

BS 8442:2022



BSI Standards Publication

**Miscellaneous road traffic signs  
and devices – Requirements and  
test methods**

**bsi.**

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# Foreword

## Publishing information

This British Standard is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 28 February 2022. It was prepared by Subcommittee B/509/3, *Construction of road traffic signs*, under the authority of Technical Committee B/509, *Road equipment*. A list of organizations represented on these committees can be obtained on request to its secretary.

## Supersession

This British Standard supersedes [BS 8442:2015](#), which is withdrawn.

## Information about this document

This is a full revision of the standard, and introduces the following principal changes:

- references to legislation and other standards have been updated and duplication of their content within this standard has been avoided where possible. This has the effect of making the full range of colours for permanent signs available also for temporary ones, with the identical chromaticity and luminance requirements;
- non-retroreflective roads studs have been removed, as these are specified in the relevant Statutory Instrument (TSRGD);
- non-illuminated post requirements have been simplified and the option of offset brackets added;
- a maximum luminance of 1 200 cd·m<sup>-2</sup> is given for beacon globes, including any device designed to improve the conspicuousness of the globe;
- the chromaticity of flashing amber signals is now to Yellow Class C2 of BS EN 12966:2014+A1:2018;
- head and body components are distinguished for foreign object and water ingress and reference made to BS EN 60529;
- clarification of purchaser information to be supplied has been made in some instances; and
- formulae in [Annex F](#) have been corrected.

This publication can be withdrawn, revised, partially superseded or superseded. Information regarding the status of this publication can be found in the Standards Catalogue on the BSI website at [bsigroup.com/standards](https://bsigroup.com/standards), or by contacting the Customer Services team.

Where websites and webpages have been cited, they are provided for ease of reference and are correct at the time of publication. The location of a webpage or website, or its contents, cannot be guaranteed.

## Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its requirements are expressed in sentences in which the principal auxiliary verb is “shall”.

*Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.*

Where words have alternative spellings, the preferred spelling of the Shorter Oxford English Dictionary is used (e.g. “organization” rather than “organisation”).

**Contractual and legal considerations**

This publication has been prepared in good faith, however no representation, warranty, assurance or undertaking (express or implied) is or will be made, and no responsibility or liability is or will be accepted by BSI in relation to the adequacy, accuracy, completeness or reasonableness of this publication. All and any such responsibility and liability is expressly disclaimed to the full extent permitted by the law.

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The recipient is advised to consider seeking professional guidance with respect to its use of this publication.

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**Compliance with a British Standard cannot confer immunity from legal obligations.**

In particular, attention is drawn to the following specific regulations:

- The Traffic Signs Regulations and General Directions 2016 [1]
- Electrical Equipment Safety Regulations 2016 [2]
- Radio Equipment Regulations 2017 [3]
- Electromagnetic Compatibility Regulations 2016 [4]
- Traffic Signs Manual [5]
- Safety at Streetworks and Road Works: A Code of Practice [6]

## 1 Scope

This British Standard specifies requirements and test methods for rigid and flexible portable signs, barriers, self-supporting portable signs, “Stop/Go” and “Stop/Works” signs, school crossing patrol signs, flat traffic delineators, flap signs, pedestrian crossing and refuge beacons, internally illuminated posts, twin amber flashing light units and retroreflective self-righting bollards.

*NOTE* The tests given in this British Standard are suitable for both initial type testing and production testing.

Road studs are not covered by this British Standard.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes provisions of this document<sup>1)</sup>. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

### Standards publications

[BS 3424-5:1982](#), *Testing coated fabrics – Part 5: Methods 7A, 7B and 7C – Methods for determination of tear strength*

[BS 7263-1](#), *Precast concrete flags, kerbs, channels, edgings and quadrants – Part 1: Precast, unreinforced concrete paving flags and complementary fittings – Requirements and test methods*

BS EN 40-2:2004, *Lighting columns – Part 2: General requirements and dimensions*

BS EN 40-6:2002, *Lighting columns – Requirements for aluminium lighting columns*

BS EN 485-1, *Aluminium and aluminium alloys – Sheet, strip and plate – Part 1: Technical conditions for inspection and delivery*

BS EN 12332-1, *Rubber- or plastics-coated fabrics – Determination of bursting strength – Part 1: Steel ball method*

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

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

BS EN 12899-1:2007, *Fixed, vertical road traffic signs – Part 1: Fixed signs<sup>2)</sup>*

BS EN 12966:2014+A1:2018, *Road Vertical Traffic Signs – Variable message traffic signs<sup>3)</sup>*

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

BS EN 50293, *Road traffic signal systems – Electromagnetic compatibility*

BS EN 60529, *Degrees of protection provided by enclosures (IP code)*

BS EN 60598-1:2000, *Luminaires – Part 1: General requirements and tests*

BS EN ISO 877-1:2010, *Plastics – Methods of exposure to solar radiation – Part 1: General guidance*

BS EN ISO 877-2:2010, *Plastics – Methods of exposure to solar radiation – Part 2: Direct weathering and exposure behind window glass*

BS EN ISO 1421, *Rubber- or plastics-coated fabrics – Determination of tensile strength and elongation at break*

<sup>1)</sup> Documents that are referred to solely in an informative manner are listed in the Bibliography.

<sup>2)</sup> This standard also gives informative references to BS EN 12899-1:2007.

<sup>3)</sup> This standard also gives an informative reference to BS EN 12966:2014+A1:2018.

BS EN ISO 1461, *Hot dip galvanized coatings on fabricated iron and steel articles – Specifications and test methods*

BS EN ISO 2286-2:1998, *Rubber- or plastics-coated fabrics – Determination of roll characteristics – Methods for determination of total mass per unit area, mass per unit area of coating and mass per unit area of substrate*

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

#### **Other publications**

[N1] INTERNATIONAL COMMISSION ON ILLUMINATION CIE 17.4, *International lighting vocabulary*

[N2] INTERNATIONAL COMMISSION ON ILLUMINATION CIE 15, *Colorimetry*

[N3] INTERNATIONAL COMMISSION ON ILLUMINATION CIE 54.2, *Retroreflection: definition and measurement*

### **3 Terms and definitions**

For the purposes of this British Standard, the terms and definitions given in CIE 17.4 [N1] and the following apply.

#### **3.1 coefficient of retroreflection $R_A$**

luminous intensity of a surface in the direction of observation, divided by the product of the illuminance on a plane perpendicular to the direction of incident light and the area of the surface

*NOTE*  $R_A$  is expressed in candelas per lux per square metre:  $\text{cd}\cdot\text{lx}^{-1}\cdot\text{m}^{-2}$ .

#### **3.2 conspicuity panel**

part of the body of a self-righting bollard that enhances its conspicuity in all lighting conditions

#### **3.3 entrance angle $\beta$**

angle between the illumination axis and the retroreflector axis

*NOTE* In signing applications the entrance angle is less than  $90^\circ$ .

#### **3.4 fluorescent**

material that exhibits fluorescence

*NOTE* Fluorescence is an attribute of daytime appearance based on absorption of light at shorter wavelengths and emission at longer wavelengths.

#### **3.5 ground line**

level of surface on which a device is mounted

#### **3.6 luminance**

physical measure of optical stimulus that produces the sensation of brightness measured by the luminous intensity of light emitted or reflected in a given direction from a surface element divided by the area of the element projected in the same direction

*NOTE* The unit of measurement is candelas per square metre ( $\text{cd}\cdot\text{m}^{-2}$ ).

#### **3.7 luminance factor $\beta$**

ratio of the luminance of a surface to that of a perfect diffuse reflector, identically illuminated and viewed

**3.8 observation angle  $\alpha$** 

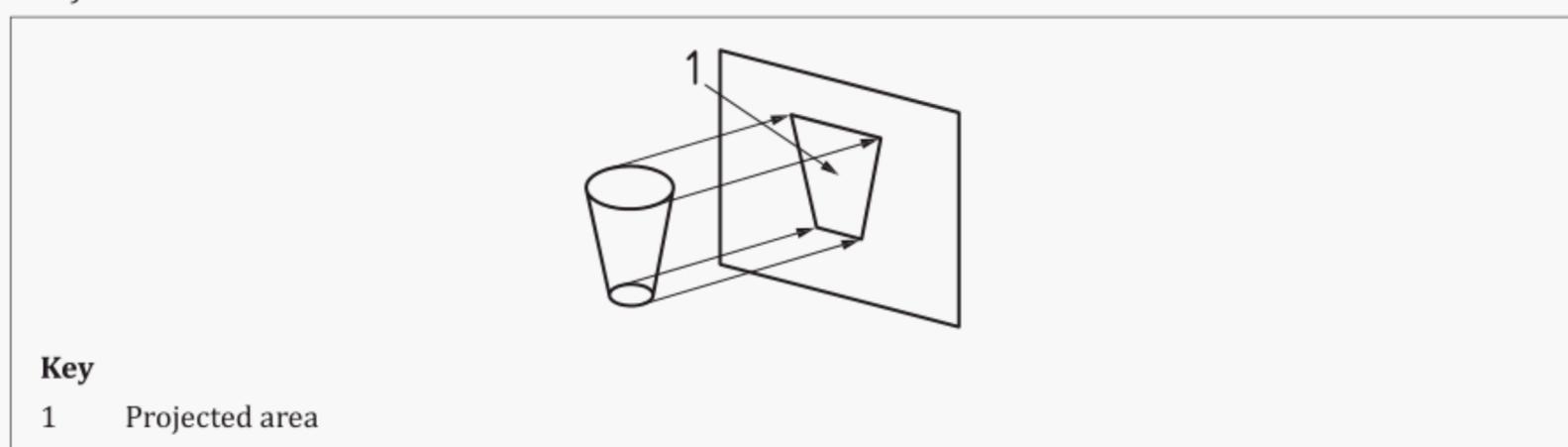
angle between the illumination axis and the observation axis

**3.9 projected area**

area of a three-dimensional object when projected on to a plane surface at right angles to the direction of viewing

*NOTE* See [Figure 1](#) for an example of projected area.

**Figure 1** — Projected area

**3.10 retroreflection**

reflection in which the reflected rays are preferentially returned in directions close to the opposite of the direction of the incident rays, this property being maintained over wide variations in the direction of the incident ray

**3.11 retroreflective self-righting bollard (RSRB)**

retroreflective self-righting device normally mounted on a refuge or a traffic island

*NOTE 1* An RSRB can contain a prescribed traffic sign or a plain white area. It incorporates conspicuity panels made from fluorescent yellow to enhance both daytime and night-time visibility. It is level A “non-harmful” (see BS EN 12767) when tested for passive safety and the depth of the body is limited so that, when deflected under impact, a vehicle can pass over it.

*NOTE 2* RSRB are defined as traffic bollards for the purposes of the Traffic Signs Regulations and General Directions [1].

