BS EN 1790:2013

BSI Standards Publication

Road marking materials — Preformed road markings

bsi.

...making excellence a habit.™

National foreword

This British Standard is the UK implementation of EN 1790:2013. It supersedes BS EN 1790:1998 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee B/509/2, Horizontal road markings and road studs.

A list of organizations represented on this committee can be obtained on request to its secretary.

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

ISBN 978 0 580 79694 4

ICS 93.080.20

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

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 October 2013.

Amendments issued since publication

Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 1790

October 2013

ICS 93.080.20

Supersedes EN 1790:1998

English Version

Road marking materials - Preformed road markings

Produits de marquage routier - Marquages routiers préfabriqués

Straßenmarkierungsmaterialien - Vorgefertigte Markierungen

This European Standard was approved by CEN on 5 April 2013.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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

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

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. EN 1790:2013: E

Contents

Page

Foreword

This document (EN 1790:2013) has been prepared by Technical Committee CEN/TC 226 “Road equipment”, the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 2014, and conflicting national standards shall be withdrawn at the latest by July 2015.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 1790:1998.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with the Construction Product Directive (89/106/EEC), see informative Annex ZA, which is an integral part of this document.

Compared with the previous version, the following changes have been introduced:

— Scope updated;

— references updated (Clause 2) and terms and definitions added (Clause 3);

— requirements updated by making reference to EN 1436, EN 1824 and EN 13197;

— test methods updated by making reference to EN 1436, EN 1824 and EN 13197;

— evaluation of conformity (Clause 6) amended;

— Annexes A to F amended;

— Annex ZA introduced.

This European Standard belongs to the following package of inter-related European Standards:

— EN 1790, *Road marking materials — Preformed road markings* (the present document),

— EN 1824, *Road marking materials — Road trials*,

— prEN 1871:2008, *Road marking materials — Paint, cold plastic and thermoplastic marking materials – Physical properties,*

— EN 12802, *Road marking materials — Laboratory methods for identification*,

— EN 13197, *Road marking materials — Wear simulator Turntable*,

— EN 13212, *Road marking materials — Requirements for factory production control*,

— EN 13459, *Road marking materials — Sampling from storage and testing*.

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

A particular category of road marking materials, used for horizontal signalisation, are preformed, i.e. manufactured products in sheet form, ready for use on the road. They can be applied by means of adhesives, pressure or heat, with or without the use of a primer. Preformed road marking materials can be linear, in pieces of a certain length or in rolls. They can also be cut out in the form of symbols or signs or parts of them, making it possible to assemble them on the road to achieve the desired shape.

Preformed road marking materials can be designed for use as permanent or temporary road markings. In both cases, they can be applied with a view to later removal and therefore the specific property of "removability" can be required.

Preformed road marking products are defined as Tape, preformed Cold Plastic road marking or preformed Thermoplastic road marking with or without drop-on materials.

Except for Thermoplastic road markings with drop-on materials, all the other type of products are fully finished during manufacturing and do not change significantly their properties during application.

They are completely covered by this standard.

Thermoplastic road markings with drop-on materials need the addition of drop-on materials during application on the road and therefore they are in some way similar to the thermoplastic products covered by prEN 1871:2008.

This standard provides all the relevant information and cross references to prEN 1871:2008 in order to cover these kinds of products.

1 Scope

This European Standard specifies construction products which are white and yellow, removable or non-removable, preformed road marking materials, under the form of tape, cold plastic, thermoplastics with or without drop-on materials, to be used for permanent and/or temporary road markings in circulation areas. Other products and colours intended for road markings are not covered in this European Standard.

This European Standard also gives specifications for the evaluation of conformity for white and yellow, removable or non-removable, preformed road materials under the form of tape, cold plastic, thermoplastics with or without drop-on materials to be used for permanent and/or temporary road markings in circulation areas including type testing and factory production control.

This European Standard includes an Annex ZA for tapes, preformed cold plastic road marking and thermoplastic road marking with and without drop-on materials with the clauses addressing the provisions of the EU Construction Product Directive for permanent road marking.

