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Specification for Road Works Series 1200 - Traffic Signs and Road Markings

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TRAFFIC SIGNS AND ROAD MARKINGS

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Traffic Signs and Road Markings

1201 Definitions, Sign Classification and Regulations

Definitions

1 For the purposes of this Specification the following definitions shall apply:

(i) Prescribed Signs – Signs which are in accordance with:

- (a) The “Traffic Signs Manual” published by the Department of Transport, Tourism and Sport; and/or
- (b) The “Road Traffic Regulations” published by the Government Publications Office, and any subsequent amendments of these Regulations and any subsequent legislation and regulations.

(ii) Non Prescribed Signs – Signs other than the above.

Sign Classification

2 The following classifications shall apply:

- (i) Permanent Traffic Signs – Traffic signs complying with sub-Clause 1201.1 part (i) or part (ii), which will remain in position at the completion of the Works;
- (ii) Employer’s Temporary Traffic Signs – Traffic signs specified by the Employer and complying with sub-Clause 1201.1 part (i) or part (ii), which will not remain in position at the completion of the Works;
- (iii) Contractor’s Temporary Traffic Signs – Traffic signs proposed by the Contractor and complying with sub-Clause 1201.1 part (i) or part (ii), which will not remain in position at the completion of the Works.

Regulations

- 3 Contractor’s Temporary Traffic Signs which are Prescribed Signs shall be in accordance with the Traffic Signs Manual.
- 4 Contractor’s Temporary Traffic Signs which are Non Prescribed Signs shall be submitted for review to the Employer’s Representative.
- 5 Regulatory signs must comply with the Traffic Signs Manual, the Road Traffic Regulations and any subsequent amendments of these Regulations and any subsequent legislation and regulations.
- 6 All other signs shall be in accordance with the Traffic Signs Manual.

1202 General Requirements for Permanent Traffic Signs

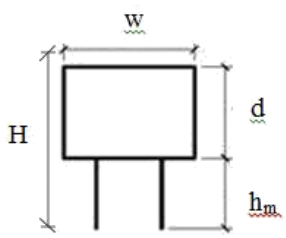
- 1 The sign system shall consist of the sign face, sign substrate, stiffeners, brackets, posts and foundations. Sign systems shall be manufactured in accordance with IS EN 12899. Performance classes specified in IS EN 12899-1 and included in Table 12/1 below shall apply.

Table 12/1 IS EN 12899-1 Performance Classes for Permanent Traffic Signs

Table	Performance Class	Performance Factor
1	CR1	Daylight chromaticity and luminance factors of retroreflective signs
6	PAF1	Partial Safety Factor
7	As per Table 7	Partial Material Factors for material types included in Table 7. Where the material properties or method of jointing are not known, the designer shall select the highest value for partial material factor.
-	-	The Shape Factor for flat signs is 1.20
9	DSL0	No performance determined for dynamic snow loads
10	PL3	Point load of 0.5 kN
11	TDB4	Maximum temporary deflection in bending of 25 mm/m for sign plate
11	TDB4	Maximum temporary deflection in bending of 25 mm/m for support with no performance requirements for passive safety (Class 0 in I.S. EN 12767)
11	TDB5	Maximum temporary deflection in bending of 50 mm/m for support which is passively safe (complies with occupant safety levels 1-4 in I.S. EN 12767)
12	TDT4	Maximum temporary deflection in torsion of 0.29 degree/m for support
13	P3	The sign face shall not be pierced for any reason
14	E1	Edges of sign face - non-protective, the substrate being a flat sheet of material
14	E2	Edges of fingerpost signs – protective, with edge stamped, formed, pressed or covered by an edging profile
15	SP1 or SP2	Protective coating provided or inherent surface protection provided
16	NR1	Daylight chromaticity and luminance factors of non-retroreflective signs

- 2 The support system shall consist of the foundation, posts, stiffeners and brackets. All foundations and posts shall be designed to withstand wind pressure values in accordance with I.S. EN 1991-1-4 with the partial safety factor and partial material factor as described in Table 12/1 applied. A force coefficient, c_f , in accordance with the National Annex to IS EN 1991-1-1 Section 2.36 shall also be applied. Large high risk structures such as gantries, cantilevers etc. shall be designed to I.S. EN 1991-1-4 and are subject to NRA BD 2 approval.
- 3 It is recommended that for very exposed sites or sites subject to local funnelling effect, signs shall be designed to I.S. EN 1991-1-4.
- 4 Wind pressure values in accordance with I.S. EN 1991-1-4 for signs up to a maximum traffic sign size of 4.6m x 7.8m and a maximum overall height of 9.6m are included in Table 12/2. All signs with maximum overall height greater than 9.6m shall be designed to I.S. EN 1991-1-4.
- 5 All sign face stiffening and bracketing shall be designed and constructed to withstand a minimum 1.5 kN/m² wind pressure with the partial safety factor, partial material factor and force coefficient described in clause 1202(2) applied.

Table 12/2 Recommended wind pressure values for use in the Republic of Ireland for Signs up to a maximum overall Height, H of 9.6m

Maximum Width, w Maximum Depth, d Maximum Mounting Height, h_m (m)	Sign maximum overall height, H (m)	Wind speed v_b (m/s)	Wind pressure value (kN/m ²) for sign maximum overall height, H					
			Distance from the Shoreline, (d)					
			$d \leq 2\text{km}$		$2\text{km} < d < 10\text{km}$		$d \geq 10\text{km}$	
								
Maximum w = 1.8 Maximum d = 1.8 Maximum h_m = 1.8	3.6	≤ 26 (See Fig. 12/1)	0.8	1.2	0.6	1.0	0.6	1.0
		> 26 (See Fig. 12/1)	0.8	1.4	0.8	1.2	0.8	1.2
Maximum w = 4.35 Maximum d = 4.5 Maximum h_m = 1.8	6.3	All wind speeds	1.4		1.4		1.3	
Maximum w = 4.6 Maximum d = 7.8 Maximum h_m = 1.8	9.6	All wind speeds	1.6		1.5		1.5	