**3.12 RSRB body**

part of an RSRB above the lower edge of the front conspicuity panel

**3.13 substrate**

material that supports the sign face

**3.14 traffic sign**

any object or device, whether fixed or portable, for conveying, to traffic on roads or any specified class of traffic, warnings, information requirements, restrictions or prohibitions of any description

**4 Information to be obtained from the purchaser**

The following information shall be obtained from the purchaser when ordering to ensure products supplied are suitable for intended use:

- a) the properties of the retroreflective material (see [Annex A](#));
- b) the level of protection against electric shock (see [12.1](#));

- c) the degree of ingress protection required if it is higher than that specified in [12.2.1](#), [12.3.1](#) and [12.4.1](#);
- d) the length of a zebra crossing or refuge beacon post above ground (see [12.3.2.1](#) and [12.3.2.2](#));  
*NOTE 1 Attention is drawn to the Traffic Signs Regulations and General Directions 2016 [1] with regard to the prescribed limits.*
- e) the method of securing a flashing amber light unit to a post (see [12.4.1](#));
- f) the substrate to which sign face material is to be applied if other than 3 mm aluminium sheet (see [A.2.2](#)); and
- g) the location ambient light levels and level of required luminance needed for the location of installation (or dimming facility) for belisha beacons, illuminated posts and flashing amber units.

*NOTE 2 Purchasers should consider levels in relation to the background against which the product is viewed.*

## 5 Self-supporting rigid portable signs, other than barriers

### 5.1 General

Self-supporting rigid portable signs shall be constructed in such a way that, when erected, the lowest edge of the sign, or of any supplementary plate, shall be not less than 300 mm above the supporting surface. The sign shall be so constructed that, when erected, the sign face is either normal to the supporting surface or inclined so that the top of the sign leans away from the viewer, at an angle not greater than 22.5° from the normal to the supporting surface when observed from the front.

*NOTE 1 Retroreflective materials are designed to provide more reflected light to drivers when mounted vertically.*

The sign assembly shall be designed to enable ballasting so that the sign resists the wind forces in its intended location. The sign assembly manufacturer shall indicate the minimum recommended ballast required and its positioning on the sign assembly's supports for the sign assembly to resist the wind speed class(es) for which it is designed [see [Table 1](#), [14.1e](#)] and [Annex B](#)].

*NOTE 2 See further TMCA Guidance on Ballasting of Temporary Road Signs (TTM Advice Note 4) [7].*

The minimum recommended ballast required for the sign assembly to resist Class A, Class B and Class C wind speeds shall be calculated using the methods described in [Annex C](#).

*NOTE 3 Attention is drawn to the TSRGD [1] where the front of any backing board or background against which the sign is displayed is required by the TSRGD [1] to be grey or yellow.*

**Table 1** — Classification of effective wind speeds  $V_e$

Class of wind speed	Effective wind speed, $V_e$ ms <sup>-1</sup>
A	26.3
B	17.6
C	8.7

*NOTE 4 Pressure due to passing vehicles is small by comparison and is not included in the calculation of effective wind speed. A guide to wind speed classes is given in [Annex D](#).*

### 5.2 Visual performance of sign face material

The visual performance of the sign face material shall conform to [A.3](#).

*NOTE The retroreflective classes from which specifiers can choose characterize reflective performance when mounted vertically. However, temporary traffic signs are often mounted non-vertically in use. The retroreflective performance of a sign mounted non-vertically is lower than that provided if that same sign was installed vertically. As no method exists to test reflective performance in non-vertical orientation, specifiers are encouraged to mount*

signs vertically whenever possible. Where non-vertical mounting is unavoidable, specifiers should take into account the resulting reduced reflective performance when determining the reflective class to specify.

### 5.3 Physical performance of the sign face

The physical performance of sign face material shall conform to [A.4](#).

### 5.4 Physical performance of the sign assembly

When tested in accordance with [Annex E](#), the sign assembly shall not:

- a) begin to overturn by rotating at the back of the base when the force is applied from the front;
- b) begin to overturn by rotating at the front of the base when the force is applied from the back; or
- c) slide along the surface if the force is applied in either direction.

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## 6 Portable barriers

### 6.1 General

Barrier units, comprising barrier boards, tapping rails, supports and bases, shall be capable of being incorporated into systems used to mark part of a highway that is closed to traffic or to guide traffic or pedestrians past an obstruction.

The barrier unit shall be constructed so as to allow the use of ballasting. The manufacturer shall indicate the minimum recommended ballast required, including its positioning on the barrier assembly's supports, for the barrier assembly to resist the wind speed class(es) for which it is designed [see [Table 1](#), [14.1e](#)) and [Annex B](#)].

*NOTE 1 Barrier units incorporating traffic signs intended to close a traffic lane, or guide traffic or pedestrians past works, are regulated by the TSRGD [1].*

*NOTE 2 The minimum recommended ballast required for the barrier assembly to resist Class A, Class B and Class C wind speeds should be calculated in accordance with [Annex E](#).*

### 6.2 Visual performance

Visual performance of any traffic sign incorporated into portable barriers shall conform to [A.3](#).

### 6.3 Physical performance

Physical performance of portable barriers shall conform to [A.4](#).

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## 7 Self-supporting flexible portable signs

### 7.1 General

The self-supporting portable sign shall be constructed in such a way that, when erected, the lowest edge of the sign or of any supplementary plate shall be not less than 300 mm above the supporting surface. The sign shall be so constructed that, when erected, the sign face is either normal to the supporting surface or inclined so that the top of the sign leans away from the viewer at an angle not greater than 22.5° from the normal to the supporting surface when observed from the front.

*NOTE 1 The self-supporting portable sign should be designed in such a way that ingress of moisture does not impair the photometric or colorimetric performance of the sign.*

*NOTE 2 Vertical mounting should be used as this improves the retroreflective performance of virtually all sign face materials.*

When tested in accordance with [Annex E](#), the sign assembly shall conform to [5.4](#).

*NOTE 3* The front of any backing board or background against which the sign is displayed is required by the TSRGD [1] to be grey or yellow.

## 7.2 Visual performance

Visual performance shall conform to [A.3](#).

## 7.3 Physical properties of substrate material

The properties of the substrate to which the sign face is applied shall conform to the properties specified in [Table 2](#), when tested in accordance with the relevant standards specified in [Table 2](#).

*NOTE 1* As these signs are generally transported and stored folded or rolled, the performance and legibility of the sign should remain intact after being transported. More details are given in the Traffic Signs Manual [5].

*NOTE 2* Substrate material is not required to conform to [A.4](#).

**Table 2** — Physical properties of substrate material

Property	Value	Test method
Minimum mass per unit area	500 g/m <sup>2</sup>	BS EN ISO 2286-2:1998, Method B
Minimum tensile strength	1 000 N/50 mm	BS EN ISO 1421
Maximum extension at break	15%	BS EN ISO 1421
Minimum tongue tear strength	400 N	<a href="#">BS 3424-5:1982</a> , Method 7A
Minimum bursting strength	2 750 kN/m <sup>2</sup>	BS EN 12332-1

## 8 Manually operated portable “Stop/Go” and “Stop Works” signs

### 8.1 General

The sign shall be supported on a stand or pole constructed in such a way that the height to the centre of the sign measured from the road surface is between 1.2 m and 1.8 m.

Where a stand is provided, it shall be so constructed that the operator can rotate the sign about a vertical axis to present either face to an adjacent observer. Where specified by a purchaser, a device shall be incorporated in the stand that halts the movement of the sign in one direction, so that it presents only one of its faces, and only allows it to revolve enough to present the other face before again being stopped.

The sign shall be fixed to the stand or pole in such a way that the fixing does not alter or obscure the layout or colouring on either side of the sign.

Any visible supporting substrate to which the sign is applied shall be coloured grey.

*NOTE 1* The signs to appear on each side of the substrate are specified in diagrams 7023, 7024 and 7031 in the TSRGD [1]. The substrate and any surrounding frame should be circular.

*NOTE 2* The method of fixing the sign to the stand should be such that the sign cannot be dislodged or rotated from its position.

### 8.2 Visual performance

Visual performance shall conform to [A.3](#).

### 8.3 Physical performance

Physical performance shall conform to [A.4](#).

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## 9 Portable school crossing patrol signs

### 9.1 General

The pole on which the sign is mounted shall be 1.4 m to 1.5 m in length. The sign shall be fixed to the pole in such a way that the fixing does not alter or obscure the layout or colouring on either side of the sign.

### 9.2 Visual performance

Visual performance shall conform to [A.3](#).

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## 10 Portable flat traffic delineators (FTDs)

### 10.1 General

The blade and its attachment to the base or fixing shall be so constructed that the face of the blade presents a plane to the approaching traffic no more than 12.5° from the vertical.

The white portions shall be retroreflective; the red portions can also be retroreflective.

*NOTE* The general design and dimensions of FTDs are prescribed in diagram 7102 and other provisions of the TSRGD [1].

### 10.2 Visual performance

Visual performance shall conform to [A.3](#).

### 10.3 Physical performance

#### 10.3.1 Impact resistance at low temperature

When tested in accordance with [Annex G](#), there shall be no cracking or delamination of any retroreflective surface from the substrate outside a circle of radius 6 mm, with the point of impact as its centre. The blade shall not become detached from its base. The FTD shall recover its original form after the impact.

#### 10.3.2 Resistance to bending

When tested in accordance with [Annex H](#), the residual deflection of the top of the blade measured from the reference surface shall not exceed 5% of the height of the blade. The blade shall be neither damaged nor detached from its base.

#### 10.3.3 Fatigue resistance

When tested in accordance with [Annex I](#), the blade shall be neither damaged nor detached from its base.

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## 11 Fixed, permanent, manually operated flap signs

### 11.1 General

A flap sign shall consist of a sign plate constructed in such a way that the whole or part of the message can be concealed when not required or an alternative message displayed.

The sign shall be so constructed that not more than 5% of its surface is obscured by fittings used to effect the changes. Any hinge plates or other fittings shall be fitted to the back of the sign.

To avoid staining of the sign face, the fittings shall conform to BS EN 12899-1:2007, 7.1.7, Table 15 for either SP1 or SP2.

*NOTE* When the message is concealed, the TSRGD [1] require the parts of the sign visible to drivers to be grey or black.

Means shall be provided for the assembly to be locked in both the displayed and concealed positions in such a manner that the sign face is not damaged.

## 11.2 Visual performance

Visual performance of the sign face material of flap signs shall conform to A.3.

## 11.3 Physical performance

The flap sign shall conform to BS EN 12899-1:2007.

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## 12 Fixed, permanent pedestrian crossing and refuge beacons and twin amber flashing lights

### 12.1 Electrical requirements

Electrical components, including associated ballasts, flashing units and controllers, shall conform to BS EN 50293 for electromagnetic compatibility.

Means shall be provided to correct the power factor to not less than 0.85 lagging or 0.95 leading.

Protection against electric shock shall be either Class 1 or Class 2 in accordance with BS EN 60598-1:2000, 2.2, as specified by the purchaser [see 4b)].

Any base compartment housing electrical components shall be fitted with a secure lock.

*NOTE* Attention is drawn to the Electrical Equipment Safety Regulations 2016 (SI 2016/1101) [2] for further information on beacon globes, transilluminated posts and twin amber flashing lights.

### 12.2 Beacon globes

#### 12.2.1 General

Unless otherwise specified by the purchaser [see 4c)], the level of ingress protection afforded by a beacon globe shall be IP 54 and conform to BS EN 60529.

Account shall be taken of load bearing and the requirements of BS EN 12767.

The globe shall be suitable for securely fixing to a post of nominal diameter 76 mm, 89 mm or 114 mm. Removal of the globe shall be possible only with the use of a tool.

The external surface of the globe shall be such that it does not retain dirt or moisture and is free from rough edges.

Globes shall remain permanently lit unless otherwise stated (e.g. flashing).

