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Miscellaneous road traffic signs and devices – Requirements and test methods

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Contents

List of tables

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 35 and a back cover.

Foreword

Publishing information

This British Standard was published by BSI and came into effect on 31 October 2006. 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 this committee can be obtained on request to its secretary.

Supersession

Together with BS EN 1463-1:1998, BS EN 1463-2:2000 and BS EN 12899-1:2001, the British Standard supersedes BS 873-1:1983, BS 873-2:1984, BS 873-4:1987 and BS 873-7:1984, which are withdrawn.

BS 873-3 is to be replaced by BS EN 12899-2, which is currently in preparation; BS 873-5 and BS 873-6 have been withdrawn and superseded by BS EN 12899-1; and BS 873-8:1985 has been withdrawn and superseded by BS EN 13422.

BS 873 was first published in 1939 in response to a request from the Association of Road Traffic Sign Makers, and was revised in 1959 and 1970. It was reissued in eight parts between 1980 and 1987. As much of it has been superseded by various European Standards, BS 8442 revises and brings together in a single document all the material not covered elsewhere.

Product certification/inspection/testing

Users of this British Standard are advised to consider the desirability of third-party certification/inspection/testing of product conformity with this British Standard. Appropriate conformity attestation arrangements are described in BS EN ISO/IEC 17025. Users seeking assistance in identifying appropriate conformity assessment bodies or schemes may ask BSI to forward their enquiries to the relevant association.

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 notes in smaller italic type, and does not constitute a normative element.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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

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

The Traffic Signs Regulations and General Directions 2002 [1]

The Zebra, Pelican and Puffin Pedestrian Crossings Regulations and General Directions 1997 (Pedestrian Crossings Regulations), as amended [2]

The School Crossing Patrol Sign (England and Wales) Regulations 2006 [3]

The School Crossing Patrol Sign (Scotland) Regulations 2002 [4]

1 Scope

This standard specifies requirements and tests (see Note) for rigid and flexible portable signs, barriers, self supporting portable signs, "Stop/Go" signs, school crossing patrol signs, flat traffic delineators, flap signs, pedestrian crossing and refuge beacons, internally illuminated posts, twin amber flashing light units, non-retroreflecting road studs and retroreflective self-righting bollards. Active road studs (incorporating light emitting devices) are not covered in this standard.

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

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 3424-5, *Testing coated fabrics – Part 5: Methods 7A, 7B and 7C – Methods for determination of tear strength*

BS 4148, *Specification for the abbreviation of title words and titles of publications*

BS 7263-1, *Precast concrete flags, kerbs, channels, edgings and quadrants – Precast concrete paving flags and complementary fittings – Part 1: Requirements and test methods*

BS 8408:2005, *Road traffic signs – Testing and performance of microprismatic retroreflective sheeting materials – Specification*

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

BS EN 12332-1:1999, *Rubber- or plastics-coated fabrics – Determination of tensile strength and elongation at break – Part 1: Steel ball method*

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

BS EN 12899-1:2001, *Fixed, vertical road traffic signs – Part 1: Fixed signs*

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, *Electromagnetic compatibility – Road traffic signal systems – Product standard*

BS EN 55014-1, *Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 1: Emission – Product family standard*

BS EN 60529, *Specification for degrees of protection provided by enclosures (IP code)*

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

BS EN ISO 1421:1998, *Rubber- or plastics-coated fabrics – Determination of tensile strength and elongation at break*

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

prEN 12899-2:2006, *Fixed, vertical road traffic signs – Part 2: Transilluminated traffic bollards*

CIE 15:2004 (third edition), *Colorimetry*

CIE 17.4, *International lighting vocabulary*

CIE 54.2, *Retroreflection: Definition and measurement*

NOTE All CIE documents are available from the International Commission on Illumination, CIE Central Bureau, Kegelstrasse 27, A-1030 Vienna. AUSTRIA +43 (01) 714 31 87/0 or www.cie.co.at

3 Terms and definitions

For the purposes of this British Standard, the terms and definitions given in BS 4148 and CIE 17.4 and the following apply.

3.1 base housing
that part of an RSRB containing the self-righting equipment which is fixed to the refuge, traffic island or carriageway

3.2 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* ($cd \cdot lx^{-1} \cdot m^{-2}$).

3.3 conspicuity panel
that part of an RSRB above the ground line which enhances the conspicuity of the RSRB in all ambient lighting conditions

3.4 entrance angle
β
angle between the illumination axis and the retroreflector axis

NOTE In signing applications the entrance angle is less than 90°.

3.5 fluorescence
attribute of daytime appearance based on absorption of light at shorter wavelengths and emission at longer wavelengths

3.6 ground line
level of the surface on which a device is mounted

3.7 luminance
physical measure of optical stimulus which 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 ($cd \cdot m^{-2}$).

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

3.9 observation angle
α
angle between the illumination axis and the observation axis

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 rays

3.11 retroreflector
retroreflective device or material capable of reflecting light back in the general direction of the light source

3.12 rotation angle
ε
angle in a plane perpendicular to the retroreflector axis from the observation half plane to the datum axis, measured counter-clockwise from the viewpoint of the source

3.13 substrate
rigid material which supports the sheeting

3.14 traffic sign
object or device, either fixed or portable, for warning, regulating, guiding or informing road users

3.15 retroreflective self-righting bollard (RSRB)
retroreflective self-righting device normally mounted on a refuge or a traffic island

NOTE An RSRB may contain a prescribed traffic sign or a plain white area.

3.16 road stud
device that is bonded to or anchored within the road surface in order to warn, guide or inform road users

3.17 RSRB body
that part of an RSRB above the base housing

4 Information and requirements to be agreed and documented

4.1 Information to be supplied by the purchaser

The following information to be supplied by the purchaser shall be fully documented. For compliance with the standard both the definitive requirements specified throughout the standard and the following documented items shall be satisfied.

a) The properties of the microprismatic material (see **5.2.2.2**).

b) The level of protection against electric shock (**13.1**).

c) The degree of ingress protection required if it is higher than that specified in **13.2.1**, **13.3.1** and **13.4.1**.

d) The length of a zebra crossing or refuge beacon post above ground within the limits prescribed by the Pedestrian Crossings Regulations and the Traffic Signs Regulations and General Directions (see **13.3.2.1** and **13.3.2.2**).

e) The method of securing a flashing amber light unit to a post (see **13.4.1**).

4.2 Items to be agreed

The following item to be agreed between the contracting parties are specified in the clauses referred to and shall be fully documented. For compliance with the standard both the definitive requirements specified throughout the standard and the following documented item shall be satisfied.

a) If testing of sign face material is to be carried out with the sample attached to a substrate other than 3 mm aluminium sheet (see **5.1.2**).

5 Sign face materials

5.1 Sampling

5.1.1 Test samples

Samples for performance testing shall be selected randomly, e.g. in accordance with one of the sampling procedures given in the BS 6001 and BS 6002 series of standards, and shall be representative of the normal production of the sheeting materials to be tested.

NOTE Guidance on the selection of sampling procedures from BS 6001 and BS 6002 is given in BS 6000.