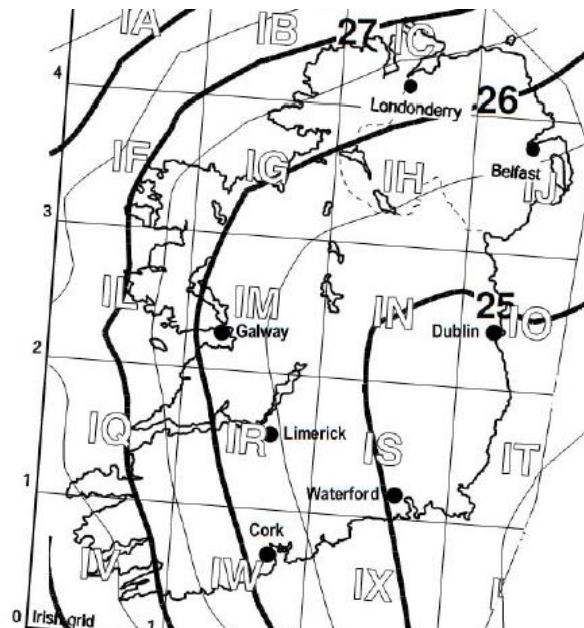
Notes:

- For signs with overall dimensions greater than 4.6m x 7.8m wind load calculations should be carried out to I.S. EN 1991-1-4. The sign maximum overall height, H, of 9.6m for wind pressure values in the above table is measured from ground level to the top of the sign assembly and not to the centroid of the sign.
- All wind pressure values given in the above table apply to a limiting altitude of 100m above sea level (at ground level). Above this altitude, structural design of all signs should be to I.S. EN 1991-1-4:2005
- The wind pressure values in the table above are based on a wind speed return period of 25 years.
- Symbols used in table:

 Indicates a sign located on level ground.

 Indicates a sign located on an incline, maximum of 1:2 (1 vertical: 2 horizontal).

Figure 12/1 Map showing wind speed v_b (m/s)



- 6 Posts, stiffeners and the reverse side of signs shall be grey non reflective (class NR1) in accordance with I.S. EN 12899-1. Galvanised posts and stainless steel, aluminium alloy, galvanised or powder coated brackets are also acceptable. Powder coating shall be carried out in accordance with I.S. EN 12206.
- 7 Wet paint coatings shall consist of a primer and finishing coat measuring 25 μ m and 37.5 μ m minimum thickness respectively. The primer shall be applied to a properly pre-treated substrate so as to ensure maximum paint adhesion and minimum corrosion in the event of the coating becoming damaged.
- 8 Minimum durability for structural elements and foundations shall be 30 years to the first maintenance intervention.
- 9 All sign components, for each sign installation shall be packaged with suitable protective wrapping to prevent damage and shall be labelled individually for ease of re-assembly on site. The sign components shall be packaged by the Contractor's fabrication supplier prior to delivery.
- 10 The sign frames and brackets for fingerpost signs shall be powder coated in accordance with I.S EN 12206. The sign frame and bracket colour shall match the text colour.

1203 Permanent Traffic Sign System

Traffic Sign Face

Material

- 1 Traffic sign face materials shall comply with the performance requirements included in Table 12/3 below.
- 2 Class RA1 and RA2 sign face materials shall demonstrate minimum performance levels in accordance with Tables 3 and 4 of I.S. EN 12899-1.

Class RA1 material shall have a signed manufacturer's warranty against material failure for 7 years.
Class RA2 material shall have a signed manufacturer's warranty against material failure for 12 years.

- 3 Sign face material performance classes R3A and R3B shall be in accordance with the requirements for Germany (Tables 8 & 10 respectively) in the Common Understanding of Assessment Procedure for microprismatic retroreflective sheetings as per European Technical Approval Request Number 01.06/04 document. Class R3A and R3B materials shall have a signed manufacturer's warranty against material failure for 12 years.

Table 12/3 Performance requirements for Traffic Sign Faces

Road classification	Unlit	Lit
Rural motorways and rural dual carriageways with 120 km/h speed limit – overhead gantry signs (long distance viewing)	R3A	R3A
Urban motorways and urban dual carriageways with a speed limit of ≤ 100 km/h – overhead gantry signs (short distance viewing)	R3B	R3B
National road	RA1 if AADT < 3500 RA2 if AADT $\geq$ 3500	RA2
Regional road	RA1	RA2
Local roads	RA1	RA1
Roadworks	RA2	RA2

Notes:

1. Exceptions to Table 12/3; Parking signs shall be RA1 and Keep Left Bollards shall be R3A or R3B for all road types.
2. Prismatic materials of suitable performance may be substituted for glass bead materials of a particular class on specific permission of the Employer's Representative. Substituted prismatic materials shall not have a retroreflectivity performance equivalent to a higher class of material.
- 4 In cases where logos or symbols form part of a sign, their shape, scale, outline and relative position shall depict the image shown in the Road Traffic Regulations and the Traffic Signs Manual for regulatory and non-regulatory signs respectively. Borders, radii and the dimensions specified therein must be adhered to.
- 5 In cases where letters or numbers form part of a sign, their font shall be as prescribed in the Traffic Signs Manual.
- 6 Signs containing light emitting display equipment shall employ light emitting diode (LED) technology complying with I.S. EN 12966.
- 7 Replacement of reflective elements of sign faces or ancillary safety equipment shall be carried out with sufficient preparation, cleaning, and skill of application, to ensure a durable and neat finish free from creasing or bubbling. Patches are not acceptable for fixing manufacturing defects such as bubbling or damage to sign faces during construction.

Traffic Sign Substrate and Stiffeners

- 8 The sign substrate and stiffeners shall be aluminium and be mechanically riveted together.
- 9 The substrate thickness shall be 2.5mm for all traffic signs.
- 10 Sign panels, which are mounted horizontally as part of the same sign, shall be interlocked to ensure they remain integrated should brackets become loose. The vertical joints of sign panels, which are mounted as part of the same sign, shall have a panel riveted to the reverse side of the substrate to ensure the panels remain integrated. Light spill through the sign face shall be prevented in all cases.
- 11 The Contractor shall provide details of the stiffening system to the Employer. The stiffening system shall be compatible with the support system provided paying particular attention to crossbars on H frames.
- 12 Where sign plates are to be stiffened this shall be achieved in a manner such that the sign face is not punctured or otherwise damaged by the introduction of the stiffening system.
- 13 Class E2 edge protection in accordance with I.S. EN 12899-1 Table 14 shall be provided for fingerpost signs. Class E1 edge protection in accordance with I.S. EN 12899-1 Table 14 shall be provided for all other traffic signs.
- 14 Overlay patches or panels shall match the material onto which they are fixed. The overlay patch or panel shall be fixed using rivets or an adhesive material approved by the Employer's Representative.