The light of a pedestrian crossing globe shall flash with the following characteristics:

- a) a flashing rate of  $(40 \pm 4)$  flashes per minute; and
- b) a light-on period of between 50% and 60% of total cycle time.

## 12.2.2 Visual performance

### 12.2.2.1 Chromaticity and luminance factor

#### 12.2.2.1.1 Performance

When measured in accordance with [12.2.2.1.2](#), the chromaticity and luminance factor of the globe shall conform to [Table 3](#).

**Table 3** — *Chromaticity coordinates and luminance factors of globes*

Colour	Day/night	Chromaticity coordinates								Luminance factor	
		1		2		3		4		$\beta$	
		x	y	x	y	x	y	x	y	Min.	Max.
White	Night	0.440	0.382	0.285	0.264	0.285	0.332	0.440	0.440	—	—
White	Day	0.350	0.360	0.300	0.310	0.290	0.320	0.340	0.370	0.45	—
Yellow	Day and night	0.522	0.477	0.470	0.440	0.427	0.483	0.465	0.534	0.75	—

#### 12.2.2.1.2 Measurement of globe chromaticity and luminance factor

The chromaticity of light emitted from the globe shall be measured using a colorimetric measuring system in accordance with CIE 15 [N2], with its light detector aligned in the same direction as used for intensity or luminance measurements specified in [12.2.2.3](#).

The light detector shall be at such a distance as to detect light from the whole of the light-emitting surface. The emitted light shall be integrated to eliminate localized colour variation before the light is measured.

#### 12.2.2.2 Luminance levels

When measured in accordance with [12.2.2.4](#), the mean luminance of the globe shall be not less than  $300 \text{ cd}\cdot\text{m}^{-2}$ .

The maximum luminance of the globe, including any device designed to improve the conspicuousness of the globe, shall not be greater than  $1\,200 \text{ cd}\cdot\text{m}^{-2}$ .

If dimming is employed, the luminance shall be nominally 30% of the normal luminance value and not less than the minimum value.

The uniformity of luminance, in terms of the ratio of the minimum to the maximum measured luminance of the globe, shall be not less than 0.66.

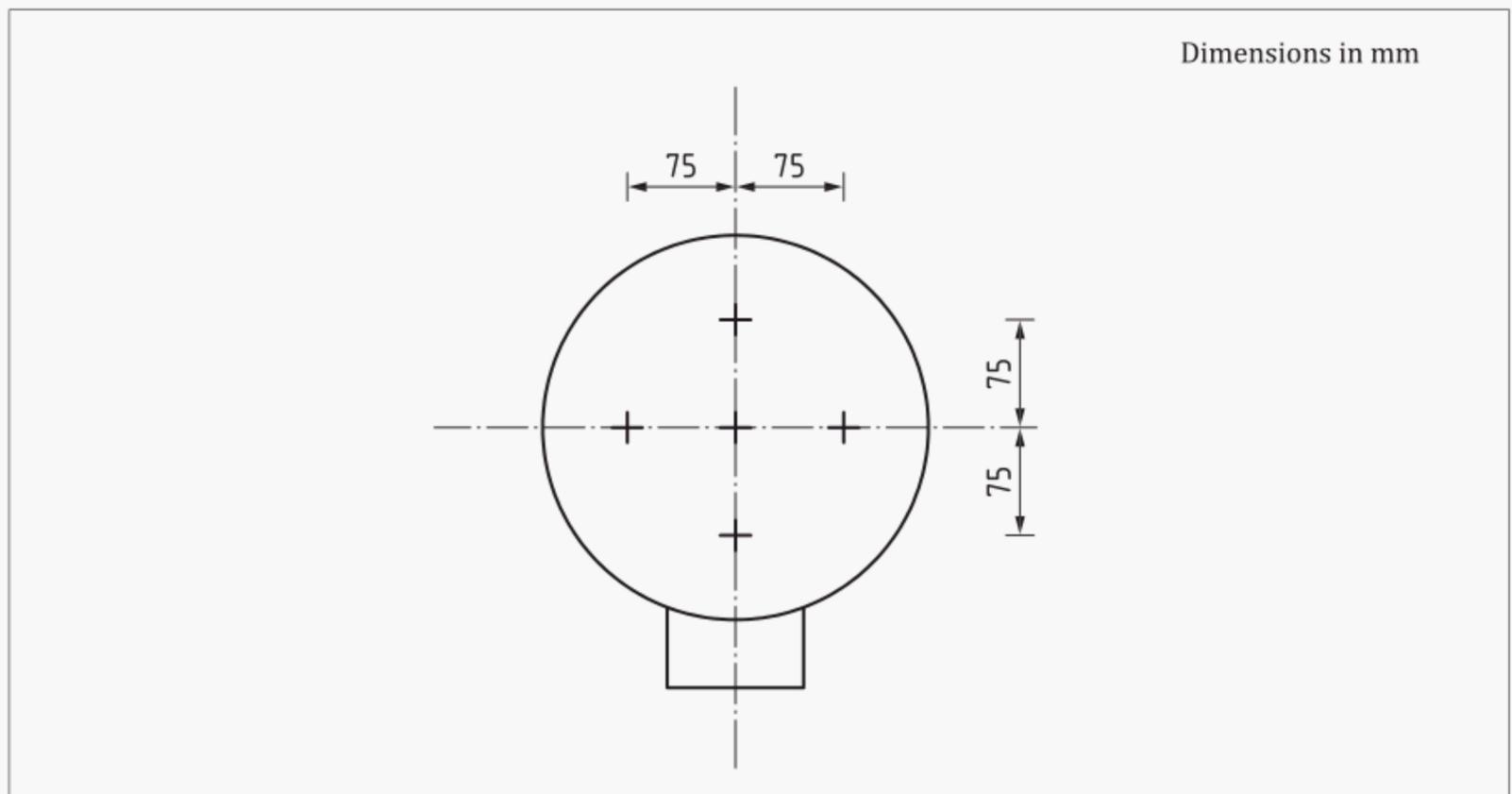
#### 12.2.2.3 Measurement of luminance and uniformity of luminance

Measurements shall be made in accordance with BS EN 13032-1.

The beacon globe shall be illuminated using the light source with which the globe is to be used, mounted in the position in which it is to be when the globe is in use.

Measurements shall be taken in a direction normal to the tangent to the surface of the globe at the points shown in [Figure 2](#) on an area of the globe of  $(25 \pm 0.5) \text{ mm}$  projected diameter. The reference axis shall be defined by the manufacturer.

The measurements shall be repeated at angles of  $120^\circ$  and  $240^\circ$  in plan to the reference axis.

**Figure 2** — Luminance measurement**12.2.2.4 Visibility of light source**

The internal light source shall be not visible through the globe material at any time.

**12.3 Posts****12.3.1 General**

A post shall consist of a base section with door opening, upper shaft and where required, an offset bracket can be fitted.

*NOTE* The shape can be cylindrical with not more than one change of diameter, or conical.

Where required, the upper shaft shall terminate in a spigot not less than 100 mm in length in order to fit the beacon globe, as specified in [12.2.1](#). The door opening and base compartment shall conform to BS EN 40-2:2004. The length of the base section below ground shall conform to the purchaser's specifications, dependant upon the installation and cable entry method used. Side cable entry slots shall conform to BS EN 40-2:2004, where required.

Unless otherwise specified by the purchaser [see [4c](#)], the level of ingress protection afforded by the post base compartment shall be not less than IP 23, in accordance with BS EN 60529.

**12.3.2 Non-illuminated posts****12.3.2.1 Zebra crossing posts**

The post shall conform to [12.3.1](#), except that it shall be cylindrical with not more than one change of diameter; any larger diameter base section shall not extend more than 1 150 mm above ground level.

**12.3.2.2 Refuge beacon posts**

The length of the post above ground shall conform to the purchaser's specifications.

*NOTE 1* Attention is drawn to the TSRGD [1] regarding the length of the post above ground [see [4d](#)].

*NOTE 2* Attention is drawn to the TSRGD [1] which requires the centre of the globe to be not less than 3.8 m and not more than 5 m above the adjacent carriageway level. The same regulations require that the posts are coloured grey or black, with two white bands, each being not less than 275 mm or more than 335 mm deep and placed in accordance with direction 45 of the TSRGD [1].

### 12.3.3 Internally illuminated posts

#### 12.3.3.1 Zebra crossing posts

If the post is manufactured from steel, the post shall conform to [12.3.1](#) and [12.3.2.1](#), except that it shall be cylindrical with not more than one change of diameter and the finished outside upper shaft diameter above the base section shall be  $(114_{+3}^{-0})$  mm.

If the post is manufactured from aluminium, the post shall conform to BS EN 40-6:2002.

The post shall be provided with a means to internally illuminate its white bands.

When this is done by means of openings in the shaft, these shall be diametrically opposite to each other and not less than 90° of arc when viewed in plan.

*NOTE* The design of the post should allow any shadows cast by components within the post to be arranged at an angle of approximately 90° to the edge of the carriageway being served.

#### 12.3.3.2 Refuge beacon posts

The refuge beacon post shall conform to [12.3.3.1](#).

*NOTE* Internally illuminated refuge beacon posts are governed by the TSRGD [1].

### 12.3.4 Visual performance

#### 12.3.4.1 Non-illuminated posts

Retroreflective white bands shall be provided for non-illuminated posts.

*NOTE* Attention is drawn to the TSRGD [1] regarding retroreflective white bands.

#### 12.3.4.2 Internally illuminated posts

##### 12.3.4.2.1 Chromaticity and luminance factor for internally illuminated posts

The chromaticity and luminance factor of the illuminated white portions shall conform to [Table 3](#) when measured in accordance with CIE 15 [N2].

##### 12.3.4.2.2 Mean luminance and uniformity of luminance of internally illuminated posts

When measured in accordance with [Annex J](#), the luminance of the post shall conform to [Table 4](#). The uniformity of luminance, in terms of the ratio of the minimum to the maximum measured luminance of the illuminated parts of the post, shall be not less than 0.66.

**Table 4** — Luminance of posts

Luminance category	Luminance	
	cd·m <sup>-2</sup>	
	Minimum	Maximum
LP1	200	400
LP2	600	800

*NOTE* Posts of luminance category LP2 are suitable for areas with a high background luminance. This is most likely to be experienced in major shopping areas, characterized by well-lit window displays and large bright fascia signs. The choice of category should be made in relation to the background against which posts are viewed. Posts of luminance category LP1 are suitable for all other locations.

### 12.3.5 Physical performance

The post and any attached signs, fittings and luminaires shall conform to the structural requirements of BS EN 12899-1:2007 and BS EN 12767.

*NOTE* See National Annex to BS EN 12899-1:2007 for recommended classes for the location concerned.

There shall be no splitting, cracking or separation of the opaque and translucent sections of internally illuminated posts as a result of applying the load.

## **12.4 Twin flashing amber light units**

### **12.4.1 General**

#### *COMMENTARY ON [12.4.1]*

*The design, colours and dimensions of a twin flashing amber light unit and its housing and associated post are prescribed in diagrams 4004 and 4005 of the TSRGD [1], as appropriate. These regulations also require that each light unit, when operated, shows an intermittent amber light at a rate of flashing of not less than 60 or more than 90 flashes per minute and in such a manner that one light is always shown when the other light is not shown.*

Unless otherwise specified by the purchaser [see 4c)], the level of ingress protection afforded by twin flashing amber light units shall be IP 54, in accordance with BS EN 60529.