5.1.2 Mounting of samples

If it is necessary for the material under test to be mounted on a substrate, the material to be tested in accordance with this standard shall be applied to 3 mm aluminium sheet conforming to BS EN 485-1 or other agreed substrate in accordance with the material manufacturer's instructions [see **4.2**a)]. Any protective coatings required by the material manufacturer shall be applied in accordance with the manufacturer's instructions.

5.2 Visual performance

5.2.1 Chromaticity

5.2.1.1 Daylight chromaticity

5.2.1.2 Non-retroreflective signs

When tested in accordance with BS EN 12899-1:2001, **5.2.1.1**, the chromaticity and the luminance factor shall conform to BS EN 12899-1:2001, Table 3.

5.2.1.2.1 Retroreflective sign face materials

6.2.1.2.1.1 Glass bead

When tested in accordance with BS EN 12899-1:2001, **5.2.1.2**, the chromaticity and the luminance factor shall conform to BS EN 12899-1:2001, Table 5.

6.2.1.2.1.2 Microprismatic

When tested in accordance with BS 8408:2005, **5.2.1.1**, the chromaticity and the luminance factor for non-fluorescent microprismatic material shall conform to BS 8408:2005, Table 2.

NOTE The chromaticity boxes for non-fluorescent materials in BS 8408:2005 and BS EN 12899-1:2001 are the same.

When tested in accordance with BS 8408:2005, **5.2.2.1**, the chromaticity and the luminance factor for fluorescent microprismatic material shall conform to BS 8408:2005, Table 4.

5.2.1.3 Night-time chromaticity of microprismatic material

NOTE Non-retroreflective signs may be illuminated by external lighting at night. At present, there is no test for the night-time chromaticity of glass bead sign face materials. As a result, this sub-clause is limited to microprismatic sign face material.

When tested in accordance with BS 8408:2005, **5.2.1.2**, the chromaticity and the luminance factor for non-fluorescent microprismatic material shall conform to BS 8408:2005, Table 3.

When tested in accordance with BS 8408:2005, **5.2.1.2**, the chromaticity and the luminance factor for fluorescent microprismatic material shall conform to BS 8408:2005, Table 5.

5.2.2 Photometric requirements

5.2.2.1 Glass bead sign face materials

When measured in accordance with the procedure in CIE 54.2, using CIE standard illuminant A, the coefficient of retroreflection (R_A) of retroreflective glass bead material shall conform to BS EN 12899-1:2001, Table 8 or 9, as required.

5.2.2.2 Microprismatic sign face materials

Microprismatic materials shall be assessed and rated in accordance with the procedures in BS 8408. The materials shall have the characteristics specified by the purchaser [see **4.1**a) and BS 8408:2005, Annex I].

5.3 Physical performance

5.3.1 Salt spray resistance of microprismatic sign face materials

Microprismatic materials shall conform to BS 8408:2005, **4.3.2**.

5.3.2 Resistance to impact of retroreflective and non-retroreflective sign face materials

5.3.2.1 Sign face materials shall conform to BS EN 12899-1:2001, **5.3.7**.

5.3.3 Resistance to weathering of the sign face of retroreflective sign face materials

5.3.3.1 Resistance of microprismatic sign face materials to accelerated artificial weathering

NOTE This test is optional for early evaluation purposes.

Microprismatic materials shall conform to BS 8408:2005, **4.3.5**.

5.3.3.2 Resistance to accelerated natural weathering

5.3.3.2.1 Glass bead materials shall conform to BS EN 12899-1:2001, **5.3.6**.

5.3.3.2.2 Microprismatic materials shall conform to BS 8408:2005, **4.3.6**.

Table 1 **Exposure period for accelerated natural weathering**

Class	**Period**
	Years
T1	2
T2	3

6 Self-supporting rigid portable signs, other than barriers

6.1 General

The 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 Vertical mounting is recommended as this improves the retroreflective performance of virtually all sign face materials.

The sign assembly shall be so designed as to allow the use of ballasting which will permit the sign assembly to resist the wind forces it is likely to experience in any location in which it is eventually deployed. 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 2, **15.1**e) and Annex A].

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 B.

NOTE 2 The front of any backing board or background against which the sign is displayed is required by the Traffic Signs Regulations and General Directions 2002 [1] to be grey or yellow.

Table 2 **Classification of effective wind speeds V_e**

Class of wind speed	**Effective wind speed V_e**
	ms^{-1}
A	26.3
B	17.6
C	8.7

NOTE 3 Pressure due to passing vehicles is small by comparison and has been ignored. A guide to wind speed classes is given in Annex C.

6.2 Visual performance of sign face material

The visual performance of the sign face material shall conform to **5.2**.

6.3 Physical performance of the sign face

The physical performance of sign face material shall conform to **5.3**.

When tested in accordance with Annex D, 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;

c) slide along the surface if the force is applied in either direction.

7 Portable barriers

7.1 General

NOTE Barrier units incorporating traffic signs intended to close a traffic lane, or guide traffic or pedestrians past works, are regulated by the Traffic Signs Regulations and General Directions 2002 [1].

Barrier units, comprising barrier boards, tapping rails, supports and bases, shall be capable of being incorporated into systems which are used to mark part of a highway which 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, and 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 2, **15.1**e) and Annex E].

The minimum recommended ballast required for the barrier assembly to resist Class A, Class B and Class C wind speeds shall be calculated using the methods described in Annex F.

7.2 Visual performance

The visual performance of any traffic sign incorporated into portable barriers shall conform to **5.2**.

7.3 Physical performance

The physical performance of portable barriers shall conform to **5.3**.

8 Self-supporting flexible portable signs

8.1 General

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.

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 2 Vertical mounting is recommended as this improves the retroreflective performance of virtually all sign face materials.

When tested in accordance with Annex D, 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;

c) slide along the surface if the force is applied in either direction.

The self-supporting portable sign assembly shall be classified for resistance to wind pressure in accordance with **6.1.**

NOTE 3 The front of any backing board or background against which the sign is displayed is required by the Traffic Signs Regulations and General Directions 2002 [1] to be grey or yellow.

8.2 Visual performance

The visual performance shall conform to **5.2**.

8.3 Physical properties of substrate material

NOTE 1 As these signs are generally transported and stored folded or rolled it is important that such treatment does not adversely impair the performance and legibility of the sign by, e.g., buckling, cracking, cockling or rippling the sign face.

The properties of the substrate to which the sign face is applied shall conform to the properties specified in Table 3, when tested in accordance with the relevant standards specified in Table 3.

Table 3 **Physical properties of substrate material**

Property	Value	Test method
Minimum mass per unit area	500 g/m^2	BS EN ISO 2286-2:1998, Method B
Minimum tensile strength	1 000 N/50 mm	BS EN ISO 1421:1998
Maximum extension at break	15%	BS EN ISO 1421:1998
Minimum tongue tear strength	400 N	BS 3424-5, Method 7A
Minimum bursting strength	2 750 kN/m^2	BS EN 12332-1:1999

NOTE 2 These products are not required to conform to ***5.3.2****.*

9 Manually operated portable "Stop/Go" signs

9.1 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. A device shall be incorporated in the stand that will halt the movement of the sign in one direction, so that it presents only one of its faces, and will only allow 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 and 7024 of the Traffic Signs Regulations and General Directions 2002 [1]. The substrate and any surrounding frame have to be circular.