Brackets, Clips and Fixings for Sign Faces

- 15 Rivets and other devices used for fixing sign plates shall be of a material compatible with the materials being joined and shall comply with I.S. EN 1993-1-1 for steel and I.S. EN 1999-1-1 for aluminium.
- 16 Sign plates shall be connected to posts by mechanical brackets of aluminium alloy or stainless steel and shall comply with I.S. EN 1999-1-1 and I.S. EN 1993-1-1 and I.S. EN 1993-1-4 respectively.
- 17 Any hole drilled in plates with plastic sheeting to accommodate a rivet or bolt shall immediately prior to the insertion of the rivet or bolt have a clear lacquer, recommended by the plastics sheeting manufacturer, applied to its edge to prevent the ingress of moisture.
- 18 The surfaces of rivets or bolts exposed on the sign face shall be covered by a suitable material of a colour to match that part of the face.
- 19 All fingerpost signs shall be fixed with mechanical brackets or shall include tek screws mechanically fixed through the support structure to prevent rotation of the sign.
- 20 Sign should be fabricated from single sheeting panels where possible.
- 21 The sheeting material used in the fabrication of signs should be from the same manufacturer.

1204 Posts for Permanent Traffic Signs

- 1 All posts for Traffic Signs shall comply with I.S. EN 12899.
- 2 For steel posts the grade of steel shall be S235. All steel posts shall be hot dip galvanised in accordance with I.S. EN ISO 1461 and Series 1900 of this Specification.

- 3 Standard steel post sizes are given in Table 12/4. Steel posts for Traffic Signs shall be of uniform cross-section along the length of the post. Truss system posts are detailed in Table 12/5. Steel truss systems for Traffic Signs shall be of uniform cross-section along the length of the post.

Table 12/4: Standard post sizes

Circular Hollow Steel Sections	
Outside Diameter	Wall Thickness
(mm)	(mm)
60.3	3.0
76.1	3.0
88.9	3.2
114.3	5.0
139.7	5.0
168.3	5.0
193.7	6.0
219.1	6.0
244.5	6.0
273.0	6.0

Table 12/5: Truss system standard post sizes

Truss System Hollow Sections	
Outside Diameter	Wall Thickness
(mm)	(mm)
Vertical Members	
48.3	2.9
60.3	2.9
76.1	2.9
Horizontal Members	
26.9	2.6
33.7	2.9

- 4 Flanged posts shall be galvanised steel in accordance with I.S. EN ISO 1461 and be secured by anchorages and attachment systems. Flanged posts shall be fabricated prior to being hot dip galvanised. Galvanised bolts shall be used and shall be lightly greased before final installation and bolts and anchorages shall be installed so as to achieve the required loading and torque settings. Flange plates shall include holes or slots to accommodate the attachment system. Flange plates shall be neat and appropriately designed for their location.
- 5 H Frame and cranked posts (RCD/1200/009) shall comply with the requirements in this specification for steel posts and shall be fabricated before being hot dip galvanised. Posts and crossbars shall be of uniform cross section.
- 6 Passively safe posts shall comply with the performance types in I.S. EN 12767 as set out in the design. The structural performance shall be clearly marked on the post.

Passively safe posts shall have a 30 year design life and the design shall have a signed manufacturer's warranty against material failure for 10 years.

- 7 Lightweight deformable mild steel truss systems for use in clear zones shall be galvanised post fabrication. Galvanised truss systems shall be fabricated from the components listed in Table 12/5. A 76.1mm vertical member shall not be used where a 60.3mm member is adequate.

Welded fixtures shall meet with the requirements of I.S. EN 1993-1-8. A minimum weld seam thickness of 2mm is permissible.

To allow the structure to deform upon impact, the tubes of the lattice columns must be welded to the footing using a girth weld.

- 8 Where signs are to be mounted on single posts or H Frame posts, a hole shall be drilled through the end of the post. The hole shall be 100mm from the end of the post and shall allow for a pin to be inserted preventing rotation in the ground.
- 9 Posts may be extended to allow for the mounting of additional or larger signage and shall be as shown on RCD/1200/05.
- 10 Post caps shall be fitted to posts in advance of or simultaneous to the erection of the post.
- 11 Posts shall not protrude above the top of the sign unless supporting an external luminaire.
- 12 The edge of posts shall not be positioned within 100mm of the edge of sign plates.

1205 Foundations for Permanent Traffic Signs and Signals

General Requirements for Foundations

- 1 All excavations for foundations shall be carried out in accordance with Clause 604 of this Specification.
- 2 All foundations shall be excavated and backfilled with concrete on the same day. No excavation shall be left open overnight on live trafficked roads. The foundations shall be sealed off from public access using suitable barriers until reinstatement of the surface is complete.
- 3 All excess spoil shall be removed from the site, in accordance with Series 600 of the Specification, prior to foundations being constructed.
- 4 Concrete used for the foundations of all traffic signs shall be in accordance with I.S. EN 206-1 and Clause 2602 of this Specification.
- 5 Any pockets formed in concrete foundations to receive posts shall be temporarily sealed or capped pending installation of the posts and shall be cleaned out immediately prior to the erection of the posts. The posts shall be placed centrally in the pockets and be bedded on mortar complying with Clause 2601 of this Specification. The pockets shall be backfilled to within 100mm of existing ground level with Clause 2606 mix ST2 concrete and compacted to comply with Clause 2602 of this Specification or with an aggregate filled cementitious grout complying with I.S. EN 197-1 and I.S. EN 12620.
- 6 All concrete finishes for traffic sign foundations shall comply with clause 2602(9) of this Specification. The classes of finish shall be Class U1 or Class F3 for unformed and formed surface finishes in accordance with Clause 1708 of this Specification.