2 Normative references

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

EN 1436:2007+A1:2008, *Road marking materials — Road marking performance for road users*

EN 1824:2011, *Road marking materials — Road trials*

prEN 1871:2008, *Road marking materials — Paint, cold plastic and thermoplastic marking materials — Physical properties*

EN 12802, *Road marking materials — Laboratory methods for identification*

EN 13197:2011, *Road marking materials — Wear simulator Turntable*

EN 13212:2011, *Road marking materials — Requirements for factory production control*

EN 13459, *Road marking materials — Sampling from storage and testing*

EN ISO 4892-3, *Plastics — Methods of exposure to laboratory light sources — Part 3: Fluorescent UV lamps (ISO 4892-3)*

EN ISO 11358, *Plastics — Thermogravimetry (TG) of polymers — General principles (ISO 11358)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
preformed road marking
factory produced road marking system (or product), in sheet or roll form, capable of being applied to the substrate with adhesive, primer, pressure, heat or a combination of these

3.1.1
tape
preformed multilayer road marking, capable of adapting itself to the texture of the substrate, which may be precoated with pressure-sensitive adhesive, capable of being stuck to the substrate without heating the material, while the photometric, colorimetric and skid resistance characteristics are not significantly modified during application

3.1.2
preformed cold plastic road marking
preformed road marking made of cold plastic marking material as defined in prEN 1871:2008, applied to the substrate by means of an adhesive, while the photometric, colorimetric and skid resistance characteristics are not significantly modified during application

3.1.3
preformed thermoplastic road marking without drop-on materials
"pre-beaded" preformed road marking made of thermoplastic marking material as defined in prEN 1871:2008, applied to the substrate by heating the material at melting temperature and without addition of any retroreflective and/or anti-skid materials during application

3.1.4
preformed thermoplastic road marking with drop-on materials
preformed road marking made of thermoplastic road marking material as defined in prEN 1871:2008, applied to the substrate by heating the material at melting temperature and with addition of retroreflective and/or anti-skid materials during application

3.2
removability
characteristic of a preformed road marking capable of being removed, intact or in large pieces, without leaving permanent marks that could confuse the road user during different weather conditions

3.3
adhesive
substance which is used to bond the preformed road marking to the substrate and the application of which may require heating

3.4
base road marking material
paint, a thermoplastic or a cold plastic with a unique identification, which may, or may not, include premix glass beads

Note 1 to entry: This definition is relevant only for preformed thermoplastic road marking with drop-on materials as defined in 3.1.4.

3.5
road marking assembly
base road marking material together with the precise application instructions including the identification of the manufacturer, dosages, types and proportions of drop-on materials needed to build up the applied road markings, every change to which is a new assembly and is identified with the name of the base road marking material followed by the word assembly and a correlative number

EXAMPLE Thermo AX – Assembly 1; Thermo AX – assembly 2, etc.

Note 1 to entry: This definition is relevant only for preformed thermoplastic road marking with drop-on materials as defined in 3.1.4.

3.6
structured road marking products
road marking product without areas of regular dimensions and tap surfaces, which has flat areas of a maximum width of 75,7 mm a maximum length of 125 mm at the top of the structure

Note 1 to entry: The areas can be crossed by gaps that take up minimum 25 % of the total surface area and have widths of minimum 5 mm. The areas can have ridges or edges of blocks with a height of minimum 1,2 mm.

3.7
non-structured road marking products
road marking product with areas of regular dimensions and tap surfaces, which has flat areas of a minimum width of 75,7 mm a minimum length of 125 mm at the top of the structure

Note 1 to entry: The areas can be crossed by gaps that take up maximum 25 % of the total surface area and have widths of maximum 5 mm. The areas can have ridges or edges of blocks with a height of maximum 1,2 mm.