NOTE 2 The method of fixing the sign to the stand should be such that the sign cannot be dislodged from its position by the passage of traffic.

9.2 Visual performance

The visual performance shall conform to **5.2**.

9.3 Physical performance

The physical performance shall conform to **5.3**.

10 Portable school crossing patrol signs

10.1 General

NOTE The legend to appear on each side of the sign plate is specified in the schedule to the School Crossing Patrol Sign Regulations [3 and 4]. These Regulations also govern any protective strip applied to the perimeter of the sign plate. The same Regulations further specify that the pole on which the sign is mounted has to be marked with alternate black and yellow bands (300 ± 20) mm high, commencing with a 300 mm black band at the top.

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.

10.2 Visual performance

The visual performance shall conform to **5.2**.

11 Portable flat traffic delineators (FTDs)

11.1 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 may also be retroreflective.

NOTE The general design and dimensions of FTDs are prescribed in diagram 7102 and other provisions of the Traffic Signs Regulations and General Directions 2002 [1].

11.2 Visual performance

The visual performance shall conform to **5.2**.

11.3 Physical performance

11.3.1 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.

11.3.2 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 not be damaged or become detached from its base.

11.3.3 Fatigue resistance

When tested in accordance with Annex I, the blade shall not be damaged or become detached from its base.

12 Fixed, permanent, manually operated flap signs

12.1 General

A flap sign shall consist of a sign plate which is 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 no 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 SP1 or SP2 as specified in BS EN 12899-1:2001, **5.3.5**.

NOTE When the message is concealed the Traffic Signs Regulations and General Directions 2002 [1] require the whole assembly to be grey or black.

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

12.2 Visual performance

The visual performance of the sign face material of flap signs shall conform to **5.2**.

12.3 Physical performance

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

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

13.1 Electrical requirements

Beacon globes, transilluminated posts, and twin amber flashing lights shall conform to all relevant parts of BS EN 60598. All electrical components, including associated ballasts, flashing units and controllers, shall conform to the relevant European or British standards.

Electrical components, including associated ballasts, flashing units and controllers, shall have radio interference field strengths within the limits set by BS EN 55014-1, and shall conform to BS EN 50293 for electromagnetic compatibility.

Means shall be provided to correct the power factor to not less than 0.85.

Protection against electric shock shall be either Class 1 or Class 2 in accordance with BS EN 60598:2000, **2.2**, as specified by the purchaser [see **4.1**b)].

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

13.2 Beacon globes

13.2.1 General

NOTE Beacon globes are regulated by the Pedestrian Crossings Regulations 1997 [2], as amended, and the Traffic Signs Regulations and General Directions 2002 [1].

Unless otherwise specified by the purchaser [see **4.1**c)], the level of ingress protection afforded by a beacon globe shall be IP 54, in terms of BS EN 60529.

The globe shall be suitable for securely fixing to a post of nominal diameter 76 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.

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

a) a flashing rate of 40 ± 4 flashes per minute, as perceived by the human eye;

b) a light-on period of between 50% and 60% of total cycle time;

c) a light-off period not exceeding 0.75 s.

13.2.2 Visual performance

13.2.2.1 Chromaticity and luminance factor

13.2.2.1.1 Performance

When measured as described in **13.2.2.1.2**, the chromaticity and luminance factor of the globe shall conform to Table 4.

13.2.2.1.2 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 15:2004, with its light detector aligned in the same direction as used for intensity or luminance measurements specified in **13.2.2.3**.

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.

Table 4 **Chromaticity coordinates and luminance factors of globes**

Colour	Day/Night	Chromaticity coordinates								Luminance factor, β	
		1		2		3		4			
		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	—	—
	Day	0.350	0.360	0.300	0.310	0.290	0.320	0.340	0.370	0.75	—
Yellow	Day and Night	0.522	0.477	0.470	0.440	0.427	0.483	0.465	0.534	0.45	—

13.2.2.2 Mean luminance and uniformity of luminance

When measured as described in **13.2.2.3,** the mean luminance of the globe shall be not less than 300 cd·m^{-2}. 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.

13.2.2.3 Measurement of mean 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 1 on an area of the globe of (25 ± 0.5) mm projected diameter.

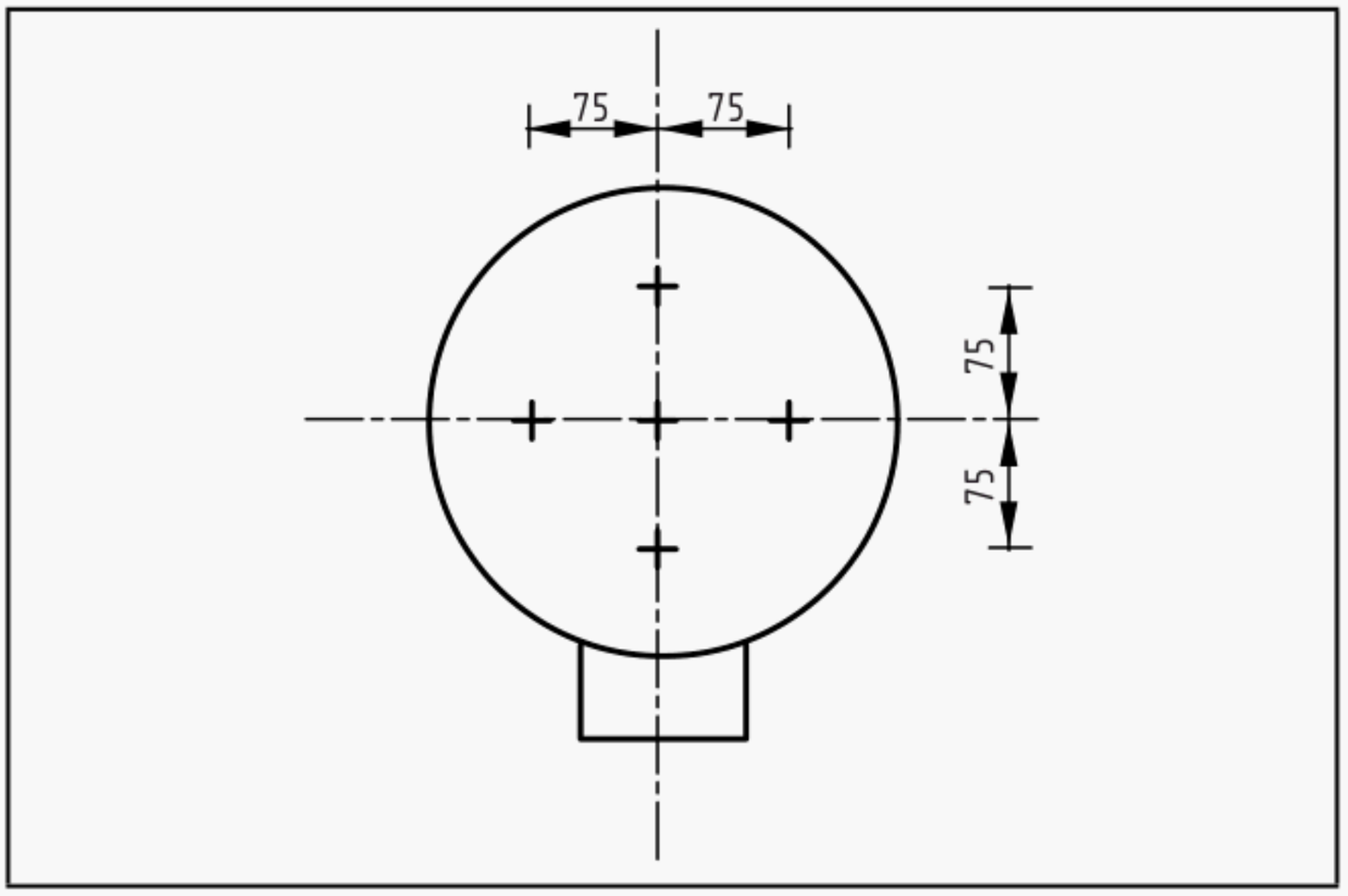
The measurements shall be repeated at angles of 120° and 240° in plan to the original direction.