- 7 All sign posts shall be given adequate temporary support to maintain line and level during setting and curing of concrete. Posts shall be supported for a minimum of 3 days after placing the concrete. Backfilling shall not take place until at least 48 hours after placing.
- 8 All backfilling of foundations shall comply with Clause 611 of this Specification except that where pipes or buried cables are present the requirements of Clauses 505 and 1421 of this Specification shall be met.
- 9 Reinstatement of pavements and paved areas above foundations shall comply with Clause 706 of this Specification. The depth of foundation should allow for reinstatement which matches the adjacent surfaces.
- 10 Where underground services are encountered and subsequently are encased in a sign foundation the location of the services shall be noted by the contractor on site and a services sticker shall be fixed to the post. See RCD/1200/010.
- 11 Where signs and supports are to be removed, the top of the foundation shall be exposed and 100mm of the concrete base shall be removed to allow the support to be cut. The top of the support shall then be capped and topped with a concrete grout.

Foundation Types

- 12 Ground sleeves for traffic signs supported by a single post or H frame post shall have the post installed centrally in a concrete sleeve with a diameter 150mm greater than that of the post. The concrete sleeve shall be backfilled with Clause 2602 mix ST2 concrete to within 100 mm of the adjacent ground surface.
- 13 For spread foundations, traffic signs supported by single or multiple posts cast into a concrete foundation shall have the posts installed at equal spacings. Where pockets or sleeves are used for posts in concrete foundations their plan diameter shall be $\geq 100\text{mm}$ larger than those of the post. Following installation of the post, the pockets shall be backfilled to within 100mm of existing ground level with Clause 2606 mix ST2 concrete and compacted to comply with Clause 2602 of this Specification or with an aggregate filled cementitious grout complying with I.S. EN 197-1 and I.S. EN 12620.
- 14 Planted foundations: The stability of this type of foundation relies on the passive resistance of the soil surrounding the foundation which must be well compacted. Minimum planting depth requirements are given in I.S. EN 40-2 Table 7. The middle column of planting depth values from Table 7 shall be used for traffic signs.
- 15 For ground screws, traffic signs supported by single or multiple posts mounted on ground screws shall be attached in accordance with the manufacturer's instructions. The ground screw shall have a 30 year design life and a 10 year signed manufacturer's warranty against material failure. Ground screws shall only be used where the soil has appropriate resistance to perform in accordance with loading designs. Ground screw installations shall comply with the requirements of I.S. EN 1997 and the National Annex to I.S. EN 1997.
- 16 Retention sockets shall be suitable to retain in position a sign post, signal post or bollard. The socket shall not deform under impact to the pole and shall allow the posts to be removed and replaced following impact without the need for excavation. The socket shall be of metal construction, with a lockable lid. Posts shall be secured in position by a captive stainless steel retention screw which shall not puncture the post. The socket shall be designed to withstand vehicle impact to the post. It shall also be designed to prevent rotation or casual removal of the post.

- 17 For concrete bases with cast in anchor bolts, traffic signs supported by single or multiple passively safe posts shall have the post installed centrally in the foundation for single posts or at equal spacing for multiple posts as per the manufacturer's instructions. The foundation units may be precast or cast in situ. Anchor bolts shall meet the requirements of European Technical Approval Guidelines 001.
- 18 Foundations for electrical installations shall be specifically designed to facilitate ease of installation, removal and maintenance of the electrical installation.

1206 Location and Erection of Permanent Traffic Signs

- 1 Site clearance and removal of vegetation to facilitate sign installation shall be carried out in accordance with the Traffic Signs Manual and Series 200 of this Specification.
- 2 Traffic signs, except those mounted on gantries, shall be erected to have their face plumb and shall be orientated relative to the carriageway in accordance with Chapter 1 of the Traffic Signs Manual.
- 3 All posts shall be erected plumb and where two or more posts are provided for any one sign, the faces of the posts shall be in the same vertical plane.
- 4 Signs erected on a single post shall be positioned such that the post is in the centre of the sign.
- 5 For poured concrete foundations, sign faces shall be fixed, not less than 3 working days, and not more than 10 working days, from the date of erection of their respective posts.
- 6 Where a new sign is being installed in front of an existing sign, the posts shall not be installed until the new sign face is fabricated and delivered to site.
- 7 Where temporary signage is erected as part of a scheme, it shall be removed and permanent signage shall be in place three weeks after Substantial Completion unless otherwise specified.
- 8 Route marker plates shall be erected on a minimum of two steel posts of 60.3mm diameter and be attached to a minimum of two stiffening rails on both marker plate and supporting sign plate.
- 9 The exact location of each traffic sign shall be recorded on site in accordance with NRA GD 101/13.

1207 Covering of Permanent Traffic Signs

- 1 Where it is required in Appendix 12/1 that permanent traffic signs be blanked-out or have an alternative message, the method to be adopted shall comply with the following, unless otherwise described in Appendix 12/1:
 - (i) Application of a removable grey opaque spray paint certified by the manufacturer as suitable for temporary use without damaging the sign face durability.
 - (ii) A plastic covering of a material approved by the Employer's Representative
- 2 Under no circumstances shall tape or any other adhesive material be applied to the sign face. If the use of adhesive tape is necessary, it shall be used on the rear of the sign only with the covering wrapped around the sign face.
- 3 Any loose covering must be sufficiently opaque to prevent reflection from the covered sign and be securely fastened to the back of the sign. Sufficient space shall be left between the covering and the face to permit air flow over the sign.

- 4 Traffic signs which are to be covered shall not be erected on trafficked roads without the covering in place.
- 5 Removal of any covering shall be carried out with the minimum disturbance to traffic and only after the Employer's Representative has given their approval.
- 6 Irrespective of any requirement in Appendix 12/1 to cover signs, any traffic sign erected at such a time that its legend does not relate either wholly or in part to the traffic movement and route in operation, shall have its sign face securely covered with one of the materials described in sub clause 1207(1) until such time as the Employer's Representative authorises its removal.
- 7 The Contractor shall inspect all covered signs daily and shall immediately replace any covering which is defective.

1208 Gantries for Traffic Signs

- 1 The structural steelwork and foundation arrangements for fabricated steel gantries shall comply with Series 1800 of this Specification and all associated Road Construction Details (RCDs) contained in Volume 4 of the NRA MCDRW.

