה ISO 9001 – Forth edition: 2008-11-15	ת"י 9001 – מערכת ניהול איכות: דרישות	EN ISO 9001

- בסוף הסעיף יוסף:

**תקנים ישראליים**

ת"י 812 חלק 1 – עמודי תאורה: עמודים מפלדה

ת"י 812 חלק 2 – עמודי תאורה: עמודים מאלומיניום

ת"י 414 – עומסים אופייניים במבנים: עומס רוח

ת"י 1225 חלק 1 – חוקת מבני פלדה: כללי

ת"י 2302 חלק 1 – חומרים ותכשירים מסוכנים: מיון, אריזה, תיווי וסימון

**חוקים, תקנות ומסמכים ישראליים**

תקנות התעבורה, התשכ"א-1961, על עדכוניהן

תקנות והנחיות להצבת תמרורים, על עדכוניהן

### 3. Terms, definitions, symbols and abbreviations

#### 3.2. sign

בסוף הסעיף יוסף:

הערה:

בלשון אנשי המקצוע מקובל גם המונח "שלט".

לאחר הגדרה 3.12 יוספו ההגדרות שלהלן:

#### 3.13. לוח תמרור

חלק התמרור הכולל את התשתית, אבזרי החיזוק ואבזרי הקיבוע.

#### 3.14. רשות תמרור מקומית

רשות תמרור מקומית – כמוגדר בתקנות התעבורה, התשכ"א-1961 על עדכוניהן.

### 4. Retroreflective sign face material

#### 4.1.1.3 Daylight chromaticity and luminance factor

Table 1 - Daylight chromaticity and luminance factor. Class CR1

- העמודות 1-4 בשורה המתייחסת לצבע חום (brown), אינן חלות, ובמקומן יחול:

	1		2		3		4	
חום	X	Y	X	Y	X	Y	X	Y
Brown	0.479	0.373	0.455	0.397	0.475	0.42	0.5	0.394

- השורה המתייחסת לצבע כתום (Orange), אינה חלה

- השורה המתייחסת לצבע ירוק כהה (Dark green), אינה חלה.

Table 2 - Daylight chromaticity and luminance factor. Class CR2

- השורה המתייחסת לצבע ירוק כהה (Dark green), אינה חלה.

- העמודות 1-4 בשורה המתייחסת לצבע חום (Brown), אינן חלות, ובמקומן יחול:

	1		2		3		4	
חום	X	Y	X	Y	X	Y	X	Y
(Brown)	0.479	0.373	0.455	0.397	0.475	0.42	0.5	0.394

- בסוף הטבלה תוסף שורה המתייחסת לצבע כתום פלואורני (fluorescent orange)

כתום פלואורני (Fluorescent Orange)	0.583	0.416	0.535	0.400	0.605	0.343	0.655	0.345	$\beta \geq 0.20$
--	-------	-------	-------	-------	-------	-------	-------	-------	-------------------

- בסוף הטבלה תוסף שורה המתייחסת לצבע שחור (Black)

שחור (Black)	0.385	0.355	0.300	0.270	0.260	0.310	0.345	0.395	$0.030 \geq \beta$
-----------------	-------	-------	-------	-------	-------	-------	-------	-------	--------------------

**NOTE**

ההערה (NOTE) אינה חלה, ובמקומה יחול:

**הערה:**

הערכים המופיעים ב- Table 1 וב- Table 2 מציינים את קואורדינטות גבולות הגוונים עבור יריעות חדשות להתקנה.

בזמן השירות, ערכי הגבולות לא יחרגו מהרמות המצוינות ב- Table 1.

**4.1.1.4 Coefficient of retroreflection  $R_a$**

**Table 3 - Coefficient of retroreflection  $R_a$  Class RA1**

- העמודה המתייחסת לצבע כתום (Orange), אינה חלה.

**Table 4 - Coefficient of retroreflection  $R_a$  Class RA2**

- העמודה המתייחסת לצבע ירוק כהה (Dark green), אינה חלה.

- העמודה המתייחסת לצבע כתום (Orange), אינה חלה.

לאחר Table 4 תוסף טבלה 4.1 כמפורט להלן:

**טבלה 4.1 – מקדם החזרת האור של יריעות ממין 1.3.2.3 שכינוי R3**

(קנדלה ללוקס למ"ר  $\text{cdlx}^{-1}\text{m}^{-2}$ )

כתום פלואורני	צהוב פלואורני	כחול	ירוק	אדום	צהוב	לבן	זווית פגיעה $\beta_1$	זווית ראייה $\alpha$
260	550	55	85	170	550	850	5°	0.1°
95	275	28	40	85	275	425	30°	
140	400	40	60	125	400	625	5°	0.2°
70	210	20	30	65	210	325	30°	
95	275	28	40	85	275	425	5°	0.33°
49	145	15	20	45	145	225	30°	
24	56	5	10	20	65	80	5°	1.0°
15	35	2.5	5	12	40	50	30°	
9	21	1.5	3	6	24	30	5°	1.5°
6	14	1	2	4	16	20	30°	

## 5. Structural performance

### 5.1. General

- בשורה הראשונה, לאחר אזכור התקן EN 1993-1-1 יוסף:
- "או ת"י 1225 חלק 1"
- בשורה השנייה, לאחר אזכור התקן EN 1999-1-1 יוסף:
- "או ת"י 812 חלק 2"
- בשורה הרביעית, לאחר אזכור התקן EN 1011 יוסף:
- "או ת"י 812 חלק 1"
- בשורה השמינית, המשפט המתחיל במילים "Verification of" ומסתיים במילים "by testing" אינו חל, ובמקומו יחול:
- אימות הביצועים ייעשה גם בחישוב וגם בבדיקה.
- בשורה התשיעית, המילה "when" אינה חלה.
- בשורה האחת-עשרה, המילה "when" אינה חלה.

### 5.2. Partial safety factors

לאחר Table 7 תוסף ההערה שלהלן:

**הערה:**

כאשר מתכננים בהתאם לדרישות התקן הישראלי ת"י 1225 חלק 1 (ראו סעיף 5.1) יש להשתמש בערך

$$\gamma_m = 1.08$$



## Loads .5.3

### Wind actions .5.3.1

#### General .5.3.1.1

- בשורה הראשונה, המילים "or taken from Table 8" אינן חלות, ובמקומן יחול:

ויסווגו בהתאם ל- Table 8

#### Calculation of wind pressure .5.3.1.2

בפסקה הראשונה, לאחר אזכור התקן EN 1991-1-4 יוסף:

או ת"י 414

בסוף סעיף זה תוסף ההערה שלהלן:

**הערה:**

כאשר מחשבים את עומס הרוח בהתאם לדרישות התקן הישראלי ת"י 414 אפשר לחשב לפי תקופת חזרה של 30 שנה.