The mean luminance and uniformity of luminance shall be calculated in accordance with BS EN 13032-1.

13.2.2.4 Visibility of light source

When the globe is illuminated, the light source shall not be visible through the globe material.

Figure 1 **Luminance measurement**



13.3 Posts

13.3.1 General

A post shall consist of a base section with door opening and an upper part. The shape may be cylindrical with not more than one change of diameter, or conical. The upper part shall terminate in a spigot ($76\ ^{+3}_{-0}$) mm diameter not less than 100 mm in length, for connection to the globe.

The door opening and base compartment shall conform to BS EN 40.

The length of the base section below ground shall be as specified by the purchaser, depending on the installation and cable entry method to be used, and shall incorporate a cable entry slot conforming to BS EN 40, unless cable entry is through the base of the post.

Unless otherwise specified by the purchaser [see **4.1**c)], the level of ingress protection afforded by the post base compartment shall be not less than IP 23, in accordance with BS EN 60529.

13.3.2 Non-illuminated posts

13.3.2.1 Zebra crossing posts

The post shall conform to **11.3.1**, except that it shall be cylindrical with not more than one change of diameter, and any larger diameter base section shall not extend more than 1 150 mm above ground level.

*NOTE The Pedestrian Crossings Regulations 1997 [2] permit the purchaser to specify the length of the post above ground [see **4.1**d)], but require that the bottom of the globe is not less than 2.1 m and not more than 3.1 m above ground level. These Regulations also require that posts are marked with alternate black and white bands.*

13.3.2.2 Refuge beacon posts

The length of the post above ground shall be as specified by the purchaser within the limits prescribed by the Traffic Signs Regulations and General Directions 2002 [1] [see **4.1**d)].

NOTE The Traffic Signs Regulations and General Directions 2002 [1] require the centre of the globe to be not less than 3.8 m and not more than 5.0 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.

13.3.3 Internally illuminated posts

13.3.3.1 Zebra crossing posts

The post shall conform to **13.3.1** and **13.3.2.1,** 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 there is a change of diameter, the larger diameter base section shall not extend more than 1 150 mm above ground level.

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 It is desirable that 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.

13.3.3.2 Refuge beacon posts

The post shall conform to **13.3.1** and **13.3.2.2,** 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 there is a change of diameter, the larger diameter base section shall not extend more than 1 150 mm above ground level.

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 Internally illuminated refuge beacon posts are governed by the Traffic Signs Regulations and General Directions 2002 [1].

13.3.4 Visual performance

13.3.4.1 Non-illuminated posts

NOTE Retroreflective white bands are required to be provided for non-illuminated posts in accordance with the Traffic Signs Regulations and General Directions 2002 [1].

13.3.4.2 Internally illuminated posts

13.3.4.2.1 Chromaticity and luminance factor for internally illuminated posts

The chromaticity and luminance factor of the illuminated white portions shall conform to the Table 4 requirements for globes when measured in accordance with CIE 15:2004.

13.3.4.2.2 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 5. 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 5 **Luminance of posts**

Luminance category	**Luminance,** $cd \cdot m^{-2}$	
	Min.	Max.
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. It is not necessarily related to high levels of street lighting. Posts of luminance category LP1 are suitable for all other locations.

13.3.5 Physical performance

When tested in accordance with Annex K, the post and any attached signs, fittings and luminaires shall resist the loading applied to the projected area of the post and such fittings or signs affixed to the post, without deflecting more than 2.5% under load and with no residual deflection after the load is removed, when measured at the extremity.

In addition, 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.

Non-internally illuminated posts may alternatively be evaluated by calculation as specified in the National Annex to BS EN 12899-1.

13.4 Twin flashing amber light units

13.4.1 General

NOTE 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 Traffic Signs Regulations and General Directions 2002 [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 nor 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 **4.1**c)], 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 accordance with the Traffic Signs Regulations and General Directions 2002 [1]. 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 not be 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 not be used.

The panel or other component 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 shall not afford access to any live parts.

The unit shall incorporate a secure method of fixing to the post specified by the purchaser [see **4.1**e)].

13.4.2 Visual performance of flashing amber light units

13.4.2.1 Chromaticity

When measured in accordance with **13.4.2.2**, the chromaticity of the flashing amber light units shall conform to Table 6.

13.4.2.2 Measurement of chromaticity

The chromaticity of light emitted from amber flashing light units shall be measured using a colorimetric measuring system in accordance with CIE 15:2004, with its light detector aligned in the same direction as specified for intensity or luminance measurements in **13.2.2.3**.

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.

Table 6 **Chromaticity of amber light units**

Chromaticity coordinates							
1		2		3		4	
x	y	x	y	x	y	x	y
0.546	0.426	0.560	0.440	0.617	0.382	0.612	0.382

13.4.2.3 Luminous intensity and distribution

When measured in accordance with **13.4.2.4**, the light unit shall conform to the following performance requirements for operation in daylight.

a) At the normal to the lens or cover, on the photometric axis of the light unit, the intensity I_N shall be not less than 50 cd and not greater than 75 cd.

b) Within an angular cone of 7° to the normal, the intensity shall be not less than 0.5 I_N.

c) At 90° to the normal, the intensity shall be zero.

NOTE These figures are based on test results and consideration of the angular relationship between the driver of a car 3 m from the kerb and a light unit offset 2 m behind the kerb with the normal parallel to the kerb, with the driver at various distances from the unit (300 m, 150m, 75 m and 50 m).

13.4.2.4 Method for the determination of the luminous intensity and distribution

The luminous intensity of a single light unit shall be measured in accordance with BS EN 13032-1.