1209 Preparation and Finish of Metal and Other Surfaces

- 1 The preparation and finish of metal and other surfaces shall comply with Series 1900 of this Specification.
- 2 Where hot dip galvanizing of a surface is specified, it shall comply with I.S. EN ISO 1461 and with Series 1900 of this Specification.

1210 Permanent Bollards

- 1 The minimum material and colour durability for all plastics shall be 5 years.
- 2 Permanent reboundable keep left bollards shall be either transilluminated or retroreflective and shall be manufactured in accordance with I.S. EN 12899 and the Traffic Signs Manual.
- 3 The visual and physical performance requirements of transilluminated and retroreflective bollards shall comply with I.S. EN 12899-2.
- 4 Unless otherwise specified the impact resistance of the permanent reboundable bollards on National Roads shall be IR2 (spring back) or IR3 (deformable) TTB in accordance with I.S. EN 12899-2.
- 5 All bollards shall be fixed to the pavement, traffic island or verge using corrosion resistant and vandal resistant materials. Bollards shall be fixed to the ground by base anchorage systems designed to facilitate easy replacement of damaged bollards without replacing the base anchorage systems. Anchorage systems and bases shall be suitable for the surrounding streetscape.
- 6 Transilluminated bollards shall have all electrical connections stored below ground level.

Junction Definition Posts

- 7 The visual and physical performance requirements of junction definition posts shall comply with I.S. EN 12899-2 and the Traffic Signs Manual.

- 8 Junction definition posts shall be circular in cross section. The posts shall be 1000mm in height above road level and 200mm in diameter. Refer to RCD/1200/004 for details.
- 9 The top 50mm and bottom 350mm of the posts shall be non retroreflective and shall be dark green in colour. The central section of the post shall consist of a 200mm retroreflective white band alternated with two 200mm retroreflective light green bands. The colours shall comply with:
 - (i) I.S. EN 12899-1 Table 16 for daylight chromaticity and luminance factors of non retroreflective parts (Class NR1)
 - (ii) I.S. EN 12899-1 Table 1 for daylight chromaticity and luminance factors of retroreflective parts (Class CR1)
- 10 The retroreflective parts of the post shall be Class RA 2 retroreflective in accordance with Table 4 of I.S. EN 12899-1.
- 11 Where a receptacle base is used it shall be manufactured from steel and shall include a 3mm steel plate fixed to the bottom. Refer to RCD/1200/004 for details.
- 12 Junction definition posts shall be fixed to the base with corrosion resistant, vandal proof materials.
- 13 Concrete foundations for junction definition posts shall be in accordance with Clause 1205 of this Specification. Concrete foundations shall be mix ST2 in accordance with Table 26/1 of Clause 2603.
- 14 Replacement junction definition posts shall meet all of the above requirements.

1211 Retroreflective Markers and Delineator Posts

- 1 Retroreflective markers to include hazard markers for delineator posts, retroreflectors on safety barriers and nosing markers shall comply with I.S. EN 12899 and the Traffic Signs Manual.
- 2 The visual and physical performance requirements of retroreflectors and delineator posts shall comply with I.S. EN 12899-3.

Hazard Markers and Retroreflectors

- 3 Hazard markers shall be as per RCD/1200/003.
- 4 Retroreflectors shall comply with IS EN 12899-3.

Delineator Posts

- 5 Delineator posts shall be as per RCD/1200/006 .
- 6 Posts shall present a projected width of not less than 100mm when viewed by a driver.
- 7 Delineator posts for ground fixing shall be type D3 and shall be designed to deflect after impact and return to an upright position in accordance with I.S. EN 12899-3.
- 8 Delineator posts shall be fixed with corrosion resistant, vandal proof materials.

Retroreflectors on Safety Barriers, Concrete Barriers and Bridge Parapet Railings

- 9 Where specified, retroreflectors shall be mounted on barriers including safety barriers, concrete barriers and bridge parapet railings. Refer to RCD/1200/003 for details.

- 10 The support brackets for retroreflectors shall be steel, aluminium or plastic. A rubber isolation pad shall be provided where two different metals are in contact. The support brackets shall be mounted on the supporting surface securely by shot fixing or with a suitable adhesive. All retroreflector supports shall have a design durability of 10 years and a signed manufacturer's warranty of 10 years.
- 11 On bridge parapet railings the nearest rail above the 500 mm level shall be used for mounting the support bracket and the alignment and levels of the post mounted retroreflectors on the approaches to the barrier mounted section shall be adjusted to ensure a smooth line is viewed by drivers on the road.

Nosing Markers

- 12 Nosing markers shall be as per the Traffic Signs Manual.
- 13 Nosing markers shall as per RCD/1200/007 & RCD/1200/008.
- 14 The reflective material on the markers shall be Class RA2 retroreflective sheeting, in accordance with Table 4 of I.S. EN 12899-1.
- 15 The nosing marker base colours shall be class NR1 non-reflective and shall comply with I.S. EN 12899-1 Table 16.
- 16 Nosing markers shall be mechanically fixed by clamps and bolts which are corrosion resistant and vandal proof.

1212 Employer's and Contractor's Temporary Traffic Signs

- 1 Employer's and Contractor's Temporary traffic signs are intended for short term use. Typical uses can be at road works, at temporary traffic diversions, mobile road closures and for emergency signposting.

Employer's Temporary Traffic Signs

- 2 Each Employer's Temporary Traffic Sign may be designated as a Type A or a Type B sign.
- 3 Type A temporary sign faces and substrates shall comply fully with all of the requirements for Permanent Traffic Signs. Type A signs shall be specified if the sign is required for in excess of three months duration. Type A temporary signs may also be specified in situations where traffic volumes or environmental conditions require.
- 4 Type A sign supports shall meet the structural performance requirements of Section 5 of I.S. EN 12899-1.

The minimum requirements for support systems for Type A temporary traffic signs are as follows:

- (i) Where signs are to be stand mounted, stands shall be formed of 25mm x 25mm x 3mm mild steel equal angle for signs of 750mm maximum dimension and 40mm x 40mm x 5mm mild steel equal angle for signs ≥ 750 mm.
- (ii) Stands shall be hot dip galvanised in accordance I.S. EN ISO 1461 and Series 1900 of this Specification.