#### Classes of wind pressure .5.3.1.3

##### Table 8 - Wind pressure

השורות המתייחסות לקבוצות הסיווג WL0, WL1, WL2, WL3, WL4, WL5 אינן חלות.

#### Dynamic pressure from snow clearance .5.3.2

בסוף הסעיף תוסף ההערה שלהלן:

**הערה:**

העומס הדינמי הנובע מפינוי השלג יובא בחשבון בחישוב העומסים המופעלים על התמרורים המיועדים להתקנה באזורים שבהם מתבצע פינוי שלג.

#### Point loads .5.3.3

##### Table 10 - Point loads

השורות המתייחסות לקבוצות הסיווג PL0, PL1, PL2, PL3, PL4, אינן חלות.

## Deflections .5.4

### Temporary deflections .5.4.1

#### Table 11 — Maximum temporary deflection – Bending

- השורות המתייחסות לקבוצות הסיווג TDB0, TDB1, TDB2, TDB3, TDB5, TDB6 אינן חלות.

(קבוצת הסיווג TDB4 חלה.)

## Table 12 — Maximum temporary deflection – Torsion

- השורות המתייחסות ל- TDT0, TDT1, TDT2, TDT3, TDT5, TDT6, אינן חלות.  
(קבוצת הסיווג TDT4 חלה.)

### 5.4.2 Permanent deflections

לאחר הפסקה הראשונה תוסף ההערה:

**הערה:**

כאשר מתכננים בהתאם לדרישות התקן הישראלי ת"י 414 אפשר לתכנן לפי תקופת חזרה של 30 שנה.

### 5.4.3 Calculations for the verification of physical performance

בפסקה השנייה, לאחר אזכור התקן EN 1993-1-1 יוסף:

או ת"י 1225 חלק 1

ולאחר אזכור התקן EN 1999-1-1 יוסף:

או ת"י 812 חלק 2

## 7. Sign plates, sign faces, transilluminated signs, externally illuminated signs and supports

### 7.1 Design

#### 7.1.2 Colour of the back

הסעיף אינו חל, ובמקומו יחול:

**גב לוח התמרור**

גב לוח התמרור יהיה בגוון אפור קהוי (מט), כדי למנוע סנוור.

#### 7.1.3 Dimensions and tolerances

הסעיף אינו חל, ובמקומו יחול:

**מידות וסבולות**

צורת רכיבי מכלל התמרור, מידותיו, והסבולות המותרות בו יתאימו לדרישות הנקובות בתקנות והנחיות להצבת תמרורים, על עדכוניהן

#### 7.1.6 Sign plate edges

### Table 14 - Edges of sign plates

בסוף הטבלה יוסף המפורט להלן:

- קבוצת הסיווג E1 המצוינת בטבלה היא למידע בלבד.

**הערה:**

- עיבוד שפות התשתית ייעשה לפי הנדרש עבור קבוצת הסיווג הנקבעת על ידי רשות התמרור המקומית.

**7.1.7 Corrosion resistance**

**Table 15 — Surface protection**

- השורה השנייה, המתייחסת ל-SP0, אינה חלה.
  - בסוף הסעיף יוסף:  
אפשר להגן על עמודים תומכים העשויים פלדה מפני שיתוך, גם לפי הסעיף המתאים בתקן ישראלי ת"י 812 חלק 1.
  - אפשר להגן על עמודים תומכים מאלומיניום משיתוך, גם לפי הסעיף המתאים בתקן ישראלי ת"י 812 חלק 2.
  - הגנה מפני שיתוך של הברגים ושל בורגי העיגון, הן של עמודי תמיכה מפלדה והן של עמודי תמיכה מאלומיניום, תתאים לדרישות התקן הישראלי ת"י 812 חלק 1.
- הערה:**  
הדרישות להגנה מפני שיתוך של ברגים, לרבות בורגי עיגון, זהות לגבי עמודים מפלדה ולגבי עמודים מאלומיניום.

**7.1.8 Protection from foreign objects and water**

- בשורה השנייה, הספרה "2" אינה חלה, ובמקומה תחול הספרה 5.
- בשורה השלישית הספרה "3" אינה חלה, ובמקומה תחול הספרה 4.

**7.1.13 Electrical**

**NOTE**

ההערה (NOTE) אינה חלה.

**7.3 Transilluminated signs**

**7.3.1.3 Daylight chromaticity and luminance factor**

**Table 18 – Daylight chromaticity and luminance factors**

- השורה המתייחסת לצבע ירוק כהה (Dark Green), אינה חלה.
- שתי העמודות שכותרתן  $\beta$  Class B1 Luminance factor, אינן חלות.

**7.3.1.4 Mean luminance**

**Table 19 – Mean luminance  $L$  of transilluminated signs**

- העמודה שכותרתה Class LS, אינה חלה.
- ההערה בסוף הטבלה, המתחילה במילים "Class LS", אינה חלה.

**7.3.1.5 Luminance contrast of transilluminated signs K**

**Table 20 — Luminance contrast K of transilluminated signs**

העמודה שכותרתה Dark Green, אינה חלה.

**Uniformity of luminance .7.3.1.6**

בסוף הסעיף תוסף ההערה שלהלן:  
הערה:

תמרורים ששטחם אינו גדול מ- 1.5 מ"ר יתאימו לדרישות של Class U3 שב- Table 21.

**Marking, labeling and product information .9**

**Marking and labelling .9.2**

בסוף סעיף (3) יוספו המילים:  
וחדש הייצור.

**Evaluation of conformity .10**

הסעיף אינו חל.

**Dangerous substances .11**

הסעיף אינו חל, ובמקומו יחול:

**.11 חומרים מסוכנים**

חומרים מסוכנים יעמדו בדרישות התקן הישראלי ת"י 2302 חלק 1.