Where two light sources and their control equipment are to be contained in the same housing, this shall be so constructed that stray light from one cannot reach the other.

The units shall be so designed that the failure of one light source does not affect the operation of the other light source.

The control unit shall be mounted so that it can be removed easily as a complete unit for servicing.

The light unit shall be operated by a key or by a push on/off switch accessed through a hole in the base of the housing, or by a remote control or programmable controller mounted within the unit which is type-approved.

In the latter two cases, an indicator shall be provided at the switching point to indicate when the equipment is switched on. The indicator shall be not visible to passing traffic.

Access to the interior of the light unit shall require the use of a special tool. All screws or fastenings that need to be loosened shall be captive. Self-tapping screws shall be not used.

The panel or other components giving access to the interior of the light unit shall, in the closed position, be firmly attached to the fixed portion of the light unit. In the open position, it shall be attached in such a way that there is no likelihood of it becoming accidentally detached or causing damage likely to impair safety of any part of the light unit or its clamps.

Any access hole to the switch shall be not greater than 3 mm in diameter and not afford access to any live parts.

The unit shall incorporate a secure method of fixing to the post, as specified by the purchaser [see 4e)].

### **12.4.2 Visual performance of flashing amber light units**

#### **12.4.2.1 Chromaticity**

When measured in accordance with 12.4.2.2, the chromaticity of the flashing amber light units shall conform to BS EN 12966:2014+A1:2018, Yellow Class C2.

*NOTE This is consistent with BS EN 12966:2014+A1:2018, Annex NA.*

#### 12.4.2.2 Measurement of chromaticity

The chromaticity of light emitted from amber flashing light units shall be measured in accordance with BS EN 12966:2014+A1:2018, 5.5.3, with the following specific conditions and variation:

- chromaticity shall be tested at the nominal voltage and at the voltage limits agreed between contractors.

#### 12.4.2.3 Luminance

When measured in accordance with 12.4.2.4, the luminance of the flashing amber light units shall conform to Table 5.

**Table 5** — Luminance requirements

Row	Ambient condition	Minimum luminance cd·m <sup>-2</sup>	Maximum luminance cd·m <sup>-2</sup>
1	Daylight	7 440	22 320
4	Dusk	360	1 080
6	Dark	45	135

*NOTE* These values are derived from BS EN 12966:2014+A1:2018 Table 5 Class L3, applicable for  $L_e$  only.

Dimming, if provided, shall conform to rows 4 and 6, as a minimum.

Illuminance thresholds for the ambient conditions shall be agreed between contractors, see Clause 4.

*NOTE* Dimming should be provided for reasons of visibility performance and the avoidance of glare during the hours of darkness, unless excluded from contractual agreement in accordance with Clause 4.

#### 12.4.2.4 Measurement of luminance

The luminance of light emitted from amber flashing light units shall be measured as follows:

- luminance to be tested in the steady light condition after stabilization. A light source shall be considered stable when its light output does not change more than  $\pm 2\%$  over a time period of 15 min;
- the light unit shall be tested at the voltage specified by the manufacturer for intended use of the product; and
- luminance shall be measured over the whole lit area of the light unit.

#### 12.4.2.5 Beam width

When measured in accordance with 12.4.2.6, the beam width of the flashing amber light units shall conform to BS EN 12966:2014+A1:2018, Annex NA.

#### 12.4.2.6 Measurement of beam width

The beam width for amber flashing light units shall be measured in accordance with BS EN 12966:2014+A1:2018, as applicable to the luminance class.

#### 12.4.2.7 Physical performance of flashing amber light units

When tested in accordance with BS EN 12899-1:2007, 7.1.7, flashing amber light units shall show no change in appearance, using an untreated sample for comparison.

## 13 Retroreflective self-righting bollards (RSRBs)

### 13.1 General

#### 13.1.1 Types

The RSRB shall be one of the following:

- a) type A: retroreflective fluorescent yellow conspicuity panels and retroreflective sign, see [13.2](#), [13.3](#) and [13.4](#);
- b) type B: retroreflective fluorescent yellow conspicuity panels and lit retroreflective sign, see [13.2](#), [13.3](#), [13.4](#) and [13.5](#);
- c) type C: lit retroreflective fluorescent yellow conspicuity panels and lit retroreflective sign, see [13.2](#), [13.3](#), [13.4](#) and [13.6](#); or
- d) type D: lit body (or body and base mounting), lit retroreflective fluorescent yellow conspicuity panels and lit retroreflective sign, see [13.2](#), [13.3](#), [13.4](#) and [13.7](#).

#### 13.2 Design: common characteristics for all RSRB types

The RSRB shall incorporate one or more traffic signs or alternatively a plain white borderless roundel conforming to [13.3](#).

*NOTE* Attention is drawn to the TSRGD [1].

##### 13.2.1 Height

The minimum height of an RSRB which displays a sign or roundel with a diameter of less than 350 mm shall be 900 mm above the ground line.

The minimum height of an RSRB which displays a sign or roundel with a diameter equal to or greater than 350 mm in diameter shall be 1 100 mm above the ground line.

The distance between the upper extremity of the RSRB and the top of any roundel shall be not more than 70 mm.

##### 13.2.2 Body

The body shall contain no sharp edges. Any curvature of a roundel shall be limited to one plane and have a radius of not less than 2 000 mm.

##### 13.2.3 Conspicuity panels

Conspicuity panels shall be applied to the front and sides of all RSRB types; rear conspicuity panels are optional. Conspicuity panels shall be retroreflective, fluorescent and yellow in colour.

*NOTE* RSRBs rely on the brightness of retroreflective panels to be conspicuous at night. Daytime conspicuity of these devices is enhanced by the use of fluorescent yellow material.

The minimum projected area of the front or side conspicuity panels shall conform to [Table 6](#). Where both faces display a traffic sign, both shall display a conspicuity panel. The lower edge of the front conspicuity panel shall be a minimum of 100 mm and a maximum of 200 mm above the ground line.

**Table 6** — Projected area of the conspicuity panels

Projected area	
mm <sup>2</sup>	
Front view	Side view
150 000	20 000

### 13.3 Visual performance: common characteristics for all RSRB types

#### 13.3.1 Chromaticity

When tested in accordance with the relevant procedure specified in CIE 15 [N2], using CIE standard daylight illuminant D65 and the standard CIE 45/0 viewing conditions, the chromaticity and the luminance factor,  $\beta$ , of the yellow fluorescent conspicuity panels and the traffic signs or plain white roundel shall conform to [Table 7](#).

**Table 7** — Daytime chromaticity and luminance factor

Colour	Chromaticity co-ordinates								Minimum luminance factor $\beta$
	1		2		3		4		
	x	y	x	y	x	y	x	y	
White	0.355	0.355	0.305	0.305	0.285	0.325	0.335	0.375	$\geq 0.27$
Red	0.735	0.265	0.674	0.236	0.569	0.341	0.655	0.345	$\geq 0.03$
Blue	0.078	0.171	0.150	0.220	0.210	0.160	0.137	0.038	$\geq 0.015$
Fluorescent yellow	0.479	0.520	0.446	0.483	0.512	0.421	0.557	0.443	$\geq 0.40$

#### 13.3.2 Photometric performance of conspicuity panels, traffic signs and plain white circles incorporated in all RSRB

Retroreflective material shall conform to BS EN 12899-1:2007.

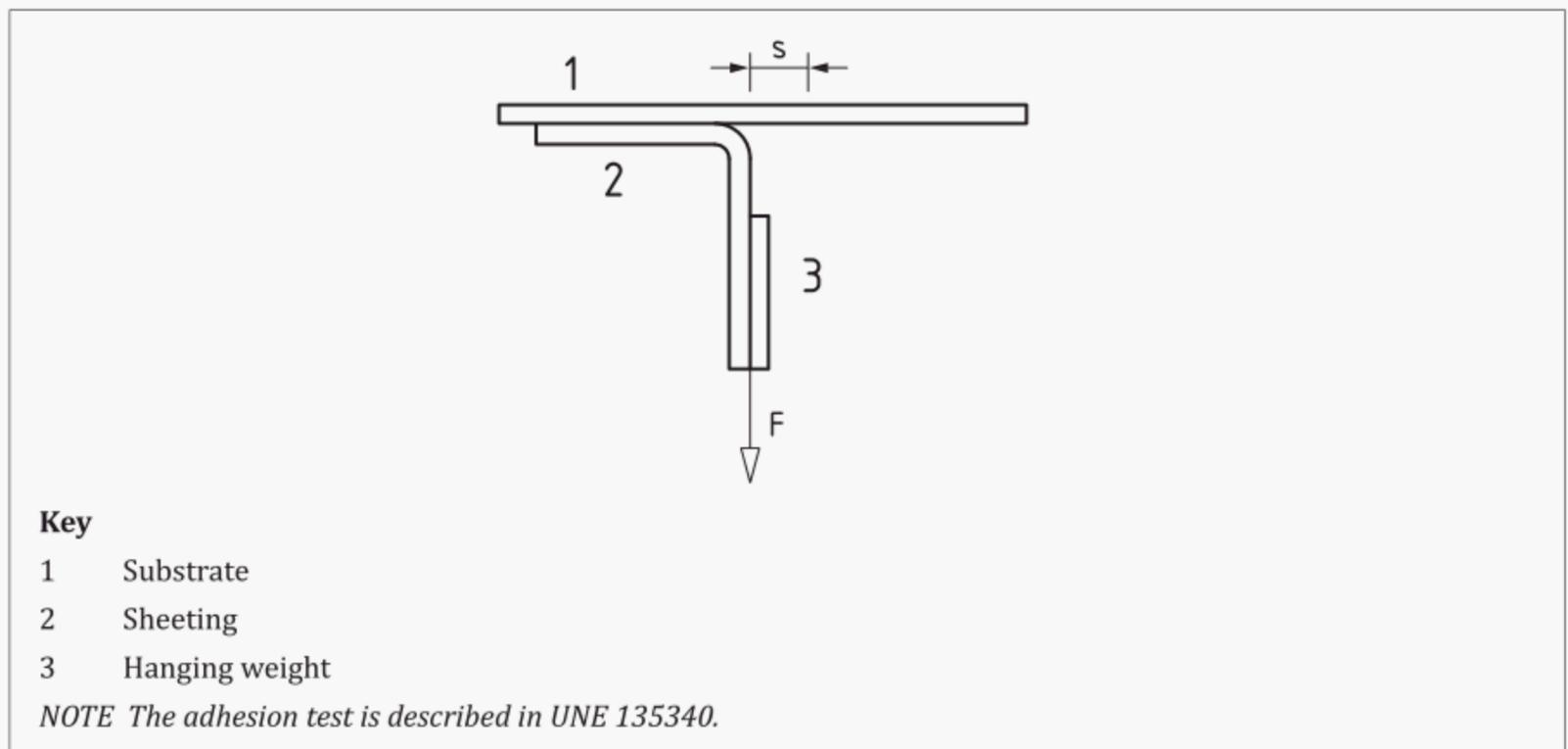
### 13.4 Physical performance: common characteristics for all RSRB types

#### 13.4.1 Adhesion to substrate test

Approximately two-thirds of the length of a (25 × 150) mm strip of the retroreflective sheeting is mounted following the sheeting manufacturer's instructions onto a sample of the intended substrate at least (200 × 70) mm in size, as shown in [Figure 3](#).