- (iii) Corners of frames shall be mitred or cold formed, but where the longest side of any rectangle, the side of any square or the diameter of any circle exceeds 1200mm cold formed corners of frames shall be strengthened by welding. Cold formed mitred corners shall have a gap not greater than 3mm at the extremity of the fold before welding. All welds shall cover the full cut of the mitre. Stands for signs exceeding 900mm in height shall have four legs.
- (iv) All pivoted joints of the sign shall be bolted. Bolts and nuts used on any part of the sign shall be stainless steel and shall not be less than 8mm diameter.

Alternative support systems may be provided on approval of the Employer's Representative.

- 5 Type B temporary signs shall comply with all the sign face requirements of permanent signs but may be constructed with any sign substrate, support and framing system suitable for their intended use. Type B temporary signs shall be specified if the sign is required for less than three months duration.
- 6 Type B signs shall have a manufacturer's warranty on sign face and structural elements for 2 years. The 2 year expiry date shall be clearly marked on the reverse of the sign.

Contractor's Temporary Traffic Signs

- 7 The sign face material shall be Class RA2 in accordance with Table 4 of EN 12899-1.
- 8 Removal of temporary signs shall be carried out as soon as they become superfluous or a hazard to traffic.

1213 Traffic Cones and Traffic Cylinders

General

- 1 The requirements for new traffic cones and new traffic cylinders with retroreflective properties are specified in I.S. EN 13422.
- 2 The Contractor shall arrange for tests for cones and cylinders in accordance with Part 7 of I.S. EN 13422 to be carried out at an approved testing laboratory in accordance with Appendix 1/5.
- 3 Amber lamps or rotating amber reflectors shall be mounted on cones on live trafficked roads as per the Traffic Signs Manual.

1214 Road Danger Lamps and High Intensity Flashing Beacons

- 1 Road danger lamps and high intensity flashing beacons on live trafficked roads shall comply with I.S. EN 12352.

1215 Traffic Signals

General

- 1 Traffic signals shall comprise road junction signals, pedestrian crossing signals, cycle signals, flashing amber signals, level crossing signals, tram signals, ramp metering and haul route signals and shall be of the type described in Appendix 12/5.

- 2 Equipment supplied shall be in conformity with the regulations made by the Minister for the Environment, Republic of Ireland, under the provisions of the Road Traffic Acts. Unless otherwise specified, the traffic signal design and traffic signal equipment shall comply with the requirements of Chapter 9 of the Traffic Signs Manual, the relevant European Standards and with the requirements and specifications described in Appendix 12/5 including any amendments therein.
- 3 Traffic signal installations shall consist of all control equipment including detection equipment which has received approval from the Minister for the Environment. They shall be installed, tested, and maintained in accordance with the manufacturer's instructions and the requirements and specifications included in Appendix 12/5.
- 4 All traffic safety and management measures associated with work on traffic signals shall comply with Clause 117, and any work entailing the switching off of existing signals shall not be carried out until the local authority has been informed and until agreed alternative traffic management measures are in operation to safeguard and control vehicles using the road.

Traffic Signal Controllers

- 5 Traffic signal controllers shall comply with I.S. EN 1267 and shall be provided and installed as described in Appendix 12/5. The cabinet shall be mounted on a foundation, with an adjacent inspection chamber as described in Appendix 12/5. The foundation shall make provision for the entry of the appropriate number of cable ducts. Cabinets located in areas with a speed limit greater than 80 km/h shall be passively safe.
- 6 Traffic signal controllers shall, in addition to any testing carried out in compliance with Clause 1424 be tested before delivery to Site and again after installation but before commissioning, to ensure they comply with the specification in Appendix 12/5.

Traffic Signal Heads

- 7 All traffic signal heads shall comply with I.S. EN 12368 and shall be in accordance with the configurations as specified in Chapter 9 of the Traffic Signs Manual and the requirements and specifications as described in Appendix 12/5.
- 8 All backing boards shall have a border of Class1 retroreflective material (white). Pressure sensitive material shall normally be supplied but vacuum applied material may be used in accordance with the manufacturer's process. Application of pressure sensitive material shall take place on dry surfaces. An ambient temperature of 15°C minimum is recommended for satisfactory adhesion. The material shall have a 50mm width throughout. Where the continuous border bridges each backing board/signal head a distinct cut edge shall be made to avoid any subsequent stretching/shrinkage of dissimilar surfaces. The finished border shall be of a neat appearance and not made up of short lengths of cuttings.

Cabling and Electrical Requirements

- 9 Traffic signal equipment on each post shall be connected to the controller in accordance with the requirements described in Appendix 12/5.
- 10 The installation shall comply with the National Rules for Electrical Installations published by the Electro-Technical Council of Ireland and in particular the External Lighting Installation requirements and the rules and regulations of the electricity supplier which provides the supply.

- 11 Cables shall, unless stated otherwise in Appendix 12/5, be PVC insulated and sheathed 600/1000V grade with steel wire armouring to BS 6346 and shall be installed in ducts in compliance with Clause 1421 and terminated in compliance with Clause 1423. Reinstatement shall be in compliance with Clause 706.
- 12 Earthing of all posts, push-button units and the controller cabinet shall comply with Clause 1420. One conductor in each cable between a post and the equipment cabinet shall be a protective conductor and shall bond the earth terminal at the post to the main earth terminal.
- 13 Cable testing shall be in accordance with Clause 1424. Tests (a), (b), (c), (e), (f), (g), (h) and (j) as defined in sub-Clause 1424.2 shall be conducted and all measurements recorded.
- 14 Compartments for electrical equipment shall wherever practicable have access doors which shall be on the side of the compartment furthest from approaching traffic. In the case of signs supported by more than one pole, such a compartment shall be on the post furthest from the carriageway, unless otherwise specified.
- 15 For traffic signals provision shall be made for cable entry through the foundation by means of ducting.

Telecommunications Carrier Interface

- 16 Where a connection interface to the plant of a telecommunications carrier is specified in Appendix 12/5 the installation shall comply with the rules and regulations of that carrier.

Traffic Signal Poles, Cantilevers and Gantries

- 17 Poles, cantilevers and gantries for traffic signals shall comply with the requirements of Appendix 12/5 and be installed in the locations specified therein in compliance with Clause 1203.