English Version

## Fixed, vertical road traffic signs - Part 1: Fixed signs

Signaux fixes de signalisation routière verticale - Partie 1 :  
Panneaux fixes

Ortsfeste, vertikale Straßenverkehrszeichen - Teil 1:  
Verkehrszeichen

This European Standard was approved by CEN on 4 February 2007.

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 CEN 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 CEN Management Centre has the same status as the official versions.

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



EUROPEAN COMMITTEE FOR STANDARDIZATION  
COMITÉ EUROPÉEN DE NORMALISATION  
EUROPÄISCHES KOMITEE FÜR NORMUNG

**Management Centre: rue de Stassart, 36 B-1050 Brussels**

## **1 Scope**

This Part 1 of EN 12899 specifies requirements for complete sign assemblies (including supports), signs (sign plates with sign faces), sign plates (without sign faces) and for other major components (retroreflective sheeting, supports and luminaires).

The main intended use of fixed signs is for the instruction and guidance of road users on public and private land.

Matters not covered by this standard:

- a) sign gantry and cantilever structures;
- b) signs with discontinuous messages, e.g. using light emitting diodes (LED), or fibre optics;
- c) variable message signs;
- d) signs used for temporary purposes;
- e) foundations;
- f) tests for extremely low temperatures.

## **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 1011, *Welding - Recommendations for welding of metallic materials*

EN 1991-1-4, *Eurocode 1: Actions on structures - Part 1-4: General actions - Wind actions*

EN 1993-1-1, *Eurocode 3: Design of steel structures — Part 1-1: General rules and rules for buildings*

EN 1995-1-1, *Eurocode 5: Design of timber structures - Part 1-1: General - Common rules and rules for buildings*

EN 1999-1-1, *Eurocode 9: Design of aluminium structures — Part 1-1: General rules – General rules and rules for buildings*

EN 10240, *Internal and/or external protective coatings for steel tubes - Specification for hot dip galvanized coatings applied in automatic plants*

EN 12665:2002, *Light and lighting – Basic terms and criteria for specifying lighting requirements*

EN 12767, *Passive safety of support structures for road equipment - Requirements and test methods*

EN 12899-4, *Fixed vertical road traffic signs – Part 4: Factory production control*

EN 12899-5, *Fixed vertical road traffic signs – Part 5: Initial type testing*

EN 13032-1, *Light and lighting - Measurement and presentation of photometric data of lamps and luminaires – Part 1: Measurement and file format*

EN 13201-3, *Road lighting – Part 3: Calculation of performance*

EN 60529, *Degrees of protection provided by enclosures (IP code) (IEC 60529:1989)*

EN ISO 139, *Textiles - Standard atmospheres for conditioning and testing (ISO 139:2005)*

EN ISO 877:1996, *Plastics - Methods of exposure to direct weathering, to weathering using glass-filtered daylight, and to intensified weathering by daylight using Fresnel mirrors (ISO 877:1994)*

EN ISO 1461 *Hot dip galvanized coatings on fabricated iron and steel articles - Specifications and test methods (ISO 1461:1999)*

EN ISO 4892-2, *Plastics - Methods of exposure to laboratory light sources - Part 2: Xenon-arc lamps (ISO 4892-2:2006)*

EN ISO 6272, *Paints and varnishes - Rapid-deformation (impact resistance) tests*

EN ISO 9001, - *Quality management systems - Requirements (ISO 9001:2000)*

ISO 4:1997, *Information and documentation — Rules for the abbreviation of title words and titles of publications*

CIE 15, *Colorimetry*

CIE 54.2, *Retroreflection – Definition and measurement*

CIE 74:1988, *Road signs*

### **3 Terms, definitions, symbols and abbreviations**

For the purposes of this document, the symbols and abbreviations given in ISO 4:1997 apply. The photometric terms and definitions given in EN 12665:2002 and the sign descriptions given in CIE 74:1988 also apply, together with the following.

#### **3.1**

##### **sign assembly**

complete assembly including the sign plate, sign face material and supports

#### **3.2**

##### **sign**

sign plate with the sign face material applied

#### **3.3**

##### **sign plate**

fabrication comprising the substrate, reinforcing members and fixings

#### **3.4**

##### **protective edge**

fabrication intended to reinforce the edge of the sign and to reduce the severity of personal injury in the event of bodily impact with the sign edge

#### **3.5**

##### **substrate**

material used to support the sign face material

#### **3.6**

##### **sign face material**

material or materials applied to the substrate to produce the finished surface of the fixed sign

## **EN 12899-1:2007 (E)**

### **3.7**

#### **standard shape sign faces**

circles, triangles, squares, diamonds and octagons containing legends in accordance with the provisions of the Vienna Convention

### **3.8**

#### **mounting height (*H*)**

distance from ground level to the lower edge of the sign plate

### **3.9**

#### **support**

component which supports the sign plate

### **3.10**

#### **temporary deflection**

displacement of the structural component under load which returns to zero when the load is removed

### **3.11**

#### **permanent deflection**

deflection which remains after the load is removed

### **3.12**

#### **production identification code**

code defined by the manufacturer in order to achieve traceability

## **4 Retroreflective sign face material**

### **4.1 Glass bead material**

#### **4.1.1 Visual performance**

##### **4.1.1.1 Test conditions**

Tests shall be carried out at a temperature of  $(23 \pm 3)^\circ\text{C}$  and a relative humidity of  $(50 \pm 5)\%$  unless otherwise specified.

##### **4.1.1.2 Test samples**

Tests shall be conducted on finished products, or on prepared samples representative of finished products and suitable for the test equipment.

Test samples and test panels shall be conditioned in accordance with EN ISO 139 and shall be identified on the back.

##### **4.1.1.3 Daylight chromaticity and luminance factor**

When tested in accordance with the relevant procedure specified in CIE 15, using CIE standard daylight illuminant D65 and the standard CIE 45/0 viewing conditions, the chromaticity and the luminance factor  $\beta$  shall conform to Table 1 or Table 2 as appropriate.