After conditioning the samples for 72 h at a temperature of (23 ± 3) °C and a relative humidity of (50 ± 5)%, a hanging weight with a mass of F = 0.8 kg is applied to the free end of the sheeting strip. The extent to which the sheeting strip peels away from the substrate five min after application of the weight is measured. The amount of peeling shall not exceed 50 mm in five min.

The test is valid only for a particular substrate material and a family of retroreflective sign face materials with identical adhesive. This test shall be repeated for other substrate materials or adhesives.

**Figure 3** — Adhesion test

### 13.4.2 Corrosion resistance

Metallic parts shall be protected against corrosion, including electrolytic corrosion, in accordance with [Table 8](#) and shall meet class SP1 or SP2.

**Table 8** — Surface protection

Class	Requirements
SP1	Protective coatings provided
SP2	Inherent surface protection provided

Hot dip galvanizing shall conform to BS EN ISO 1461 or BS EN 10240, as appropriate.

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.

### 13.4.3 High impact resistance

When tested in accordance with BS EN 12767, the RSRB shall remain in position and no portion of the RSRB greater than 25 g shall become detached. The RSRB shall return to its original position, or have a residual deflection of no more than 10% of its height, measured horizontally at the upper extremity, not more than 15 min after the time of impact.

After impact, its mountings shall remain in place for not more than 15 min after the time of impact and the residual rotation about the vertical axis shall not exceed 5°.

When tested in accordance with BS EN 12767, the RSRB shall conform to the performance classes given in the NA to BS EN 12767.

After testing in accordance with BS EN 12767, lit parts shall continue to operate.

## 13.5 Type B bollards: additional requirements

### 13.5.1 Mean luminance

When measured in accordance with [Annex K](#), the lit traffic sign or any plain white roundel shall conform to [Table 9](#).

*NOTE* See BS EN 12899-1:2007, Annex NA, for recommended classes for visual performance most suitable for UK practice.

**Table 9** — Mean luminance,  $L$ ,  $\text{cd}\cdot\text{m}^{-2}$

Colour	Class L1	Class L2
White	$40 \leq L \leq 150$	$150 \leq L \leq 300$
Yellow	$30 \leq L \leq 100$	$100 \leq L \leq 300$
Red	$6 \leq L \leq 20$	$20 \leq L \leq 50$
Blue	$4 \leq L \leq 10$	$10 \leq L \leq 40$

### 13.5.2 Luminance contrast

When measured in accordance with [Annex K](#), the luminance contrast of the lit traffic sign shall conform to [Table 10](#).

**Table 10** — Luminance contrast,  $K$ , lit traffic sign

Colour	Blue	Red
Contrast colour	White	White
Luminance contrast	$5 \leq K \leq 15$	$5 \leq K \leq 15$

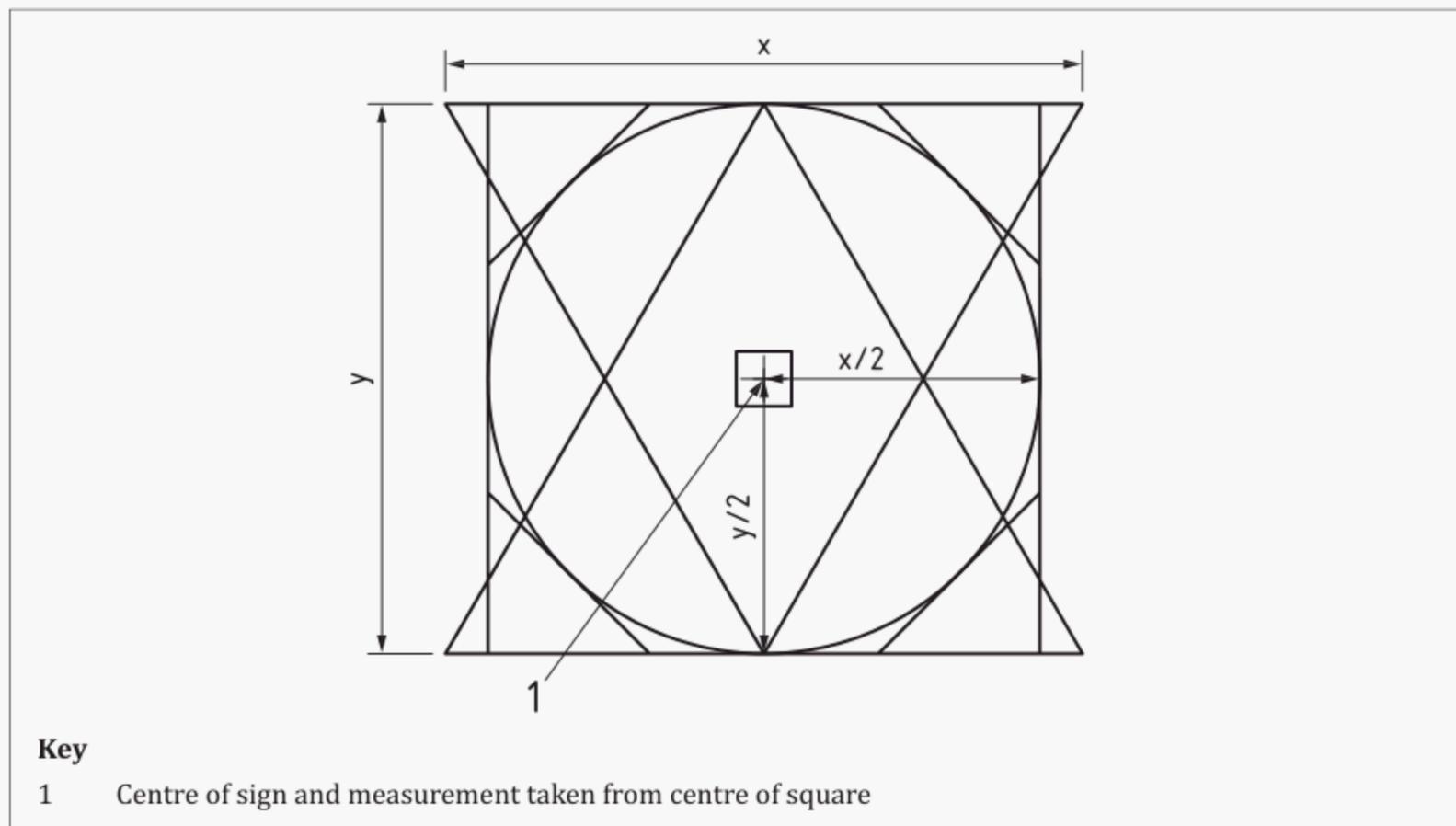
### 13.5.3 Uniformity of luminance

When measured in accordance with [Annex K](#), the uniformity of luminance, determined by the ratio of the lowest and highest measurements taken, shall be not less than 1/3.

*NOTE 1* For the purposes of luminance uniformity testing, a plain white roundel is used. This roundel is of the same retroreflective material as is used for the sign face on the finished product.

*NOTE 2* [Figure 4](#) shows the location of the central test square on a sign face from which the location of all other test squares is based.

**Figure 4** — Location of the central sign centre



### 13.5.4 Colour rendering of light sources

Light sources shall be of types with a general colour rendering index  $R_A$ , as defined in BS EN 12665, of a minimum value of 80.

### 13.5.5 Protection from foreign objects and water

The minimum levels of protection against penetration by solid particles and water, specified in BS EN 60529, shall be in accordance with [Table 11](#).

**Table 11** — Protection from foreign objects and water

Component	Solid particles	Water
Head and body	Level 2	Level 3
Electrical components above ground	Level 5	Level 6
Electrical components housed wholly or partly below ground	Level 6	Level 7

### 13.5.6 Electrical

Electrical components, circuitry and installation shall conform to BS EN 12899-1:2007, **7.1.13**.

Electrical supply cables shall enter the base below the ground line.

Access shall be possible only by the use of a special tool or key.

### 13.6 Type C bollards: additional requirements

Type C bollards shall conform to [13.5](#) and have night-time performance as follows:

- conspicuity panels shall be translucent and lit;
- the luminance shall be in accordance with [Table 9](#); and
- the uniformity of luminance shall be not less than 1/6.

### 13.7 Type D bollards: additional requirements

Type D bollards shall conform to [13.5](#) and have night-time performance as follows:

- the RSRB body shall be fully lit and conspicuity panels shall be translucent;
- the luminance shall be in accordance with [Table 9](#); and
- the uniformity of luminance shall be not less than 1/10.

## 14 Marking and information

### 14.1 Marking

Single-sided sign plates shall be marked as follows.

*NOTE 1 Attention is drawn to the TSRGD [1] for the colour and size of the lettering of the label.*

No coloured or reflective background shall be permitted; lettering shall be applied directly to the sign back or by means of a transparent adhesive label or one which has the same background as the sign back.

Signs and other devices shall, where practicable, be clearly and durably marked on the back with the following:

- the number and date of this British Standard, i.e. BS 8442:2022<sup>4)</sup>;
- the name, trade mark or other means of identification of the manufacturer or vendor;
- the month and year of manufacture;

<sup>4)</sup> Marking BS 8442:2022 on or in relation to a product represents a manufacturer's declaration of conformity, i.e. a claim by or on behalf of the manufacturer that the product meets the requirements of the British Standard. The accuracy of the claim is solely the claimant's responsibility. Such a declaration is not to be confused with third-party certification of conformity.

- d) the classification of any retroreflective material used, where applicable; and
- e) the level of wind resistance afforded by the notified ballast (see [Annex B](#)), where applicable.

*NOTE 2 Attention is drawn to the TSRGD [1].*

Where it is not practicable to mark this information on the product, it shall be included in the accompanying commercial documentation.

## 14.2 Durability of marking

When tested using the procedure given in BS EN 60598-1:2000, 3.4, the marking on any sign or other device shall remain legible and adhesive labels, where used, shall not become detached or curled at the edges.

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## 15 Information to be supplied by the manufacturer

The manufacturer shall provide the following information with each product:

- a) instructions on assembly, erection, usage and operation (see Note 1);

*NOTE 1 The purchaser should be made fully aware of the conditions under which the product performs adequately.*

- b) details of any limitations on location or usage (see Note 1);
- c) instructions on the maintenance of the product;
- d) when applicable, the type, wattage and lumen output of the light source for which the unit is designed (see Note 2); and

*NOTE 2 This should enable the purchaser to replace spent lamps with the correct type.*

- e) where applicable, the voltage, with tolerances, of the electrical supply on which the unit is designed to operate.

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## Annex A (normative)

### Retroreflective sheeting materials

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#### A.1 General

The specifier shall choose the visual performance requirements for retroreflective material and/or signfaces and classes of retroreflective performance.

*NOTE* Many of the devices described in this British Standard require retroreflective material and/or signfaces. Retroreflective materials return some light from a vehicle's headlamp to its driver to enable visibility of that device at night.

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#### A.2 Sampling and preparation of retroreflective test samples

##### A.2.1 Test samples

Samples for performance testing shall be representative of the normal production of the retroreflective sheeting materials used for the devices described in this British Standard.

##### A.2.2 Preparation samples

The tests listed in [Annex A](#) require reflective sheeting samples to be mounted on a flat substrate for testing; where this is required the retroreflective sheeting shall be applied in accordance with the material manufacturer's application instructions to 3 mm aluminium sheet conforming to BS EN 485-1 or other agreed substrate [see [4b](#)]. Any protective coatings required by the material manufacturer shall be applied in accordance with the manufacturer's instructions.