1216 Road Markings

Permanent Road Markings

- 1 Permanent road marking materials shall be one of the following types:
 - (i) Reflective thermoplastic road marking material conforming to the requirements of I.S. EN 1871 Road Marking Materials Physical Properties shall meet the requirements of the relevant classes of I.S. EN 1436 Performance for Road Users.
 - (ii) preformed road markings in accordance with I.S. EN 1790;
 - (iii) other materials as described in Appendix 12/3.
- 2 Premix and drop-on glass beads shall conform to the requirements of I.S. EN 1424 and I.S. EN 1423 respectively.

Performance Requirements

- 3 Road markings shall comply with the performance requirements of I.S. EN 1436, including those in Table 12/6. "Table 6" as referred to below relates to I.S. EN 1436.

Table 12/6 Initial I.S. EN 1436 Road Marking Performance Requirements

I.S. EN 1436 Property	Requirement	Value
Table 2 Luminance Factor β	1. Class B4	$\beta \geq 50$
	2. Class B4	$\beta \geq 50$
	3. Class B2	$\beta \geq 30$
	4. Class B2	$\beta \geq 30$
Table 3 Class of Reflective Luminance (R_L) for dry road markings	Regional and Local Roads constructed or improved as part of a National Road Scheme	1 & 2. Class R2 $R_L \geq 100$
		3 & 4. Class R1 $R_L \geq 80$
	National Roads	1, 2, 3 & 4. Class R4 $R_L \geq 200$
Table 6 Colour	1 & 2. White	x & y co-ordinates given in Table 6
	3 & 4. Yellow Class Y1 & Y2	x & y co-ordinates given in Table 6
Table 7 Skid Resistance *	1. Class S2	SRT ≥ 50
	2. Class S3	SRT ≥ 55
	3. Class S2	SRT ≥ 50
	4. Class S3	SRT ≥ 55
	Transverse Yellow Bar Markings Class S5	SRT ≥ 65

1. = White lines

2. = White arrows, lettering, chevron markings and yield symbols,

3. = Yellow lines

4. = Yellow lettering and chevron markings.

The classes Y1 and Y2 for yellow road markings are intended for permanent and temporary road markings respectively.

* An SRT value of S3 or S5 shall be provided where specified in Appendix 12/3.

- 4 Road markings shall not be laid when the road temperature is below 5°C.
- 5 Road markings shall not be laid on wet road surfaces. The road surface should be adequately dried and cleaned prior to the application of road markings. All existing road markings shall be scabbled to remove all loose material and to provide a key before the application of new markings to prevent the final marking being greater than 6mm in height.
- 6 The Contractor shall guarantee the performance, materials and workmanship of permanent road markings in terms of durability, retroreflectivity, luminance and chromaticity to be in accordance with I.S. EN 1436 and Table 12/6 of this Specification for the period of the guarantee. In the event of failure of the road markings to meet the performance requirements within the guarantee period, the Contractor shall replace the markings, at their own cost, such that the performance requirements are met.

- 7 The coefficient of retroreflected luminance R_L after two years and three years in service shall be as per Table 12/7.

Table 12/7 Minimum Values of R_L for markings on National Roads during the Guarantee Period

I.S. EN 1436 Property	Requirement	Minimum Value for 1&2	Minimum Value for 3&4
After 2 years			
Table 3 Class of R_L for dry road markings	Class R3	$R_L \geq 150$	$R_L \geq 150$
After 3 years			
Table 3 Class of R_L for dry road markings	Class R2	$R_L \geq 100$	$R_L \geq 100$

1. = White lines

2. = White arrows, lettering, chevron markings and yield symbols,

3. = Yellow lines

4. = Yellow lettering and chevron markings.

- 8 A two year durability guarantee is required for road markings laid on non National roads.
- 9 The Employer may specify testing at any location. Where the contractor's work does not comply, the cost of removal of the road marking will be borne by the contractor. Testing shall be in accordance with Appendix 1/5 and where not specified shall not be less than 1 test per km.

Marking Thickness

- 10 The thickness of application shall be 4mm +/- 0.5mm on all new road surfaces.
- 11 The thickness of application shall be 2.5mm +/- 0.5mm on recovery work where the thickness of existing marking is less than 1mm.
- 12 The thickness of application shall be 1.5mm +/- 0.5mm for temporary markings, marking lightly trafficked areas or for recovery work where the thickness of existing marking is 1mm or greater.

Longitudinal Road Markings Lateral Tolerances

- 13 Lateral and longitudinal tolerance: For longitudinal road markings, the lateral tolerance shall be within +/- 25mm of the designed position.
- 14 Marking width: The tolerance for road marking widths shall be within +10% and -5% of the specified width of the marking.
- 15 Marking length: The average of any 10 consecutive segments of road markings shall be between +/- 50mm of the specified length and no one segment within that 10 segments shall be less than the specified length by more than 75mm. Where lengths fall short of the specified length, removal and replacement of the markings will be required.

Durability

- 16 At least 90% of the marked area shall contain a uniform coating of marking material through which the underlying surfacing has not penetrated. Discontinuities, due to wear, shall not be accepted in continuous markings. At least 75% of each marked segment of a broken line shall remain intact.

Drainage

- 17 Drainage gaps shall be provided on all continuous markings where surface water crosses the marking in accordance with the Traffic Signs Manual. The gaps shall be no longer than 100mm and shall be a minimum of 2m and a maximum of 5m apart in sag locations and rollover locations.

Road Markings on Porous Asphalt Surfacing

- 18 A specialist method statement is required prior to the application of road markings on porous asphalt surfaces.

Raised Profile Edge Markings

- 19 Raised profile markings shall consist of a continuous line marking with ribs across the line at regular intervals in accordance with the Traffic Signs Manual.
- 20 Thermoplastic materials for raised profile markings shall be formulated specifically for this type of road marking.
- 21 Raised profile markings shall maintain a regular shape and resist deformation for the guarantee period.
- 22 Minimum and maximum heights shall be as per the Traffic Signs Manual following the guarantee period.
- 23 Detailed data sheets for raised profile markings should be submitted to the Employer's Representative.

Preformed Road Markings

- 24 Preformed road markings shall comply with the requirements set out in I.S. EN 1790.

Temporary Road Markings

- 25 Temporary road markings shall comply with the requirements of permanent road markings and with the Traffic Signs Manual.
- 26 Orange road markings shall comply with (i) the requirements of permanent yellow road markings except for colour, and (ii) with the Traffic Signs Manual.