Table 1 — Daylight chromaticity and luminance factors. Class CR1

Colour	1		2		3		4		Luminance factor $\beta$	
	x	y	x	y	x	y	x	y	Table 3	Table 4
White	0,355	0,355	0,305	0,305	0,285	0,325	0,335	0,375	$\geq 0,35$	$\geq 0,27$
Yellow see Table 3	0,522	0,477	0,470	0,440	0,427	0,483	0,465	0,534	$\geq 0,27$	
Yellow see Table 4	0,545	0,454	0,487	0,423	0,427	0,483	0,465	0,534		$\geq 0,16$
Orange	0,610	0,390	0,535	0,375	0,506	0,404	0,570	0,429	$\geq 0,17$	$\geq 0,14$
Red	0,735	0,265	0,674	0,236	0,569	0,341	0,655	0,345	$\geq 0,05$	$\geq 0,03$
Blue	0,078	0,171	0,150	0,220	0,210	0,160	0,137	0,038	$\geq 0,01$	$\geq 0,01$
Green	0,007	0,703	0,248	0,409	0,177	0,362	0,026	0,399	$\geq 0,04$	$\geq 0,03$
Dark green	0,313	0,682	0,313	0,453	0,248	0,409	0,127	0,557	$0,01 \leq \beta \leq 0,07$	
Brown	0,455	0,397	0,523	0,429	0,479	0,373	0,558	0,394	$0,03 \leq \beta \leq 0,09$	
Grey	0,350	0,360	0,300	0,310	0,285	0,325	0,335	0,375	$0,12 \leq \beta \leq 0,18$	

Table 2 — Daylight chromaticity and luminance factors. Class CR2

Colour	1		2		3		4		Luminance factor $\beta$	
	x	y	x	y	x	y	x	y	Table 3	Table 4
White	0,305	0,315	0,335	0,345	0,325	0,355	0,295	0,325	$\geq 0,35$	$\geq 0,27$
Yellow see Table 3	0,494	0,505	0,470	0,480	0,493	0,457	0,522	0,477	$\geq 0,27$	
Yellow see Table 4	0,494	0,505	0,470	0,480	0,513	0,437	0,545	0,454		$\geq 0,16$
Red	0,735	0,265	0,700	0,250	0,610	0,340	0,660	0,340	$\geq 0,05$	$\geq 0,03$
Blue see Table 3	0,130	0,086	0,160	0,086	0,160	0,120	0,130	0,120	$\geq 0,01$	
Blue see Table 4	0,130	0,090	0,160	0,090	0,160	0,140	0,130	0,140		$\geq 0,01$
Green see Table 3	0,110	0,415	0,150	0,415	0,150	0,455	0,110	0,455	$\geq 0,04$	
Green see Table 4	0,110	0,415	0,170	0,415	0,170	0,500	0,110	0,500		$\geq 0,03$
Dark green	0,190	0,580	0,190	0,520	0,230	0,580	0,230	0,520	$0,01 \leq \beta \leq 0,07$	
Brown	0,455	0,397	0,523	0,429	0,479	0,373	0,558	0,394	$0,03 \leq \beta \leq 0,09$	
Grey	0,305	0,315	0,335	0,345	0,325	0,355	0,295	0,325	$0,12 \leq \beta \leq 0,18$	

**EN 12899-1:2007 (E)**

NOTE The limits specified in Table 1, with the exception of dark green, brown and grey, are recommended in CIE 39.2 as surface colours for visual signalling. When colours deteriorate beyond these chromaticity limits the signs can be unsuitable for the intended purpose. The chromaticity limits specified in Table 2 can ensure a more uniform appearance and consistency in the colour of new signs which are installed at different times than the limits specified in Table 1. Colours conforming to the limits of Table 2 can also be expected to take longer to deteriorate beyond the limits of Table 1.

**4.1.1.4 Coefficient of retroreflection  $R_A$**

When measured in accordance with the procedure specified in CIE 54.2, using CIE standard illuminant A, the minimum initial coefficient of retroreflection  $R_A$  ( $\text{cd} \cdot \text{lx}^{-1} \cdot \text{m}^{-2}$ ) of retroreflective material, using glass bead technology, shall be not less than the values in Table 3 or Table 4, as appropriate.

The coefficient of retroreflection ( $R_A$ ) of all printed colours, except white, shall be not less than 70 % of the values in Table 3 or Table 4 for Class RA1 and Class RA2 signs respectively.

**Table 3 — Coefficient of retroreflection  $R_A$  Class RA1**

unit:  $\text{cd} \cdot \text{lx}^{-1} \cdot \text{m}^{-2}$

Geometry of measurements		Colour							
$\alpha$	$\beta_1$ ( $\beta_2 = 0$ )	White	Yellow	Red	Green	Blue	Brown	Orange	Grey
12'	+5°	70	50	14,5	9	4	1	25	42
	+30°	30	22	6	3,5	1,7	0,3	10	18
	+40°	10	7	2	1,5	0,5	#	2,2	6
20'	+5°	50	35	10	7	2	0,6	20	30
	+30°	24	16	4	3	1	0,2	8	14,4
	+40°	9	6	1,8	1,2	#	#	2,2	5,4
2°	+5°	5	3	1	0,5	#	#	1,2	3
	+30°	2,5	1,5	0,5	0,3	#	#	0,5	1,5
	+40°	1,5	1,0	0,5	0,2	#	#	#	0,9
# Indicates "Value greater than zero but not significant or applicable".									

Table 4 — Coefficient of retroreflection  $R_A$  Class RA2unit:  $\text{cd.lx}^{-1}.\text{m}^{-2}$ 

Geometry of measurements		Colour								
$\alpha$	$\beta_1$ ( $\beta_2 = 0$ )	White	Yellow	Red	Green	Dark green	Blue	Brown	Orange	Grey
12°	+5°	250	170	45	45	20	20	12	100	125
	+30°	150	100	25	25	15	11	8,5	60	75
	+40°	110	70	15	12	6	8	5,0	29	55
20°	+5°	180	120	25	21	14	14	8	65	90
	+30°	100	70	14	12	11	8	5	40	50
	+40°	95	60	13	11	5	7	3	20	47
2°	+5°	5	3	1	0,5	0,5	0,2	0,2	1,5	2,5
	+30°	2,5	1,5	0,4	0,3	0,3	#	#	1	1,2
	+40°	1,5	1,0	0,3	0,2	0,2	#	#	#	0,7

# Indicates "Value greater than zero but not significant or applicable".

**4.1.1.5 Durability****4.1.1.5.1 Resistance to weathering**

After weathering in accordance with 4.1.1.5.2 or 4.1.1.5.3, the following requirements shall apply.

The chromaticity and luminance factor of materials using glass beads technology shall conform to the requirements of 4.1.1.3 as appropriate.