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#### A.3 Visual performance

##### A.3.1 Daylight chromaticity and luminance factor

###### A.3.1.1 Non-retroreflective sign face material

When tested, the chromaticity and the luminance factor shall conform to BS EN 12899-1:2007.

###### A.3.1.2 Retroreflective sign face materials colour requirements

When tested in accordance with BS EN 12899-1:2007, [4.1.1.3](#), the chromaticity and the luminance factor of retroreflective sheeting shall conform to BS EN 12899-1:2007, Table 1, class CR1.

##### A.3.2 Coefficient of retroreflection sign face materials

When measured in accordance with the procedure specified in CIE 54.2 [N3], using CIE standard illuminant A, the minimum initial coefficients of retroreflection  $R_A$  ( $\text{cd}\cdot\text{lx}^{-1}\cdot\text{m}^{-2}$ ) of retroreflective materials shall conform to BS EN 12899-1:2007, Table 4, class RA2 or above.

##### A.3.3 Resistance to weathering of retroreflective sheeting materials

After weathering in accordance with [A.3.4](#):

- a) the chromaticity and luminance factor of materials shall conform to BS EN 12899-1:2007, Table 1, class CR1;

- b) for all sheetings, when tested at an observation angle ( $\alpha$ ) of 20° and entrance angles ( $\beta 1 = 5^\circ$  and 30°, with  $\beta 2 = 0^\circ$ ) the coefficient of retroreflection shall be not less than 80% of the values required at those test angles for the declared material class (RA1, RA2, R2, R3B, etc.);
- c) retroreflective sheeting used on traffic devices intended for temporary use shall have the same visual performance as those used on permanent devices.

*NOTE* Retroreflective sheeting used on traffic devices intended for temporary use might have a shorter service life.

#### A.3.4 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 BS EN ISO 877-1:2010 and BS EN ISO 877-2:2010, Method A for the exposure period selected from Table A.1.

*NOTE* Two periods of accelerated natural weathering exposure are available.

Manufacturers of retroreflective sheeting shall select an exposure class from Table A.1 and declare a product's results after T1 or T2 accelerated natural weathering exposure.

**Table A.1** — Exposure period for accelerated natural weathering

Class	Period
	Years
T1	2
T2	3

#### A.3.5 Accelerated artificial weathering

Samples prepared in accordance with BS EN 12899-1:2007, 4.1.1.5.3, for 2 000 h shall meet the after-weathering requirements of A.3.3 and A.3.4.

### A.4 Physical performance

#### A.4.1 Resistance to impact

When tested in accordance with BS EN 12899-1:2007, 4.1.2, non-reflective and retroreflective materials shall conform to BS EN 12899-1:2007, 4.1.2.

#### A.4.2 After-weathering test reports

Tests reports shall be provided on request. These reports shall include performance before and after accelerated natural weathering.

Preliminary test reports based only on performance after accelerated artificial weathering may be produced as an interim while accelerated natural weathering is being conducted; these reports shall be labelled as preliminary test reports.

## Annex B (normative)

### Ballast for self-supporting rigid and flexible portable signs, and classification and labelling of barrier units

#### B.1 Temporary signs

Using the sample form shown in [Table B.1](#), the manufacturer shall indicate the mass of the ballast to be added to each sign assembly to resist a specified class of wind speed (calculated in accordance with [Annex C](#)), depending upon the sign shape, size and the level of wind resistance chosen.

*NOTE* For further guidance please refer to *TMCA Guidance Note on Ballasting of Temporary Road Signs [7]*.

**Table B.1** — Ballast required for wind resistance of temporary signs

Sign shape	Sign size mm	Ballast required for wind resistance		
		A	B	C
	600			
	750			
	900			
	1 200			
	1 500			
	600			
	750			
	900			
	1 200			
	1 500			
	600			
	750			
	900			
	1 200			
	1 500			
	600			
	750			
	900			
	1 200			
	1 500			
	1 050 × 750			
	600 × 450			

#### B.2 Barrier units

Using the sample form shown in [Table B.2](#), the manufacturer shall indicate the mass ballast to be added to each barrier assembly to resist a specified class of wind speed (calculated in accordance with [Annex C](#)), depending upon the barrier configuration and the level of wind resistance chosen.

**Table B.2** — Ballast required for wind resistance of barrier assembly

Configuration	Barrier board length m	Ballast requirement for class of wind speed		
		A	B	C
	1.25			
	2			
	2.5			
	3			
	1.25			
	2			
	2.5			
	3			

## Annex C (normative)

### Calculation of minimum recommended ballast required to resist overturning and sliding of self-supporting rigid portable signs

#### C.1 Calculation of the force on a sign face due to wind pressure

The force,  $F$ , on a flat plate (a road sign) perpendicular to its surface, due to wind pressure, shall be expressed as a function of the plate area,  $A$ , and the wind speed,  $V$ , as given in equation C.1.

$$F = C_w A \left( \frac{1}{2} \rho V_e^2 \right) \quad (\text{C.1})$$

This reduces to:

$$F = SA(V_e)^2 \quad (\text{C.2})$$

where:

- $F$  is the force on the sign plate perpendicular to its surface, due to wind pressure, in Newtons (N);
- $C_w$  is the coefficient based on the characteristics of the sign plate and frame, the values of which are given in [Table C.1](#);
- $A$  is the area of the sign plate in metres squared ( $\text{m}^2$ );
- $\rho$  is the density of air in kilograms per cubic metre ( $1.23 \text{ kg}\cdot\text{m}^{-3}$ );
- $V_e$  is the effective wind speed in metres per second ( $\text{ms}^{-1}$ ), as given in [Table 1](#) (see [5.1](#)); and
- $S$  is the function of  $C_w$  and  $\rho$ , values of which are given in [Table C.2](#).

**Table C.1** — Values of  $C_w$ 

Size of sign plate mm	Unframed	Framed
<1 500	1.2	1.45
$\geq 1 500$	1.4	1.65

**Table C.2** — Values of  $S$ 

$C_w$	$S$
1.2	0.74
1.4	0.86
1.45	0.89
1.65	1.01

## C.2 Mass and positioning of ballast

Equations C.3 and C.4 shall be used to calculate the minimum recommended ballast required to resist overturning and sliding of a self-supporting rigid portable sign. These calculations assume that the sign assembly is designed so that the ballast is placed symmetrically about the longitudinal and transverse centrelines; if this is not so, the calculations shall be amended to take account of the actual position of the ballast.

## C.3 Overturning

The mass of the ballast plus sign support,  $W$ , in kilograms (kg), required to resist overturning shall be calculated using one of the following formulae:

- a) where the wind acts on the front of the sign plate:

$$W = \frac{Fy \cos \alpha - Fx \sin \alpha}{gb} - \frac{wx}{b} \quad (\text{C.3})$$

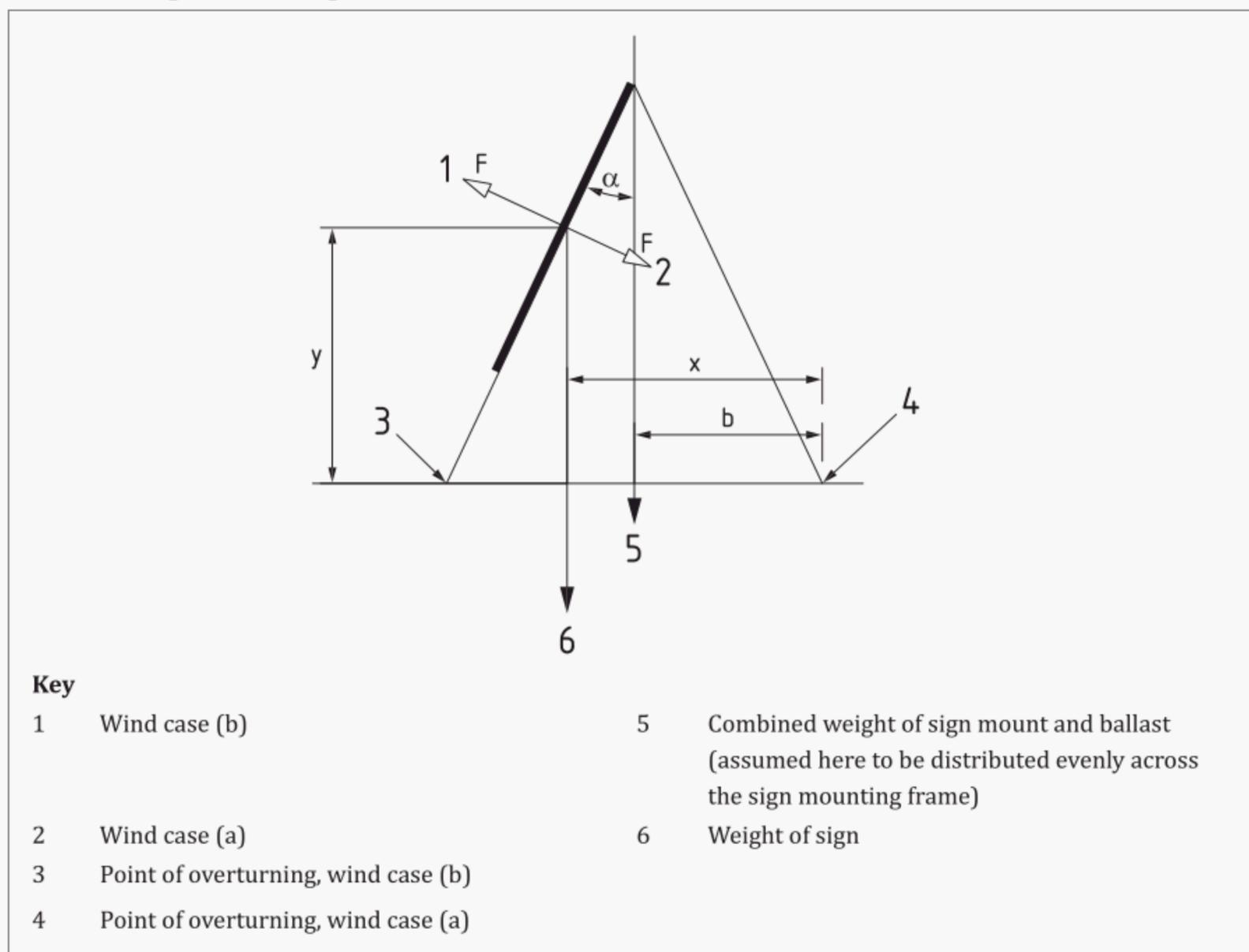
- b) where the wind acts on the rear of the sign plate:

$$W = \frac{Fy \cos \alpha + Fx \sin \alpha}{gb} - \frac{wx}{b} \quad (\text{C.4})$$

where:

- $w$  is the mass of the sign plate in kilograms (kg);
- $F$  is the force on the sign plate due to wind pressure in Newtons (N);
- $W$  is the mass of the sign support and ballast in kilograms (kg);
- $\alpha$  is the angle of inclination of the sign plate in degrees ( $^\circ$ ), as shown in [Figure C.1](#); and
- $g$  is the acceleration due to gravity ( $9.81 \text{ ms}^{-2}$ ).

**NOTE** Where wind acts on the rear of the sign plate, the values of  $x$ ,  $y$  and  $b$  for case (b) can be different due to the change in the point of overturning (see [Figure C.1](#)).