The light unit shall be operated at the voltage at which it is to be used, as specified by the manufacturer.

The angle subtended at the geometric centre of the warning light by the diameter of the detector aperture shall be not greater than 10 minutes of arc.

The measured values for angles shall be within the following tolerances:

± 0.1° for angles > 2° and < 4°

± 0.2° for angles ≥ 4° and < 8°

± 0.4° for angles of 8° and above.

Sufficient readings shall be taken within the angular limits specified in **13.4.2.3** to find and record the points of both maximum and minimum intensity.

13.4.3 Physical performance of flashing amber light units

When tested in accordance with BS EN 12899-1:2001, **5.3.5**, flashing amber light units shall show no change in appearance, using an untreated sample for comparison.

13.5 Non-retroreflective road studs

Studs shall be designed so that, when correctly installed, they do not present sharp edges to traffic.

NOTE Attention is drawn to the requirements of the Traffic Signs Regulations and General Directions 2002 [1] regarding the colour, size and shape of non-retroreflecting road studs.

14 Retroreflective self-righting bollards (RSRBs)

14.1 Design

14.1.1 Height

The minimum height of the RSRB shall be 900 mm above the ground line.

14.1.2 Body

The body shall contain no sharp edges.

14.1.3 Projected area

The minimum projected area of the front or side conspicuity panel(s) shall be in accordance with Table 7. The lower edge of the conspicuity panels shall be a minimum of 100 mm and a maximum of 200 mm above the ground line.

Table 7 **Projected area of the conspicuity panels**

Projected area, mm^2	
Front view	Side view
150 000	20 000

14.1.4 Conspicuity panels

Conspicuity panels shall be retroreflective, fluorescent and yellow in colour.

NOTE RSRBs rely for night-time conspicuity on the brightness of retroreflective panels incorporated into their design. Daytime conspicuity is enhanced by the use of fluorescent yellow material.

14.2 Visual performance

14.2.1 Chromaticity

When tested in accordance with BS 8408:2005, **5.2.2**, the daytime chromaticity and luminance factor for the yellow fluorescent conspicuity panels shall conform to BS 8408:2005, Table 4, and the night-time chromaticity shall conform to BS 8408:2005, Table 5, respectively.

14.2.2 Photometric performance of conspicuity panels and any sign incorporated

When rated in accordance with BS 8408, retroreflective material shall have a performance index of not less than 9.0 for a V1 vehicle (car), using distance range D3 and angularity A1 (see Note), luminance index B and a position correction factor of 1.73.

NOTE The performance index may be based on an entrance angle of 5° instead of the 15° specified in BS 8408:2005.

14.3 Physical performance

14.3.1 Adhesion to substrate

When tested in accordance with **14.3.3**, the retroreflective sheeting shall remain substantially adhered to the substrate.

14.3.2 Corrosion resistance

Metallic parts shall be protected against corrosion as specified in the corrosion resistance clause of BS EN12899-1 and meet class SP1 or SP2 of that clause.

14.3.3 High impact resistance

When tested in accordance with BS EN 12767, the RSRB shall remain in position and no portion of the RSRB exceeding 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 at the upper extremity, no more than 15 min after the time of impact.

When tested in accordance with BS EN 12767, the RSRB shall meet one of the following performance classes:

100,NE,4; 70,NE,4 or 50,NE,4.

14.3.4 Torsion test

When tested in accordance with prEN 12899-2:2006, **5.6.4**, the RSRB and its mounting shall remain in place and the permanent (residual) angular deflection shall not exceed 5°. The signs, plain surfaces or components of the external surface shall not be damaged or dislodged from their mountings.

15 Marking and information

15.1 Marking

Single-sided sign plates shall be marked on the back.

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

a) the number and date of this British Standard, i.e. BS 8442:2006[1)];

b) the name, trade mark or other means of identification of the manufacturer or vendor;

c) the month and year of manufacture;

d) the classification of any retroreflective material used, where applicable;

e) the level of wind resistance afforded by the notified ballast (see Annex A and Annex E), where applicable.

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

15.2 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.

16 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);

b) details of any limitations on location or usage (see Note 1);

c) instructions on the maintenance of the product;

---

1) Marking BS 8442:2006 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 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) when applicable, the type, wattage and lumen output of the light source for which the unit is designed (see Note 2);

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

NOTE 1 The purchaser has to be made fully aware of the conditions under which the product will perform adequately.

NOTE 2 This requirement is intended to enable the purchaser to replace spent lamps with the correct type.

Annex A (normative) Ballast for self-supporting rigid and flexible portable signs

Using the sample form below, the manufacturer shall indicate the mass of the ballast to be added to each sign assembly to resist a specified class of wind speed, depending upon the sign shape, size and the level of wind resistance chosen.

Table A.1 **Ballast required for wind resistance**

Sign shape	Sign size mm	Ballast requirement for wind speed class kg		
		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			

Annex B (normative) Calculation of minimum recommended ballast required to resist overturning and sliding of self-supporting rigid portable signs

B.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, can be expressed as a function of the plate area (A) and the wind speed (V), as given in equation B.1.

$$F = C_w A\ (1/2\ \rho V_e^2) \tag{B.1}$$

This reduces to:

$$F = S A\ (V_e)^2 \tag{B.2}$$

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 B.1

A is the area of the sign plate (m^2)

r is the density of air (1.23 $kg \cdot m^{-3}$)

V_e is the effective wind speed (ms^{-1}), as given in Table 2 (Clause **6**)

S is the function of C_w and ρ, values of which are given in Table B.2.