When tested at an observation angle ( $\alpha$ ) of 20° and entrance angles ( $\beta_1 = 5^\circ$  and  $30^\circ$ , with  $\beta_2 = 0^\circ$ ) the coefficient of retroreflection shall be not less than 80 % of the values required in 4.1.1.4 as appropriate.

**4.1.1.5.2 Accelerated natural weathering**

Samples of material shall be exposed, inclined at an angle of 45° to the horizontal and facing the equator, in accordance with EN ISO 877:1996, Method A for three years.

**4.1.1.5.3 Accelerated artificial weathering**

The manufacturer may use accelerated artificial weathering to predict durability but testing shall be commenced by accelerated natural weathering not later than the start of the accelerated artificial weathering. The result of accelerated natural weathering shall take precedence over the result of accelerated artificial weathering.

The apparatus shall be either an air-cooled or water-cooled Xenon arc weathering device capable of exposing samples in accordance with EN ISO 4892-2.

Preparation of test specimens shall be in accordance with the general guideline given in EN ISO 4892-2.

The samples shall be exposed in accordance with EN ISO 4892-2 using the parameters given in Table 5, for a period of 2000 h.

Table 5 — Artificial weathering test parameters

Exposure parameters	Air-cooled lamp	Water-cooled lamp
Light/dark/water spray cycle	Continuous light with water spray on specimens for 18 min every 2 h	Continuous light with water spray on specimens for 18 min every 2 h
Black standard temperature during light only periods	(65 ± 3) °C using a black standard thermometer	(65 ± 3) °C using a black standard thermometer
Relative humidity	(50 ± 5) %	(50 ± 5) %
Irradiance (W/m <sup>2</sup> ) controlled at — over 300 nm to 400 nm range — over 300 nm to 800 nm range	60 550	60 630
<p>NOTE 1 Water used for specimen spray should contain no more than 1 ppm silica. Higher levels of silica can produce spotting on samples and variability in results. Water of the required purity can be obtained by distillation or by a combination of deionization and reverse osmosis.</p> <p>NOTE 2 Whilst irradiance levels should be set at the above levels, variations in filter ages and transmissivity, and in calibration variations, will generally mean that irradiance error will be in the order of ± 10 %.</p>		

#### 4.1.2 Impact resistance

When tested in accordance with EN ISO 6272, using a mass of 450 g with a contact radius of 50 mm dropped from a height of 220 mm, there shall be no cracking or, for sign face sheeting material, delamination from any substrate, outside a circle of 6 mm radius with the point of impact as the centre.

The test sign shall be supported as it would be when installed, or the test sample shall be supported over an open area of 100 mm x 100 mm.

#### 4.2 Microprismatic material

The performance of retroreflective materials using microprismatic technology can be found in the relevant European Technical Approval (ETA). The manufacturer shall obtain the performance specifications from the purchaser.

NOTE The testing procedure for retroreflective materials using microprismatic technology can be found in the relevant European Technical Approval (ETA).

### 5 Structural performance

#### 5.1 General

Steel constructions and steel mounting elements shall conform to EN 1993-1-1.

Aluminium constructions shall conform to EN 1999-1-1.

Timber constructions shall conform to EN 1995-1-1.

Welded fabrications shall conform to EN 1011, as appropriate.

Other materials are acceptable but if they are used they shall enable conformity to this standard.

All components and assemblies shall withstand dead and live loading, multiplied by the appropriate partial safety factor from 5.2.

Verification of performance may either be by calculation or by testing.

When verification of performance is to be by calculation, the structural performance of signs and their supports and fixings shall be calculated in accordance with 5.4.3.

When verification of performance is to be done by testing, tests shall be made in accordance with 5.4.4. The deflections to be calculated shall be those between the sign and support, or between the supports and the foundations.

The deflections of sign plates are evaluated relative to the supports. The deflections of supports are evaluated separately, except in the case of large supporting structures such as sign gantries, the deflections of which are not considered as they are outside the scope of this document.

When supports are to be supplied for stock, or otherwise where the conditions of use are not known at the time of manufacture of the support, the support manufacturer shall supply information on the structural performance of the support to enable the structural performance of the complete assembly to be calculated. The structural information to be provided shall be:

either

(a) for supports of constant cross-section:

- maximum bending moment  $M_u$  (kNm);
- stiffness for bending  $EI$  ( $\text{kNm}^2$ );
- maximum moment for torsion  $T_u$  (kNm);
- stiffness for torsion  $GIt$  ( $\text{kN}\cdot\text{m}^2$ );

NOTE 1  $EI$  = modulus of elasticity x moment of inertia.

NOTE 2  $GIt$  = shear modulus x torsion constant.

For a non-constant cross-section, equivalent values shall be given related to the actual length of the support.

or (b) the type and grade of material and all the dimensions;

or (c) verification of conformity to a purchaser's prescriptive specification for materials and dimensions.

Information to be provided in case (a) may be obtained by calculation in accordance with 5.4.3 or by physical testing in accordance with 5.4.4. The criterion for the maximum bending moment  $M_u$  and the maximum moment for torsion  $T_u$  shall be as 5.4.4.4.

The declared maximum bending moment shall be given at the designed ground level. If the weakest point is other than at ground level the equivalent value at ground level shall be given.

Any other relevant information shall be given as part of the manufacturer's supporting data, e.g. details and strength of fixings integral to the supports.

NOTE 3 Case (b) can be adequate for supports of simple construction, for instance comprising a standard metal tube of any standard cross-sectional shape.

## 5.2 Partial safety factors

The safety factors for loads shall be in accordance with Table 6.

**Table 6 — Partial safety factors  $\gamma_f$**

PAF class	Wind, dynamic snow and point loads	Dead load
PAF1	1,35	1,2
PAF2	1,50	1,35

The safety factors for materials shall be in accordance with Table 7.

**Table 7 — Partial material factors  $\gamma_m$**

Material	$\gamma_m$
Steel	1,05
Aluminium	1,15
Timber	1,35
Fibre reinforced polymer	1,50
Plastics	1,80

To obtain the overall safety factor, multiply the figures from Table 6 and Table 7.

## 5.3 Loads

### 5.3.1 Wind actions

#### 5.3.1.1 General

The wind pressure may be either calculated by the method in 5.3.1.2 or taken from Table 8.

In either case the wind load shall be multiplied by the shape factor. The shape factor for flat signs is 1.20.

