

Specification

1 Scope

This Part of BS 873 specifies requirements for reflecting and non-reflecting road studs which may be either bonded to or anchored within the road surface. Sampling and test procedures applicable to this standard are given in appendices A to F, with general advice for the installation of road studs given in appendix G.

NOTE. The titles of the publications referred to in this standard are listed on the inside back cover.

2 Definitions

For the purposes of this Part of BS 873 the definitions given in BS 873 : Part 1 apply, together with the following.

2.1 permanent reflecting road studs. A reflecting road stud as described in 2.8.4 of BS 873 : Part 1 : 1983 that provides long-term warning, guidance and information to road users.

2.2 temporary reflecting road studs. A reflecting road stud as described in 2.8.4 of BS 873 : Part 1 : 1983 that provides warning, guidance and information to road users when required at road works installations.

NOTE. Temporary reflecting road studs are designed to be effective for a period of approximately 3 months.

2.3 unidirectional reflecting road studs. A reflecting road stud that has only one retroreflecting face.

2.4 bidirectional reflecting road studs. A reflecting road stud that has two opposing retroreflecting faces.

2.5 omnidirectional reflecting road studs. A reflecting road stud that is capable of providing retroreflection when subjected to the light emitted from the headlamp(s) of a motor vehicle approaching from any direction.

2.6 category A stud. A reflecting road stud incorporating one or more corner cube retroreflectors.

2.7 category B stud. A reflecting road stud incorporating one or more biconvex retroreflectors.

3 Marking

Road studs and/or their containers shall be clearly marked with the following information.

- The number and date of this British Standard, i.e. BS 873 : Part 4 : 1987*.
- The name, trade mark or other means of identification of the manufacturer.

4 Construction of road studs

NOTE 1. Attention is drawn to the requirements of the Regulations† regarding shape, size and colour of road studs.

NOTE 2. Reflecting road studs for use on public roads in the UK require to be type approved by the appropriate Government Department responsible for highways. Information regarding the required road test is given in appendix F.

4.1 Non-reflecting road studs

The upper surfaces of non-reflecting road studs shall retain their original colour throughout the life of the studs. The enveloping profile of the head of the studs shall not present any sharp edges to traffic.

4.2 Reflecting road studs

Reflecting road studs require the incorporation of retroreflectors which shall comply with the colorimetric requirements of clause 6 and the photometric requirements of clause 7 or 9. The enveloping profile of the head of the studs shall not present any sharp edges to traffic.

When the studs are constructed in two or more parts, one of these shall incorporate the reflectors and shall be a removable insert which shall only be removable by the use of a tool recommended by the manufacturer.

NOTE. Any removable insert incorporating the retroreflector should preferably be capable of fitting into the fixed part(s) in two opposite directions so that the retroreflectors are capable of being reversed.

4.3 Depressible reflecting road studs

Depressible reflecting road studs shall comply with 4.2 and clause 12. They shall be self-wiping and shall revert to their original form after being traversed by a vehicle.

4.4 Temporary reflecting road studs

Temporary reflecting road studs shall be of the unidirectional type. The body of the studs shall be a fluorescent green-yellow colour complying with the colorimetric and luminance requirements of clauses 8 and 10. The retroreflector or combination of retroreflectors on the face of the stud shall comply with the colorimetric requirements of clause 6 and the photometric requirements of clause 9.

5 Materials

Road studs shall be made from any materials such that they shall comply with clause 4 and the appropriate requirements listed in appendix A.

* Marking BS 873 : Part 4 : 1987 on or in relation to a product is a claim by the manufacturer that the product has been manufactured in accordance with the requirements of the standard. The accuracy of such a claim is therefore solely the manufacturer's responsibility. Enquiries as to the availability of third party certification should be addressed to the appropriate certification body.

† See foreword for details.

9 Photometric requirements for retroreflectors of temporary reflecting road studs

The retroreflector or combination of retroreflectors on the face of the stud shall have a coefficient of luminous intensity R within the limits given in table 9 or 10, as appropriate, when multiplied by the appropriate colour factor given in table 7.