Table B.1 **Values of C_w**

Size of sign plate	Unframed	Framed
< 1 500 mm	1.2	1.45
⩾1 500 mm	1.4	1.65

Table B.2 **Values of S**

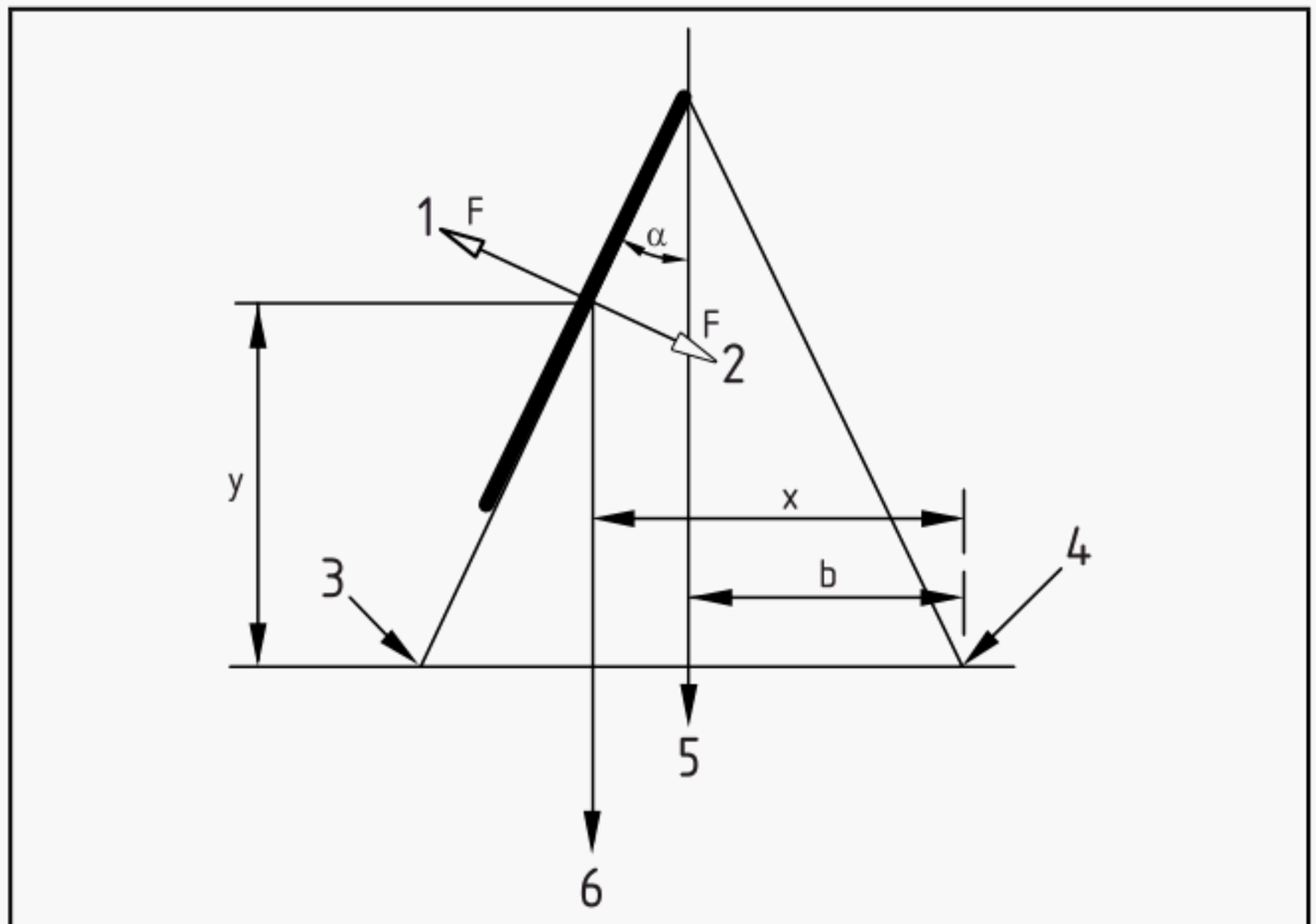
C_w	S
1.2	0.74
1.4	0.86
1.45	0.89
1.65	1.01

B.2 Mass and positioning of ballast

Equations B.3 and B.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 then the calculations shall be amended to take account of the actual position of the ballast.

B.3 Overturning

Figure B.1 **Overturning moment diagram**



Key

1 = Wind case (b)

2 = Wind case (a)

3 = Point of overturning, wind case (b)

4 = Point of overturning, wind case (a)

5 = Combined weight of sign mount and ballast (assumed here to be distributed evenly across the sign mounting frame)

6 = Weight of sign

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:

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

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

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

where:

w is the mass of the sign plate in kilograms (kg)

F is the force on the sign plate due to wind pressure (N)

W is the mass of the sign support and ballast in kilograms (kg)

α is the angle of inclination of the sign plate, as shown in B.1 (°)

g is the acceleration due to gravity (9.81 $m{\cdot}s^{-2}$)

NOTE Where wind acts on the rear of the sign plate, the values of x, y and b for case (b) will be different because of the change in the point of overturning (see Figure B.1).

B.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:

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

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

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

where:

μ is the coefficient of friction between the sign assembly supports and the surface on which they rest. μ shall be taken as 0.6.

Symbols are as indicated in Figure B.1.

Annex C (informative) Classes of wind speed

The following notes on wind speed classes are intended to guide the sign manufacturer and the purchaser.

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.

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.

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 2, but rural locations can be expected to experience wind speeds as much as 40% greater.

Annex D (normative) Method of test for overturning and sliding performance of self-supporting rigid portable signs

D.1 Apparatus

D.1.1 *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.

D.1.2 *Pull cord.*

D.1.3 *Pulley.*

D.1.4 *Weight pan,* containing the weight to produce the required load.

D.1.5 *Weight.*

D.1.6 *Spring gauge.*

D.1.7 *Pulling mechanism,* such as a block and tackle anchored to a wall.

D.2 Procedure

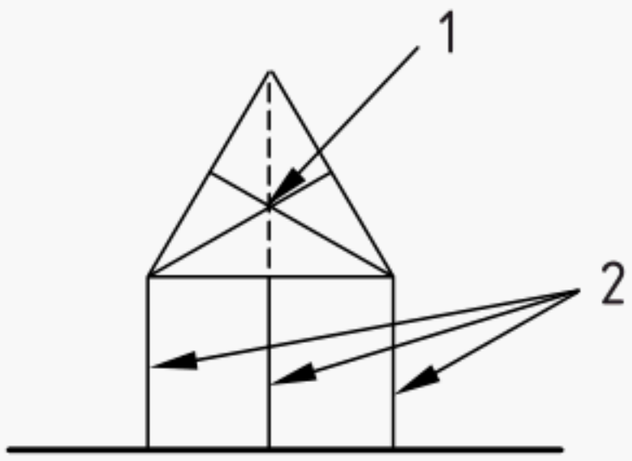
D.2.1 Erect the sign assembly in accordance with the manufacturer's instructions on the flat test surface as shown in Figure D.1, and add the ballast specified by the manufacturer for the wind speed classification being tested.