In both cases the wind pressure shall be applied as a uniformly distributed load over the area of the sign plate and act at the centre of pressure of the sign plate in order to calculate the bending moments in the supports and sign plate.

The eccentricity value shall be declared in the requirements and in the evaluation report of the product.

NOTE This is often taken as zero however purchasers can require different values as they affect the bending moment applied to the post.

#### 5.3.1.2 Calculation of wind pressure

Wind actions shall be calculated in accordance with EN 1991-1-4. The calculations shall identify whether they are based on a 25 year or a 50 year reference wind speed.

The reference wind speed shall be appropriate to the sign location taken from the location data.

### 5.3.1.3 Classes of wind pressure

The wind pressure for calculating the structural integrity of the sign plate, fixings and supports shall be in accordance with Table 8.

**Table 8 — Wind pressure**

Class	Wind pressure kN.m <sup>-2</sup>
WL0	No performance determined
WL1	0,40
WL2	0,60
WL3	0,80
WL4	0,90
WL5	1,00
WL6	1,20
WL7	1,40
WL8	1,50
WL9	1,60

NOTE 1 Wind speeds in mountainous, coastal and estuarial regions can be as much as 40 % above speeds in other areas. Purchasers should consider specifying a higher class of wind load or reference wind speed for these locations.

NOTE 2 The wind pressures in Table 8 do not include safety factors and shape factors.

### 5.3.2 Dynamic pressure from snow clearance

The dynamic pressure from snow clearance, from Table 9, shall be applied to the areas indicated in Annex A. This load is not simultaneous with wind load and point load.

**Table 9 — Dynamic snow pressure**

Class	Dynamic snow pressure kN.m <sup>-2</sup>
DSL0	No performance determined
DSL1	1,5
DSL2	2,5
DSL3	3,0
DSL4	4,0

### 5.3.3 Point loads

The point load, from Table 10, shall be placed as indicated in Annex A. This load is not applied simultaneously with the wind load and snow load. The acceptance criterion shall be as given in 5.4.2.

**Table 10 — Point loads**

Class	Point load kN
PL0	No performance determined
PL1	0,15
PL2	0,30
PL3	0,50
PL4	0,75
PL5	1,00

#### 5.3.4 Dead loads

Dead loads shall be the combined weight of the individual components of the finished sign such as substrate, sign housing, protective edge, stiffeners, luminaires, supports, fixings etc.

The acceptance criterion shall be as given in 5.4.2.

#### 5.4 Deflections

##### 5.4.1 Temporary deflections

The wind load for calculating the temporary deflection shall be based on the wind loads multiplied by 0,56, and no partial action and material factors are applied.

NOTE 1 The factor of 0,56 is derived from the 50 year wind speed reduction to one year wind speeds.

Temporary deflections from wind actions only shall be calculated in accordance with 5.4.3 or tested in accordance with 5.4.4.

The temporary deflection of the sign plate, specified from Table 11, shall be determined at the point where the deflection is greatest (see Figures A.1 to A.7).

The maximum temporary deflection of the supports relative to the foundations shall conform to the deflection class(es) chosen from Tables 11 and 12.

**Table 11 — Maximum temporary deflection – Bending**

Class	Bending mm·m <sup>-1</sup>
TDB0	No performance determined
TDB1	2
TDB2	5
TDB3	10
TDB4	25
TDB5	50
TDB6	100



Table 12 — Maximum temporary deflection – Torsion

Class	Torsion degree·m <sup>-1</sup>
TDT0	No performance determined
TDT1	0,02
TDT2	0,06
TDT3	0,11
TDT4	0,29
TDT5	0,57
TDT6	1,15

NOTE 2 Table 12 only applies to a single sign support subjected to torsion from an asymmetrical load, position or shape of the sign.

#### 5.4.2 Permanent deflections

Permanent deflections shall be assessed using the following loads: 25 year or 50 year wind load, dynamic snow load, point load and dead load. The partial action and material factors are applied.

When the structural performance is evaluated by means of a physical test, the maximum permanent deflection shall not exceed 20 % of the temporary deflection using the same load.

NOTE This takes into account the slack in the fixings and other non-elastic phenomena.

When the structural performance is evaluated by calculation, the material stresses shall not exceed the elastic limit.

#### 5.4.3 Calculations for the verification of physical performance

The construction shall be designed in such a way that the deformation shall stay in the elastic region when applying the specified (25 year or 50 year) wind load, point load or dynamic load from snow clearance.

Calculations shall be in accordance with, and fulfil the requirements of, EN 1993-1-1, EN 1995-1-1 or EN 1999-1-1 as appropriate.

The relevant safety factors in 5.2 and shape factors for the individual member shall be applied when calculating the loading.

When calculating temporary deflections, only shape factors for the individual member shall be applied.

#### 6.4 Corrosion resistance

The material of the support, the system of protection and the class of corrosion resistance in accordance with 7.1.7 shall be declared.

#### 6.5 Base plates

Circular hollow section supports shall if required be fitted with a base plate or other device to prevent rotation in the ground or foundation.

Base plates or other devices may take the form of a separate component to be fitted during construction or installation of the sign assembly.

### 7 Sign plates, sign faces, transilluminated signs, externally illuminated signs and supports

#### 7.1 Design

##### 7.1.1 General

For products used to manufacture complete signs, the product shall conform to the appropriate parts of this or other relevant European or International Standards.

##### 7.1.2 Colour of the back

The Manufacturer shall ensure that the colour of the back of the sign plate is in accordance of the purchaser's requirements.

##### 7.1.3 Dimensions and tolerances

The dimensions and the signs faces shall be in accordance to the purchaser's requirements.

##### 7.1.4 Corner radii

Unless otherwise specified in the purchaser's requirements, the corner radii shall be not less than 10 mm.

##### 7.1.5 Piercing

When sign substrates are stiffened with additional reinforcing members, these shall be fixed to the sign substrate in accordance with Table 13.

**Table 13 — Piercing of sign face**

Class	Requirements
P1	The sign face shall be pierced only at intervals of not less than 150 mm in any direction, except when required for the purpose of securing the sign substrate to the supporting structure
P2	The sign face shall not be pierced, except when required for the purpose of securing the sign substrate to the supporting structure
P3	The sign face shall not be pierced for any reason

### 7.1.6 Sign plate edges

Sign edges shall conform to Table 14.