NOTE 1. The two categories of road stud A and B are defined in 2.5 and 2.7 and the method of measurement and failure criteria are described in 7.4.

NOTE 2. The vertical entrance angle of 0° corresponds to the normal aspect of the retroreflector(s) when the reflecting road stud is installed in a horizontal road surface.

10 Colour fastness to light of body of temporary reflecting road studs

The colour of the road stud body shall comply with clause 8 of this standard after being subjected to the natural exposure weathering test specified in 15.2.1 of BS 873 : Part 1 : 1983 for a period of 3 months between 1 April and 31 October.

11 Corrosion resistance of retroreflectors of reflecting road studs

After treatment as described in appendix C the retroreflectors incorporated in reflecting road studs shall comply with the colorimetric and photometric requirements of clauses 6, 7 and 9.

12 Resilience of depressible reflecting road studs

When tested as described in appendix D depressible reflecting road studs shall show no breakdown of the depressing action or the self-wiping action, and no 'permanent set' of such an extent that the reflective portion is permanently either wholly or partially obscured.

13 Adhesives for bonding road studs

13.1 Adhesives for permanent road studs

13.1.1 *General.* Adhesives that are furnished as separate components shall be in contrasting colours, each packed separately. Satisfactory cure shall be achieved with the quantity of hardener varying by $\pm 5\%$ of the recommended quantity. No volatile solvents shall be present in any adhesive used.

13.1.2 *Rate of cure.* When tested as described in appendix E the time taken to develop a bond strength of 1.4 N/mm^2 at each test temperature shall be not more than that given in table 11.

Table 11. Test temperature for adhesive cure

Test temperature $\pm 1^\circ\text{C}$	Time
$^\circ\text{C}$	min
25	100
15	190
5	270

Table 9. Minimum and maximum R values for category A temporary studs

Entrance angle	$V = 0^\circ$ $H = 15^\circ$ L and R	$V = 0^\circ$ $H = 10^\circ$ L and R	$V = 0^\circ$ $H = 10^\circ$ L and R	$V = 0^\circ$ $H = 5^\circ$ L and R
Observation angle	2°	1°	0.5°	0.3°
R (mcd/lx)	2 to 8	10 to 36	32 to 100	60 to 200

Table 10. Minimum and maximum R values for category B temporary studs

Entrance angle	$V = 0^\circ$ $H = 15^\circ$ L and R	$V = 0^\circ$ $H = 10^\circ$ L and R	$V = 0^\circ$ $H = 10^\circ$ L and R	$V = 0^\circ$ $H = 5^\circ$ L and R
Observation angle	2°	1°	0.5°	0.3°
R (mcd/lx)	1.4 to 8	7 to 36	10 to 100	13 to 200

13.1.3 Minimum shear strength of adhesive bond. When tested as described in appendix E the shear strength of the adhesive bond shall be not less than:

- (a) 8.9 N/mm^2 after 24 h cure at $25 \pm 2^\circ\text{C}$ when tested dry;
- (b) 6.2 N/mm^2 after 24 h cure at $25 \pm 2^\circ\text{C}$ followed by 7 days' immersion in distilled water at $25 \pm 2^\circ\text{C}$. The specimen shall be tested immediately it is removed from the water.

13.1.4 Adhesive bond strength. The adhesive shall be such that when tested as described in appendix E the bond strength of the bonded road stud is not less than 3.447 N/mm^2 .

13.1.5 Skinning. The adhesive shall be such that none of the components exhibit skinning after having been stored for 12 months from the date of manufacture.

13.1.6 Storage stability. The adhesive shall be such that after being stored in a closed container for 2 weeks at 40°C it shall comply with 13.1.2 to 13.1.4.

13.2 Adhesives for temporary reflecting road studs

Adhesives used to bond temporary reflecting road studs shall complement the colour of the surface of the road, being black or dark-brown on bituminous and white or cream on concrete, and shall be such to allow the stud to remain in position on the road surface for a period of 3 months but shall permit easy removal of the stud without causing damage to the road surface.