Wet Retroreflectivity of Road Markings

- 27 Where wet retroreflectivity is specified by the Employer for improved visibility in wet conditions at night, road markings shall meet the performance requirements as set out in Table 12/8.

Table 12/8 Wet retroreflectivity of road markings

Property	I.S. EN 1436 Property	Requirement	Value
Retroreflectivity	Table 4	Class RW3	≥ 50

Removal of Road Markings

- 28 Water blasting shall be used on all significant sections of road marking removal. Water blasting shall be carried out by experienced personnel using calibrated equipment. The equipment and operation shall be continuously monitored by the operator to ensure minimum superficial damage to the surface. The operator shall immediately cease the operation if it is evident that removal will cause more than superficial damage.
- 29 Hot Compressed Air lancing (HCA) shall only be used on small difficult areas where water blasting is impractical or where water blasting will have a damaging effect on the pavement surface.
- 30 Mechanical scabbling may only be used as a pre-treatment or for the removal of excess material.
- 31 All pavement structural damage caused by the removal of road markings shall be repaired by the contractor at their own cost to the Employer's satisfaction.

Refurbishment of Road Markings

- 32 Existing longitudinal road markings shall be prepared by removing all loose material or markings which previously did not bond correctly to the road surface. All loose debris resulting from this work shall also be removed.

Masking of Road Markings

- 33 Where black masking materials are required to cover existing permanent road markings, they shall comply with BS 7962. The total overall thickness of permanent road markings and masking materials shall not exceed 6mm.

Replacement of Road Markings

- 34 Should road markings fail the required parameters after testing in accordance with Appendix 1/5, the road markings shall be replaced on a like for like basis.
- 35 Replacement may be required at any time within the guarantee period where substantial failure is evident.

1217 Road Studs

Permanent Road Studs

- 1 All road studs shall be retroreflective complying with I.S. EN 1463-1.
- 2 All road studs shall be installed strictly in accordance with the manufacturer's instructions.
- 3 Surface mounted road studs shall only be used with the prior consent of the Employer.

- 4 The road surface should be free of dust and loose material following the installation of road studs.
- 5 Unless otherwise specified by the Employer, permanent road studs shall be embedded as defined in I.S. EN 1463-1.
- 6 Embedded road studs shall consist of a protective housing and a replaceable insert.
- 7 The embedded protective housing shall be capable of withstanding the anticipated traffic loads and protecting the inserts for the expected life of the pavement. The replaceable insert shall meet the performance requirements of Sub Clause 1217 (13).
- 8 Retroreflectors for permanent road studs shall be Type 1, Type 2 or Type 3 as classified in Table 2 of I.S. EN 1463-1.
- 9 The design of permanent road studs shall be Type A or Type B in accordance with Table 3 of I.S. EN 1463-1.
- 10 The coefficient of luminous intensity (R) of each retroreflective face of a permanent road stud shall be class PRP 1 in accordance with Table 4 of I.S. EN 1463-1.
- 11 The dimensions of permanent road studs shall be a maximum of Class H2 (height) and HD2 (maximum horizontal dimension) in accordance with Clause 5.2 of I.S. EN 1463-1. For lane markings with road studs and edge markings with road studs on the trafficked side of the edge marking the following shall apply:
 - (i) Class H2 road studs shall be provided for lane lines and the trafficked side of edge markings
 - (ii) Class H3 road studs may be provided for lane lines on the specific approval of the Employer's Representative.
- 12 The retroreflected radiation of a permanent road stud shall be class NCR 1 in accordance with Table 9 of I.S. EN 1463-1.
- 13 The Contractor shall guarantee the performance of permanent road studs for a period of three years from the date of opening to traffic on National roads and two years on non National roads. In the event of failure of the road studs to meet the performance requirements for the guarantee period, the Contractor shall replace the road studs as necessary such that the performance requirements are met.
- 14 Type 1 and Type 2 road studs must remain in place and retain at least 50% of their retroreflected radiation over the duration of the guarantee period. Road Studs failing to meet this requirement must be replaced within 3 weeks of notification by the Employer's Representative.

Lateral Tolerance

- 15 For road studs, the lateral tolerance shall be within +/- 25mm of the designed position.

Removal and Replacement of Existing Road Studs

- 16 The cavity resulting from the removal of an existing stud shall be heated, dried and loose material removed with the aid of compressed air. Following heating, drying and removal of the loose material, the cavity shall be immediately filled in accordance with Clause 946 of this Specification.

- 17 Road stud housings intended for re-use, shall be cleaned in a manner approved by the Employer's Representative. Such housings shall have new inserts installed prior to installation in the road surface.

Reflecting Road Studs on Porous Asphalt Surfacing

- 18 A specialist method statement is required prior to the application of all road studs on porous asphalt surfaces.
- 19 The edges of recesses for reflecting road studs shall be milled when the material has cooled to ambient temperature. Care shall be exercised when removing porous asphalt to form the recess to prevent damage occurring to the cut edges and to prevent detritus material clogging the porous asphalt surfacing.

Temporary Road Studs

- 20 Temporary reflecting road studs, Type T, shall comply with I.S. EN 1463-1, and shall only be used for the duration of the roadworks, and shall be inspected at weekly intervals and non-conforming and missing road studs replaced.
- 21 Where permanent reflecting road studs, Type P, complying with I.S. EN 1463-1 are used for temporary purposes, the contractor shall have the Employer's Representative's prior approval.
- 22 Where permanent road studs conflict with a temporary road layout they shall be obscured in accordance with chapter 8 of the Traffic Signs Manual.

Replacement of Road Studs

- 23 Replacement may be required at any time within the guarantee period where substantial failure is evident.

1218 Pedestrian Crossings

- 1 The location and details of pedestrian crossings shall be as described in Appendix 12/5.
- 2 Road markings at pedestrian crossing areas shall have a minimum skid resistance Class of S3 when tested in compliance with I.S. EN 1436.
- 3 Road markings shall be white permanent non-reflective markings and shall be in accordance with Clause 1216.
- 4 Traffic signals, related control and other equipment on pedestrian crossings together with installation and reinstatement shall comply with Clause 1215 for permanent traffic signals.



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