**Table 14 — Edges of sign plates**

Class	Requirements
E1	Non-protective, the substrate being a flat sheet of material
E2	Protective, with the edge stamped, formed, pressed, or covered by an edging profile
E3	Protective, protection being provided by the mounting structure

### 7.1.7 Corrosion resistance

The classes of surface protection against corrosion shall be in accordance with Table 15.

**Table 15 — Surface protection**

Class	Requirements
SP0	Surface protection not provided
SP1	Protective coatings provided
SP2	Inherent surface protection provided

Hot dip galvanizing shall conform to EN ISO 1461 or EN 10240.

Any part of an aluminium support which is to be placed underground shall have a protective coating applied in accordance with the instructions and recommendations of the manufacturer of the surface coating.

The manufacturer shall apply surface coating in accordance with the instructions and recommendations of the manufacturer of the surface coating.

Timber components shall be treated for preservation in accordance with the instructions and recommendations of the manufacturer of the preservation material.

### 7.1.8 Protection from foreign objects and water

The minimum levels of protection of transilluminated sign housings, luminaires and luminaire housings against penetration by dust and water, specified in EN 60529, shall be level 2 for solid particles and level 3 for water.

NOTE This does not exclude the possibility of a purchaser specifying a higher level of protection.

### 7.1.9 Light sources and circuits

Lit signs may have either a single light source or multiple light sources.

Multiple light source circuits shall be arranged so that in the event of one circuit failure, the sign will remain evenly illuminated.

#### 7.1.10 Colour rendering of light sources

Light sources installed in transilluminated signs, or in luminaires for external illumination of road signs, shall be of types with a general colour rendering index Ra, as defined in EN 12665, of a minimum value of 60.

NOTE Improved performance can be obtained with light sources with a colour rendering index of 80.

#### 7.1.11 Transilluminated sign housings

Sign housings for transilluminated signs shall be designed to ensure reliable transfer of all static and dynamic forces to the fixing and mounting structures. The walls of the housing shall be designed to satisfy the static requirements. Corners shall be rounded. The design shall ensure that rainwater does not run off the housing and down the sign face.

#### 7.1.12 External lighting units

Luminaires for the external illumination of signs shall be of the enclosed type. The structural design shall include the whole structure consisting of housing, support and fixings. The luminaire shall incorporate light source, control equipment, reflector and cover or lens.

Luminaires for the external illumination of signs shall be mounted so that they do not hide any part of the sign face from the view of drivers and do not lead to surface reflections in the sign face material as seen in normal viewing directions.

NOTE Surface reflections are normally avoided when directions of illumination form angles to the normal of the sign face greater than 30°. This can be obtained by mounting the luminaires below the road sign, above it or at the sides. Each of these mounting arrangements have advantages and disadvantages, e.g. reduced free height below the luminaires and possibly light shining in the eyes of drivers travelling in the opposite direction. This latter problem can be reduced by an extension of the sign plate.

#### 7.1.13 Electrical

Mounting devices shall have cable entries to accommodate cable connection equipment.

NOTE The Low Voltage and EMC Directives apply to electrical components.

Means shall be provided to correct the power factor in accordance with national electricity supply requirements.

The nominal life of light sources shall be declared by the manufacturer.

#### 7.1.14 Fixings

Sign fixings shall fit sign supports so that they prevent sliding on or rotation around the support and enable conformance to 5.1 when the specified vertical or horizontal load from Table 9 is applied. Sign fixings shall also conform to 7.1.7.

NOTE The limits specified in Table 16, with the exception of brown and grey, are recommended in CIE 39.2 as surface colours for visual signalling. When colours deteriorate beyond these chromaticity limits, in some cases the signs will not be suitable for the intended purpose. The chromaticity limits specified in Table 17 ensure a more uniform appearance and consistency in the colour of new signs which are installed at different times than the limits specified in Table 16. Colours conforming to the limits of Table 17 can also be expected to take longer to deteriorate beyond the limits of Table 16.

#### **7.2.2.1.4 Durability of visual performance**

Test samples of non-retroreflective material shall be exposed, inclined at an angle of 45° to the horizontal and facing the equator, in accordance with EN ISO 877:1996, Method A for two years.

When tested after exposure the chromaticity and luminance factor shall conform to the requirements of 7.2.2.1.3 as appropriate.

#### **7.2.2.2 Impact resistance**

Impact resistance shall be verified using the procedure in 4.1.2.

### **7.3 Transilluminated signs**

#### **7.3.1 Visual performance**

##### **7.3.1.1 Test conditions**

Test conditions shall conform to 4.1.1.1.

##### **7.3.1.2 Test samples**

Tests shall be conducted on prepared samples representative of finished products and suitable for the test equipment. Any substrate used for the samples shall be non reflective.

Test samples and test panels shall be conditioned in accordance with EN ISO 139 and shall be identified on the back.

##### **7.3.1.3 Daylight chromaticity and luminance factor**

When tested in accordance with the relevant procedure specified in CIE 15, using CIE standard daylight illuminant D65 and the standard CIE 45/0 viewing conditions, the chromaticity and the luminance factor  $\beta$  shall be in accordance with Table 18.

**Table 18 — Daylight chromaticity and luminance factors**

Colour	1		2		3		4		Luminance factor $\beta$ Class B1		Luminance factor $\beta$ Class B2	
	x	y	X	y	x	y	x	y	min.	max.	min.	max.
Red	0,690	0,310	0,595	0,315	0,569	0,341	0,655	0,345	0,03		0,07	
Orange	0,610	0,390	0,535	0,375	0,506	0,404	0,570	0,429	0,20		0,20	
Yellow	0,522	0,477	0,470	0,440	0,427	0,483	0,465	0,534	0,24		0,45	
Green	0,313	0,682	0,313	0,453	0,209	0,383	0,013	0,486	0,03		0,10	
Dark Green	0,313	0,682	0,313	0,453	0,177	0,362	0,026	0,399	0,03		0,10	
Blue	0,078	0,171	0,196	0,250	0,225	0,184	0,137	0,038	0,01		0,05	
Brown	0,445	0,352	0,445	0,382	0,602	0,396	0,551	0,442	0,01		0,03	
White	0,350	0,360	0,300	0,310	0,290	0,320	0,340	0,370	0,40		0,75	
Grey	0,440	0,382	0,285	0,264	0,285	0,332	0,440	0,432	0,08	0,24	0,16	0,24
Black	0,385	0,355	0,300	0,270	0,260	0,310	0,345	0,395		0,03		0,03

When points lie on the spectral boundary, they shall be joined by that boundary and not by a straight line.