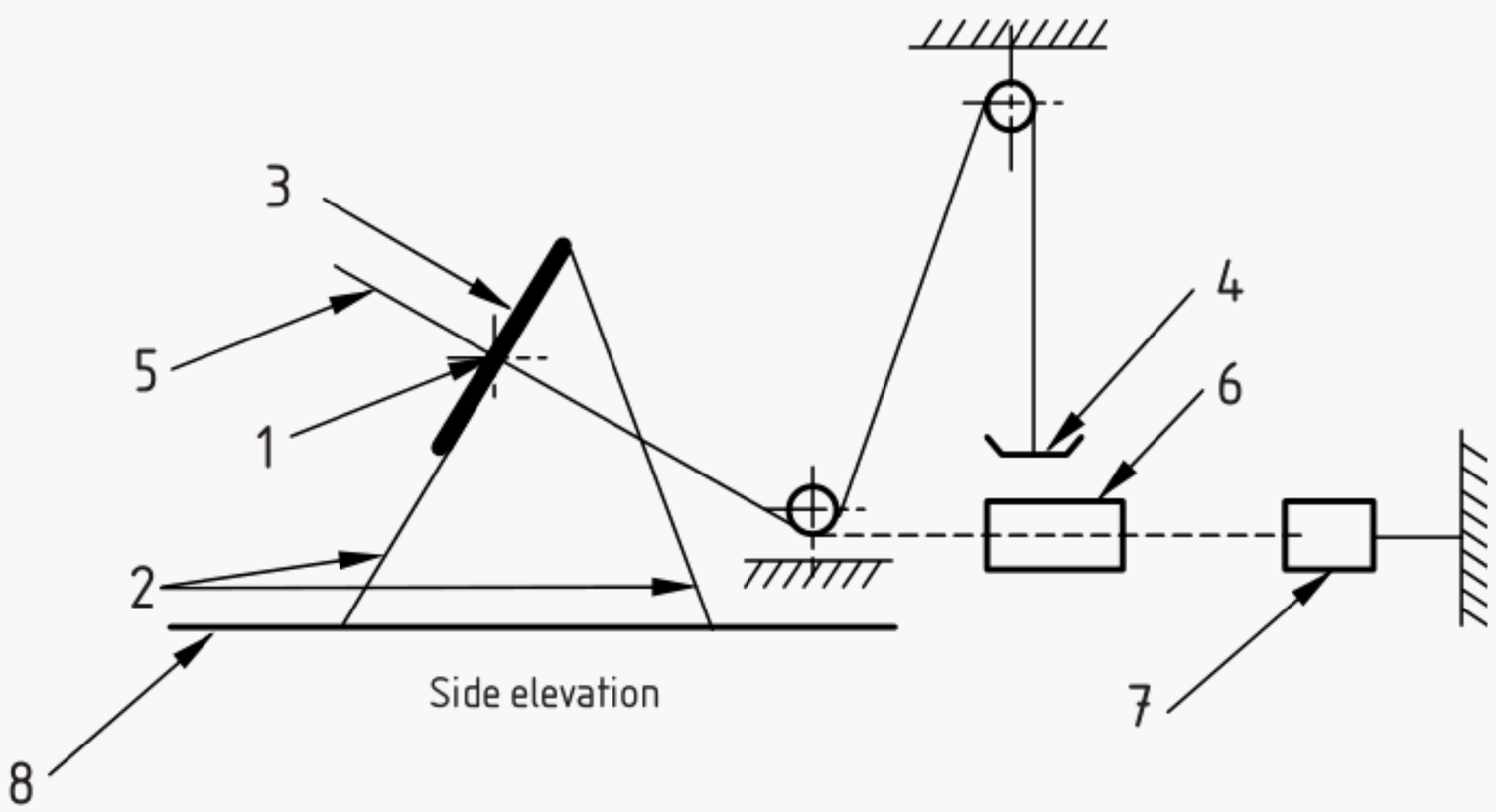
D.2.2 Attach the pull cord directly to the centre of the sign plate area so that a force equivalent to one of the wind speeds in Table 2 is applied perpendicular to the sign plate. Either pass the cord over a pulley and connect it to a weight pan, or attach it via a spring gauge to a pulling mechanism, such as a block and tackle anchored to a wall, as shown in Figure D.1.

D.2.3 Apply the load until the design force derived from equation B.2 is reached or until the sign assembly overturns or slides.

D.2.4 Repeat the test procedure with the force applied to the reverse of the sign face.

Figure D.1 **Test apparatus for stability and sliding performance**





Key

1 = Centre of area of sign plate

2 = Supports

3 = Sign plate

4 = Weight pan

5 = Opposite direction of pull

6 = Spring gauge

7= Anchored pulling mechanism

8 = Test surface

Annex E (normative) Classification and labelling of barrier units

Using the sample form below, the manufacturer shall indicate the mass ballast to be added to each barrier assembly to resist a specified class of wind speed, depending upon the barrier configuration and the level of wind resistance chosen.

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

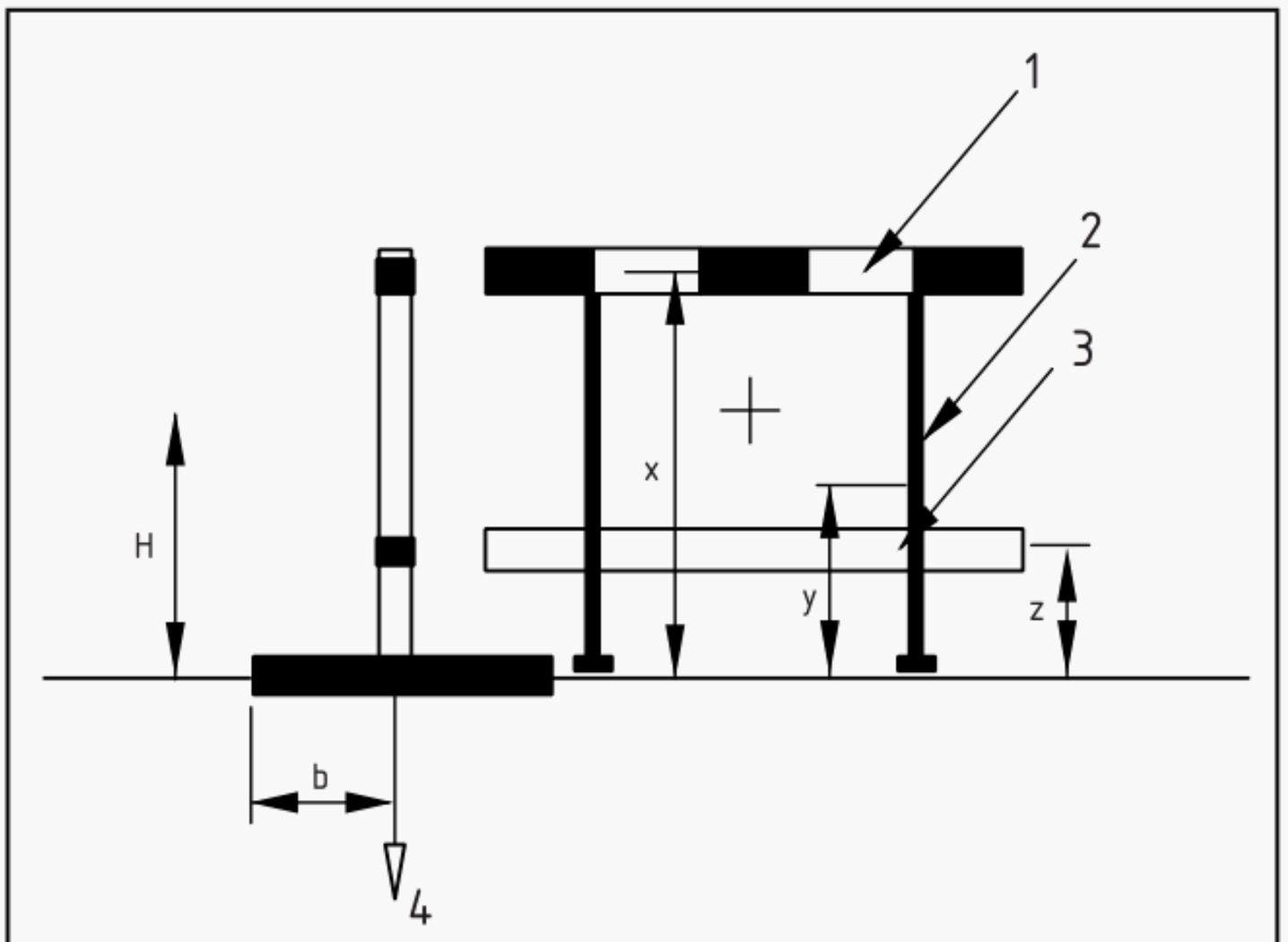
Annex F (informative) Calculation of minimum recommended ballast required to resist overturning and sliding of barrier units

F.1 Positioning of ballast

The calculations in **F.2** and **F.3** can be used to calculate the minimum recommended ballast required to resist overturning and sliding of barrier units.