**Figure C.1** — *Overturning moment diagram*

## C.4 Sliding

The mass of the ballast plus sign support,  $W$ , in kilograms (kg), required to resist sliding shall be calculated using one of the following formulae:

- a) where the wind acts on the front of the sign plate:

$$W = \frac{F \cos \alpha - F \sin \alpha}{\mu g} - \frac{w}{g} \quad (\text{C.5})$$

- b) where the wind acts on the rear of the sign plate:

$$W = \frac{F \cos \alpha + F \sin \alpha}{\mu g} - \frac{w}{g} \quad (\text{C.6})$$

where:

$\mu$  is the coefficient of friction between the sign assembly supports and the surface on which they rest;  $\mu$  shall be taken as 0.6; and

$g$  is the acceleration due to gravity ( $9.81 \text{ ms}^{-2}$ ).

**NOTE** Symbols are as indicated in [Figure C.1](#) and in [C.3](#).

---

## Annex D (informative)

### Classes of wind speed

The following notes on wind speed classes should be used as a guide for the sign manufacturer and the purchaser:

- a) Class A – This is the maximum wind speed likely to be experienced on any one day in any year in urban and rural locations in England and Wales. This does not include extremes such as estuarial or very high and exposed sites. A sign designed to resist Class A wind speed might be appropriate for longer term or more exposed works;
- b) Class B – This is the maximum wind speed likely to be experienced on any one day in the months of May, June and July in any year in urban and rural locations in England and Wales. A sign designed to resist Class B wind speed might be appropriate for works which are not always attended or which occur at less windy times of the year; and
- c) Class C – This represents a maximum wind speed approximately half of that for Class B. A street sign designed to resist Class C wind speed might be appropriate for routine short-term works, attended works and unplanned incidents which would not need Class A or B.

Urban locations in Scotland and Northern Ireland can be expected to experience similar wind speeds to those indicated in [Table 1](#) (see [5.1](#)), but rural locations should be expected to experience wind speeds as much as 40% greater.

Purchasers should be aware of changes identified by the national meteorological service.

---

## Annex E (normative)

### Test for overturning and sliding performance of self-supporting rigid portable signs

---

#### E.1 Principle

This test is used to determine that when ballasted for a wind class as recommended by its manufacturer, the rigid portable sign resists sliding and overturning. In this test, a pulley system is used to apply a load equal to that wind class and the sliding or overturning behaviour is noted.

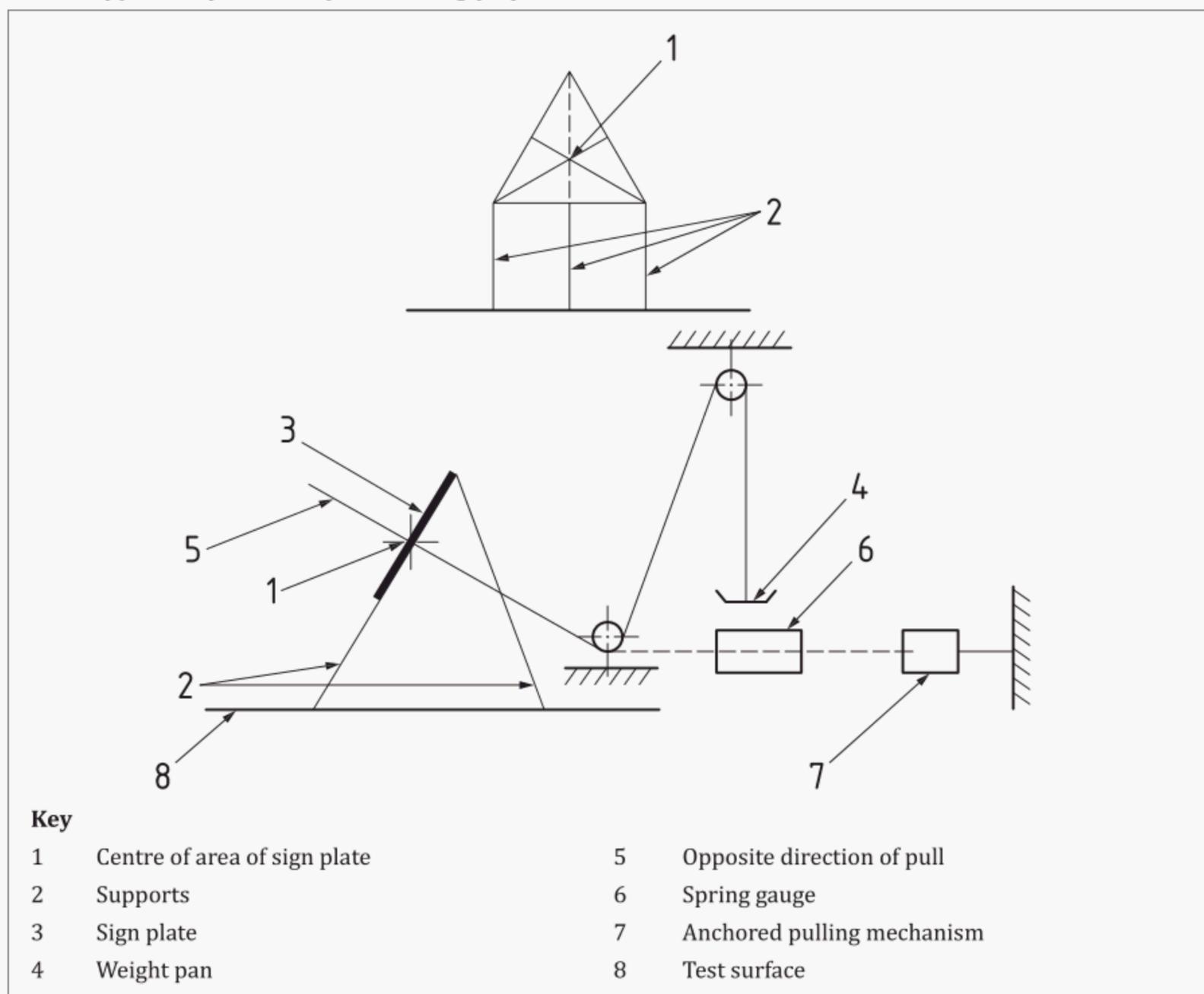
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#### E.2 Apparatus

- E.2.1 *Test surface*, comprising wet-pressed or semi-dry concrete flags manufactured in accordance with [BS 7263-1](#). The edges of the concrete flags shall be so placed as to not interfere with the potential sliding of the sign assembly.
- E.2.2 *Pull cord*.
- E.2.3 *Weight pan*, containing the weight to produce the required load.
- E.2.4 *Weight*.
- E.2.5 *Spring gauge*.

**E.2.6** Pulling mechanism.

*NOTE* The pulling mechanism could be a block and tackle anchored to a wall. See [Figure E.1](#).

**Figure E.1** — Test apparatus for stability and sliding performance**E.3 Procedure**

- E.3.1** Erect the sign assembly in accordance with the manufacturer's instructions on the flat test surface, as shown in [Figure E.1](#).
- E.3.2** Add the ballast specified by the manufacturer for the wind speed classification being tested.
- E.3.3** Attach the pull cord directly to the centre of the sign plate area so that a force equivalent to one of the wind speeds in [Table 1](#) (see [5.1](#)) is applied perpendicular to the sign plate.
- E.3.4** Either pass the cord over a pulley and connect it to a weight pan, or attach it via a spring gauge to a pulling mechanism, such as a block and tackle anchored to a wall, as shown in [Figure E.1](#).
- E.3.5** Apply the load until the design force derived from equation C.2 is reached or until the sign assembly overturns or slides.
- E.3.6** Repeat the test procedure with the force applied to the reverse of the sign face.

## E.4 Test report

The test report shall declare whether the ballasted product overturned or slid when (or before) the target wind force was applied to the face and the back of the sign.

# Annex F (informative)

## Calculation of minimum recommended ballast required to resist overturning and sliding of barrier units

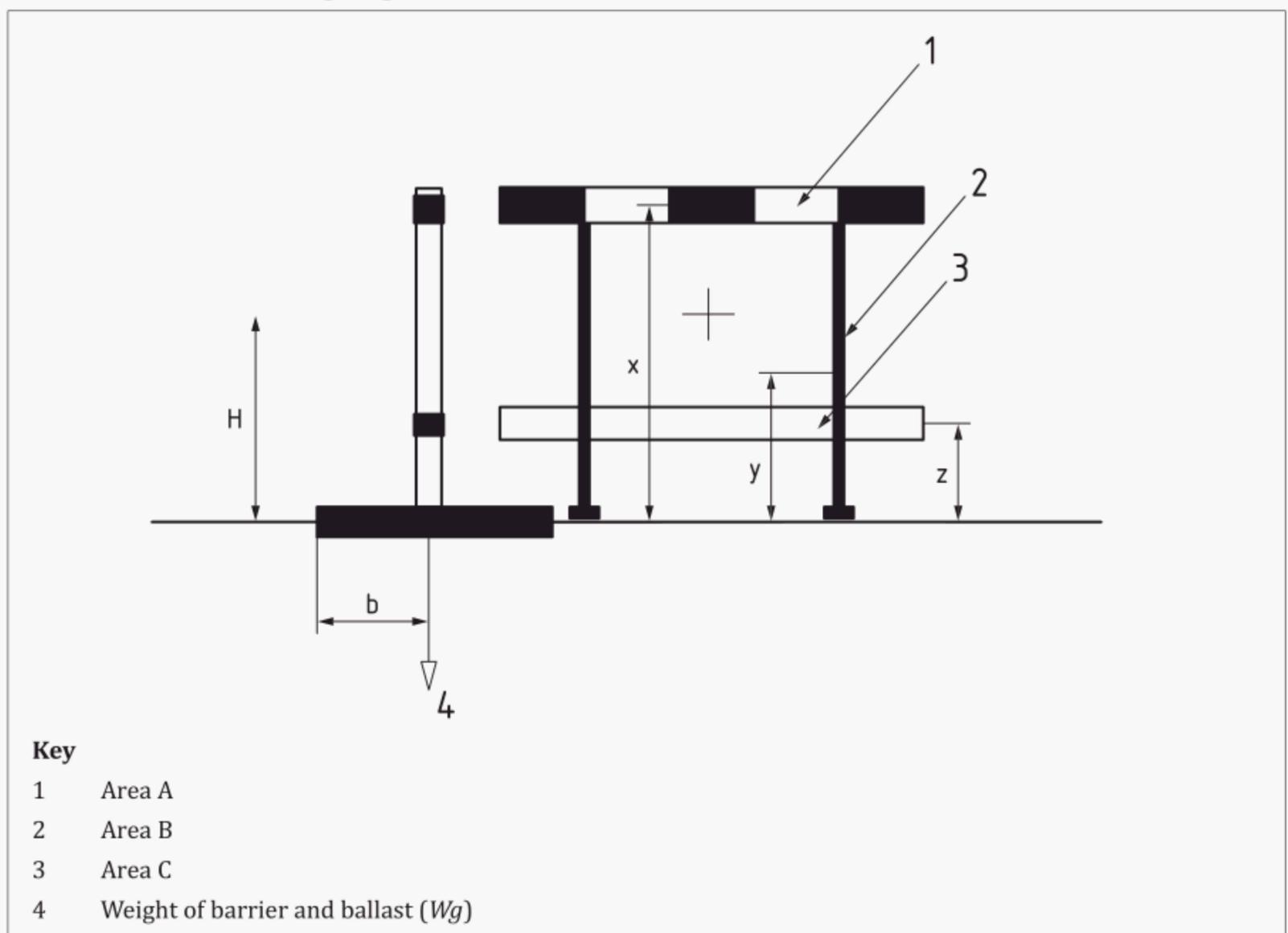
### F.1 Positioning of ballast

The calculations in equations F.2 and F.3 should be used to calculate the minimum recommended ballast to resist any overturning and sliding of barrier units.