**7.3.1.4 Mean luminance**

When measured in accordance with 7.3.1.7, transilluminated signs shall conform to Table 19.

**Table 19 — Mean luminance  $L$  of transilluminated signs**

unit:  $\text{cd m}^{-2}$

Colour	Class L1	Class L2	Class L3	Class LS
White	$40 \leq L < 150$	$150 \leq L < 300$	$300 \leq L \leq 900$	$10 \leq L < 40$
Yellow	$30 \leq L < 100$	$100 \leq L < 300$	$300 \leq L \leq 900$	$7.5 \leq L < 30$
Red	$6 \leq L < 20$	$20 \leq L < 50$	$50 \leq L \leq 110$	$1.5 \leq L < 6$
Blue	$4 \leq L < 10$	$10 \leq L < 40$	$40 \leq L \leq 80$	$1 \leq L < 4$
Green	$8 \leq L < 20$	$20 \leq L < 70$	$70 \leq L \leq 180$	$2 \leq L < 8$
Dark Green	$4 \leq L < 10$	$10 \leq L < 40$	$40 \leq L \leq 80$	$1 \leq L < 4$
Brown	$4 \leq L < 10$	$10 \leq L < 40$	$40 \leq L \leq 80$	$1 \leq L < 4$

Class LS may be used in those Member States using electro-luminescent material and is recommended for use only when the sign face material is translucent retroreflective.

**7.3.1.5 Luminance contrast of transilluminated signs  $K$**

When measured in accordance with 7.3.1.7, the luminance contrast of transilluminated signs, as determined by the ratio of the luminance of the contrast colour to the luminance of the colour, shall conform to the requirements of Table 20.

**Table 20 — Luminance contrast  $K$  of transilluminated signs**

Colour	Blue	Red	Green	Dark Green	Brown
Contrast colour	White	White	White	White and yellow	White
Luminance contrast	$5 \leq K \leq 15$	$5 \leq K \leq 15$	$5 \leq K \leq 15$	$5 \leq K \leq 15$	$5 \leq K \leq 15$

**7.3.1.6 Uniformity of luminance**

When measured in accordance with the procedures specified in 7.3.1.7, the uniformity of luminance, determined by the ratio of the lowest to the highest level measured at any part of the background colour of the sign, shall conform to the requirements of Table 21.

**Table 21 — Uniformity of luminance**

Class	Maximum ratio
U1	1/10
U2	1/6
U3	1/3

**7.3.1.7 Test methods for the mean luminance, the luminance contrast and the uniformity of luminance****7.3.1.7.1 Procedure**

The test procedure shall be as follows.

Mount the transilluminated sign with the sign face vertical.

Stabilize the supply voltage at the supply voltage declared by the manufacturer.

Divide the sign face into test squares commencing at the centre of the sign face. The side of the test squares shall be either 10 % of the sign height or 100 mm, whichever is greater.

Using a luminance meter conforming to EN 13032-1, measure the luminance of each test square in a direction normal to the test square so that the circular area of the measuring spot falls on the centre of the test square and is larger than 10 % of the test square area. Omit measurement for those test squares where the area of the circular measuring spot falls partly outside the sign face, or includes other colours than the background colour.

Calibrate the luminance meter across the full range of measurements. After the application of any photometric correction factors, calculate the mean luminance value and the luminance uniformity as the ratio of minimum to maximum luminance.

For any other colour of the sign face, measure the luminance of that colour at a suitable location in a direction perpendicular to the location using a measuring spot fully contained within an area with that colour. Measure also the luminance of the background colour at a location as close as possible to the above-mentioned location with the measuring spot fully contained within the background colour.

Calculate the luminance contrast as the ratio of the luminance of a white or yellow colour to the luminance of a blue, red, green, dark green or brown colour.

## **EN 12899-1:2007 (E)**

The test sign shall be supported as it would be when installed, or the test sample shall be supported over an open area of 100 mm x 100 mm.

### **8 Sign assemblies**

Components for sign assemblies shall conform to the relevant sections of this document.

### **9 Marking, labelling and product information**

#### **9.1 General**

The manufacturer shall provide the following information. Where this cannot be marked on the product it shall be in the accompanying documentation. In this event there shall be a product identification code on the product.

#### **9.2 Marking and labelling**

All products and components mentioned in the scope shall be clearly and durably marked on the back with the following information:

- 1) number and date of this European Standard;
- 2) relevant performance classification of the product;
- 3) last two digits of the year of manufacture;
- 4) name, trade mark or other means of identification of the manufacturer or supplier when not the manufacturer;
- 5) batch or lot number.

Retroreflective sheetings used in the manufacture of fixed traffic signs shall have a durable and visible identification mark. The durability of the mark shall be equivalent to the expected lifetime of the retroreflective sheeting and the mark shall be visible on the finished product. The mark shall contain at least the following information:

- manufacturer's identification logo or symbol;
- production identification code; and
- retroreflective performance class as specified in EN 12899-1 or the relevant ETA.

All information shall be consistently repeated at least once within an area of 400 mm × 400 mm.

NOTE Additional information can be provided.

Where regulatory marking requires the same information as this subclause, then the requirements for information in accordance with this subclause are deemed to be satisfied.

#### **9.3 Product information**

The manufacturer or supplier shall make available the following information:

- instructions on the assembly and erection of the sign;
- details of any limitations on location or use;



- instructions on the operation, maintenance and cleaning of the sign, including lamp replacement procedures.

#### **9.4 Luminaires**

The manufacturer shall provide a luminous intensity distribution to prove conformity to the other relevant requirements of this standard.

### **10 Evaluation of conformity**

The conformity of a vertical road traffic sign to the requirements of this standard and with the stated values (including classes) shall be demonstrated by:

- initial type testing in accordance with EN 12899-5; and
- factory production control by the manufacturer in accordance with EN 12899-4.

A FPC system conforming to the requirements of EN ISO 9001 and made product specific to the requirements of this standard shall be considered to satisfy FPC requirements in accordance with this standard.

### **11 Dangerous substances**

Materials used in products shall not release any dangerous substances in excess of the maximum permitted levels specified in a relevant European Standard for the material or permitted in the national regulations of the member state of destination.