F.2 Overturning

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



Key

1 = Area A

2 = Area B

3 = Area C

4 = Weight of barrier and ballast (Wg)

It is necessary to determine both W (the mass of the barrier assembly and ballast) and P (the pull-over force).

Taking moments about the point of overturning:

$$Wgb = PH = [F(Ax + 2By + Cz)] \quad \text{(F.1)}$$

H, W and P can be calculated from:

$$H = \frac{Ax + 2By + Cz}{(A + 2B + C)} \quad \text{(F.2)}$$

$$W = \frac{F(Ax + 2By + Cz)}{gb} \quad \text{(F.3)}$$

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

where:

F = the force on the barrier assembly due to wind pressure, perpendicular to its surface (N) (see equation B.2)

A, B and C = the area of the barrier assembly components (m^2)

x, y and z = the height of the centres of area of the barrier assembly components (m)

H = the height of the pull-over weight application (the centre of pressure of the overall wind force) (m)

P = the pull-over force (N)

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

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

F.3 Sliding

For sliding the sideways force (P) is given by:

$$P = Wg\mu = F(A + 2B + C)$$

where:

μ is the coefficient of friction between the sign assembly supports and the surface on which they rest. μ shall be taken as 0.6.

W and P can be calculated from:

$$P = F(A + 2B + C) \quad \text{(F.5)}$$

$$W = \frac{F(A + 2B + C)}{\mu g} \quad \text{(F.6)}$$

Annex G (normative) Test for impact resistance of flat traffic delineators (FTDs) at low temperature

G.1 Test sample

G.1.1 *Flat traffic delineator*, complete with its retroreflective component.

G.2 Apparatus

G.2.1 *Reference surface.*

G.2.2 *Steel ball*, of mass of (0.9 ± 0.04 5) kg, suspended from one or two steel pendulum wires of not more than 1 mm diameter so that the pendulum radius is (1 750 ±10) mm.

G.3 Procedure

G.3.1 Fix the base of the FTD to the reference surface.

G.3.2 Condition the sample for a period of not less than 2 h at a temperature of (–16 ± 2) °C.

G.3.3 Carry out impact testing less than 60 s after conditioning, using the steel ball swung on its pendulum. 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 ± 10 mm (where H is the height of the FTD) above the reference surface.

G.3.4 Examine the sample for any damage to the retroreflective surface or detachment of the blade.

Annex H (normative) Test for bending resistance of flat traffic delineators (FTDs)

H.1 Test sample

H.1.1 *Flat traffic delineator*, complete with its retroreflective component (not the same specimen tested in Annex G).

H.2 Apparatus

H.2.1 *Reference surface.*

H.3 Procedure

H.3.1 Fix the base of the FTD to the reference surface in accordance with the manufacturer's instructions for installation.

H.3.2 Condition the blade and its base for a period of not less than 2 h at a temperature of (−16 ± 2) °C.

H.3.3 Less than 60 s after conditioning, in an ambient temperature not greater than 25 °C, bend the blade over about its base line by applying a force to the face of the blade at a point on its vertical centre line H/2 ± 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). When the top edge of the blade touches the reference surface or base the bending force shall be removed immediately.

H.3.4 Between 30 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 perpendicular to the reference surface.

H.3.5 Repeat the test in the opposite direction.

H.3.6 Repeat the procedure at a temperature of (32 ± 2) °C.

H.3.7 Examine the sample for deflections, damage, detachment of the blade from its base, and any movement of the base.

Annex I (normative) Test for fatigue resistance of flat traffic delineators (FTDs)

I.1 Test sample

I.1.1 *Flat traffic delineator*, complete with its retroreflective component (not the same specimen tested in Annex G or in Annex H).

I.2 Apparatus

I.2.1 *Reference surface.*

I.3 Procedure

I.3.1 Fix the blade to the base in accordance with the manufacturer's instructions for installation.

I.3.2 Condition the blade and its base for a period of not less than 2 h at a temperature of (−16 ± 2) °C.

I.3.3 Oscillate the blade, at a frequency of between 60 oscillations and 90 oscillations per min, for 10 min by applying a force to the face of the blade at a point on its vertical centre line H/2 ± 10 mm from the top.

The amplitude of the oscillation shall be 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.3.4 Repeat the procedure at a temperature of (32 ± 2) °C.

I.3.5 Examine the sample for damage and any detachment of the blade from its base.

Annex J (normative) Measurement of the luminance of internally illuminated posts

J.1 Sample

J.1.1 *Internally illuminated post.*

J.2 Apparatus

J.2.1 *Luminance meter.*

J.3 Procedure

J.3.1 Illuminate the post using the light source and in the position specified by the manufacturer.

J.3.2 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 ± 0.5) mm projected diameter.

J.3.3 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.3.4 If the illuminated section of the post consists of translucent openings in the shaft, take measurements in the centre of each opening.

J.3.5 Calculate the mean luminance and uniformity of luminance.

J.3.6 Record the measured values, the mean luminance and the uniformity of luminance.

Annex K (normative) Test for resistance to horizontal loads of sign posts

K.1 Apparatus

K.1.1 *Clamp.*

K.1.2 *Reference plates;* one of 335 mm diameter and another of 600 mm diameter.

NOTE These simulate a beacon globe and a circular traffic sign respectively.

K.2 Procedure

K.2.1 Clamp the sign post in such a way that it cannot rotate during the test. The post shall not be able to deflect at the point where it is clamped due to any loading applied to the attached signs and fittings during the test.

K.2.2 Apply:

a) for a zebra crossing post to be used in England or Wales, a load of 0.123 kN at a distance of 3.27 m from the nominal ground level;

b) for a zebra crossing post to be used in Scotland or Northern Ireland, a load of 0.141 kN at a distance of 3.27 m from the nominal ground level;

c) for a refuge beacon post to be used in England or Wales, a load of 0.123kN at a distance of 5.17 m from the nominal ground level, together with a load of 0.396 kN at a distance of 2.6 m from the nominal ground level;

d) for a refuge beacon post to be used in Scotland or Northern Ireland, a load of 0.141 kN at a distance of 5.17 m from the nominal ground level, together with a load of 0.452 kN at a distance of 2.6 m from the nominal ground level.

K.2.3 Apply the applicable load specified in **K.2.2** for 5 min. With the load applied, measure the deflection of the post at the top of the post.

K.2.4 Remove the load and, after at least 10 min, measure the residual deflection at the top of the post.

K.2.5 Record the deflection under load and any residual deflection in the test report.

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