### F.2 Overturning

*NOTE* [Figure F.1](#) shows the physical attributes of barriers to use in equations F.1, F.2, F.3 and F.5.

**Figure F.1** — Resistance to overturning diagram



The force on each area can be found by applying equation C.1 (see [Annex C](#)) of this British Standard (or the simplified version C2).

Both  $W$  (the mass of the barrier assembly and ballast) and  $P$  (the pull-over force) should be determined.

Taking moments about the point of overturning:

$$Wgb = PH = F_A \cdot x + F_B \cdot y + F_C \cdot z \quad (\text{F.1})$$

$F_A$  is found by substituting area A into equation C.1,

$F_B$  is found by substituting area 2B into equation C.1, and

$F_C$  is found by substituting area C into equation C.1.

$H$ ,  $W$  and  $P$  can be found from:

$$H = \frac{(F_A \cdot x + F_B \cdot y + F_C \cdot z)}{(F_A + F_B + F_C)} \quad (\text{F.2})$$

$$W = \frac{(F_A \cdot x + F_B \cdot z + F_C \cdot z)}{gb} \quad (\text{F.3})$$

$$P = \frac{Wgb}{H} \quad (\text{F.4})$$

where:

$F_A$ , $F_B$ and $F_C$	is the force on that component of the barrier assembly due to wind pressure, perpendicular to its surface in Newtons (N) (see equation C.2);
$A$ , $B$ and $C$	is the area of the barrier assembly components in metres squared (m <sup>2</sup> );
$x$ , $y$ and $z$	is the height of the centres of area of the barrier assembly components in metres (m);
$H$	is the height of the pull-over weight application (the centre of pressure of the overall wind force) in metres (m);
$P$	is the pull-over force in Newtons (N);
$g$	is the acceleration due to gravity (9.81 ms <sup>-2</sup> );
$W$	is the mass of the sign support and ballast in kilograms (kg).

This assumes, as in most cases, that the supports present a significant surface area.

The supports and joints should be strong enough to resist the forces imposed.

### F.3 Sliding

For sliding the sideways force,  $P$  is given by:

$$P = Wg\mu = (F_A + F_B + F_C) \quad (\text{F.5})$$

where:

$\mu$	is the coefficient of friction between the sign assembly supports and the surface on which they rest; $\mu$ should be taken as 0.6.
-------	--

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## Annex G (normative)

# Test for impact resistance of flat traffic delineators (FTDs) at low temperature

---

### G.1 Principle

This test is used to determine the effect of impact on an FTD at cold temperature. The FTD at the required temperature is held and struck by a weight. The effect, if any, on the FTD and the retroreflective material on it are noted.

---

### G.2 Test sample

Flat traffic delineator, complete with its retroreflective component.

---

### G.3 Apparatus

**G.3.1** *Reference surface.*

**G.3.2** *Steel ball, of mass of  $(0.9 \pm 0.045)$  kg, suspended from one or two steel pendulum wires of not more than 1 mm diameter so that the pendulum radius is  $(1\,750 \pm 10)$  mm.*

---

### G.4 Conditioning

**G.4.1** Fix the base of the FTD to the reference surface.

**G.4.2** Condition the sample for a period of not less than 2 h at a temperature of  $(-16 \pm 2)$  °C.

---

### G.5 Procedure

**G.5.1** With the base of the FTD fixed to the reference surface, conduct impact testing less than 60 s after conditioning, using the steel ball swung on its pendulum.

**G.5.2** The point of impact shall be vertically beneath the centre of radius of the pendulum and at a height on the specimen of  $(H/2 \pm 10)$  mm (where  $H$  is the height of the FTD) above the reference surface.

**G.5.3** Examine the sample for:

- a) any damage to the retroreflective surface; and
- b) detachment of the blade from its base.

---

### G.6 Test report

A test report shall declare if the retroreflective sheeting has been damaged and the extent of that damage, as well as whether the blade of the FTD detached from its base.

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# Annex H (normative)

## Test for bending resistance of flat traffic delineators (FTDs)

---

### H.1 Principle

This test is used to determine the effect of bending on an FTD at cold and hot temperatures. The FTD at each required temperature is bent and any residual horizontal deflection measured and other effects noted.

---

### H.2 Test sample

Flat traffic delineator, complete with its retroreflective component (not the same specimen tested in [Annex G](#)).

---

### H.3 Apparatus

H.3.1 *Reference surface.*

---

### H.4 Conditioning

- H.4.1 Fix the base of the FTD to the reference surface in accordance with the manufacturer's instructions for installation.
- H.4.2 Cold condition the blade and its base for a period of not less than 2 h at a temperature of  $(-16 \pm 2) ^\circ\text{C}$ .
- 

### H.5 Procedure

- H.5.1 Set the temperature at not greater than  $25 ^\circ\text{C}$ . Start the test within 60 s of the cold conditioned samples being taken from the cold environment.
- H.5.2 With the base of the FTD fixed to the reference surface, bend the blade over its base line by applying a force to the face of the blade at a point on its vertical centre line  $(H/2 \pm 10)$  mm from the top, so that the top edge touches the reference surface or the base (where  $H$  is the height of the FTD).
- H.5.3 When the top edge of the blade touches the reference surface or base, remove the bending force immediately.
- H.5.4 Between 30 s to 60 s after bending, measure the maximum residual horizontal deflection of the top of the blade from the vertical axis passing through the centre of the base of the blade and keep perpendicular to the reference surface.
- H.5.5 Repeat the test in the opposite direction.
- H.5.6 Repeat the procedure at a temperature of  $(32 \pm 2) ^\circ\text{C}$ .
- H.5.7 Examine the sample for deflections, damage, detachment of the blade from its base, and any movement of the base.

## H.6 Test report

- H.6.1** A test report shall include the extent of residual deflection in each direction at both test temperatures.
- H.6.2** A test report shall also report whether the blade became detached from the base during testing and whether the base moved or separated from the reference surface.

---

# Annex I (normative)

## Test for fatigue resistance of flat traffic delineators (FTDs)

---

### I.1 Principle

This test assesses the effect of fatigue on the FTD. In this test a sample is repeatedly oscillated at a set frequency after cold conditioning and then at an elevated temperature to determine whether fatigue damages the FTD or causes its blade to become detached from its base.

### I.2 Test sample

Flat traffic delineator, complete with its retroreflective component (not the same specimen tested in [Annex G](#) or in [Annex H](#)).

### I.3 Apparatus

- I.3.1** *Reference surface.*

### I.4 Conditioning

- I.4.1** Fix the blade to the base in accordance with the manufacturer's instructions for installation.
- I.4.2** Condition the blade and its base for a period of not less than 2 h at a temperature of  $(-16 \pm 2)$  °C.

### I.5 Procedure

After conditioning and with the blade fixed to the base in accordance with the manufacturer's instructions, oscillate the blade, at a frequency of between 60 and 90 oscillations per minute, for 10 min by applying a force to the face of the blade at a point on its vertical centre line  $(H/2 \pm 10)$  mm from the top.

The amplitude of the oscillation shall be at  $H/4$ , measured at the top with the reference surface held in a horizontal position, where  $H$  is the height of the FTD. One oscillation is the movement from the upright position to the maximum amplitude in one direction, then to the maximum amplitude in the opposite direction and then the return to the upright position.

- I.5.1** Repeat the procedure at a temperature of  $(32 \pm 2)$  °C.
- I.5.2** Examine the sample for damage and any detachment of the blade from its base.

## I.6 Test report

- I.6.1 A test report shall report any damage to the FTD and at what stage it occurred.
- I.6.2 A test report shall also report whether the blade detached from the base and the conditions at which this happened.

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# Annex J (normative)

## Measurement of the luminance of internally illuminated posts

---

### J.1 Procedure

This test determines the mean and uniformity of luminance of internally illuminated posts.

### J.2 Test sample

Internally illuminated post.

### J.3 Apparatus

- J.3.1 *Luminance meter.*

### J.4 Procedure

- J.4.1 Illuminate the post using the light source and in the position specified by the manufacturer.
- J.4.2 Take luminance measurements in a direction normal to the tangent to the surface of the illuminated part of the post, on an area of  $(25 \pm 0.5)$  mm projected diameter.
- J.4.3 If the illuminated section of the post consists of completely illuminated bands, take four measurements at 90° intervals around the centre of each band.
- J.4.4 If the illuminated section of the post consists of translucent openings in the shaft, take measurements in the centre of each opening.
- J.4.5 Calculate the mean luminance and uniformity of luminance.

### J.5 Test report

Test reports shall report the measured luminance values, the mean luminance and the uniformity of luminance.

---

## Annex K (normative)

# Determination of mean luminance and uniformity of luminance

---

### K.1 Principle

This test measures the luminance across the surface of the transilluminated retroreflective signs mounted on RSRBs (see [Clause 13](#)) and from this data calculate the mean luminance and the uniformity of luminance for each colour and determine the luminance contrast between colour combinations used on the signs. Single colour transilluminated retroreflective roundels of the same material as is used for the sign face on the finished RSRB product are used as proxies for the traffic sign roundel. This is done so that the maximum number of test squares containing a single colour can be tested. This test method is based on BS EN 12899-1:2007, 7.3.1.7, but differs from it in the size of the test squares used and in the use of full colour roundels as proxies for the traffic sign.

---

### K.2 Apparatus

**K.2.1** *Luminance meter*, conforming to BS EN 13032-1.

---

### K.3 Calibration

Calibrate the luminance meter across the full range of measurements.

---

### K.4 Procedure

- K.4.1** Each colour retroreflective roundel shall be mounted onto an RSRB using the same sheeting orientation that shall be used for the sign face on the finished product.
- K.4.2** The supply voltage shall be stabilized at the value declared by the manufacturer.
- K.4.3** The roundel shall be divided into test squares beginning at the centre of the sign face (see [Figure 4](#)).
- K.4.4** The sides of the test squares shall be 50 mm.
- K.4.5** The luminance shall be measured 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.
- K.4.6** Measurements for those test squares where the area of the circular measuring spot falls partly outside the retroreflective roundel shall be omitted.
- K.4.7** After the application of any photometric correction factors, the mean luminance for each colour shall be calculated using simple averaging and the luminance uniformity for each colour shall be calculated as the ratio of the lowest measured luminance to the highest measured luminance for that sample.
- K.4.8** Luminance contrast,  $K$ , for two colours that occur on signs shall be calculated as the ratio of the larger mean luminance to the smaller mean luminance.

---

## **K.5 Test report**

The test report shall declare the luminance of each of the squares tested, the mean luminance for each applicable colour, the luminance uniformity for each colour and the luminance contrast for colour combinations to be used on traffic signs mounted on the final product.

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For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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UNE 135340, *Vertical signs – Microprismatic polymetric retroreflecting sheetings – Characteristics and test methods*

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