Note 2 to entry: Additional materials to those described in 3.1 to 3.3 can include, if recommended by the manufacturer, primers which are liquid products which may contain solids and liquid additives suspended in an organic solvent or in water. The solids comprise inorganic and/or organic fillers, pigments and additives. The content of volatile organic solvents is not limited.

Primers are used to precoat road surfaces before the road marking system is applied. They improve the adhesion of the road marking and protect against disintegration, discolouring, etc. caused by incompatible compounds in the road surface.

4 Requirements

4.1 Tape, Preformed Cold Plastic Road Marking and Preformed Thermoplastic Road Marking without drop-on Materials

4.1.1 General

The requirements are meant as characteristics of the materials as fully finished products. They are therefore intended as laboratory requirements.

4.1.2 Day-time visibility (reflection in daylight or under road lighting)

Day-time visibility represents the brightness of a road marking as seen by driver's vehicles in typical or average daylight or under road lighting. It shall be measured either by the coefficient of luminance under diffuse illumination (Qd), expressed in $mcd \cdot m^{-2} \cdot lx^{-1}$ or by the luminance factor (β).

a) When luminance coefficient under diffuse illumination Qd is measured, the preformed road marking material is tested in accordance with 5.2.2 a) and shall comply with classes Q1 to Q5 of EN 1436:2007+A1:2008, Table 1.

b) When luminance factor β is measured, the preformed road marking material is tested in accordance with 5.2.2 b), and shall comply with Table 1:

Table 1 — Classes of luminance factor β in dry conditions

Type and colour	Class	Luminance factor β
Permanent		
White and yellow	B0	No value requested
White	B5	≥ 0,60
Yellow	B3	≥ 0,40
Temporary		
White and yellow	B0	No value requested
White	B6	≥ 0,70
Yellow	B3	≥ 0,40

4.1.3 Night-time visibility (retroreflection under vehicle headlamp illumination)

Night-time visibility represents the brightness of a road marking as seen by driver's vehicles under the illumination by the driver's own headlamp. The result is expressed by the coefficient of retroreflected luminance in $mcd \cdot m^{-2} \cdot lx^{-1}$.

The coefficient of retroreflected luminance on dry conditions changes during wetness or during rain. Retroreflected luminance during wetness or during rain only applies for road markings type II.

a) When preformed road marking material is tested on dry conditions, in accordance with 5.2.3 a), the coefficient of the retroreflected luminance R_L shall comply with classes R1 to R5 of EN 1436:2007+A1:2008, Table 3 (only for retroreflective road marking products).

b) When preformed road marking material is tested during wetness in accordance with 5.2.3 b), the coefficient of the retroreflected luminance R_L shall comply with classes RW1 to RW6 of EN 1436:2007+A1:2008, Table 4 (only for type II road marking products).

c) When preformed road marking material is tested during rain in accordance with 5.2.3 c), the coefficient of the retroreflected luminance R_L shall comply with classes RR1 to RR6 of EN 1436:2007+A1:2008, Table 5 (only for type II road marking products).

4.1.4 Day-time visibility (Colour in daylight or under road lighting)

Day-time visibility shall be defined by means of (*x*,*y*) chromaticity co-ordinates.

When a white preformed road marking is tested in accordance with 5.2.4, the *x*, *y* chromaticity co-ordinates shall lie within the region defined by the corner points given in EN 1436:2007+A1:2008, Table 6 for white road markings.

When a yellow preformed road marking is tested in accordance with 5.2.4, the *x*, *y* chromaticity co-ordinates shall lie within the region Y2 defined by the corner points given in EN 1436:2007+A1:2008, Table 6 for yellow road markings.

4.1.5 Skid resistance SRT value (only for non-structured road marking products)

Skid resistance represents the energy loss caused by the friction of a rubber slider over a specified length of a road marking surface in wet conditions. The result is expressed in SRT (Skid Resistance Tester) units.

Measured on samples in the laboratory according to 5.2.5, the skid resistance of preformed materials shall be in accordance with classes S1 to S5 of EN 1436:2007+A1:2008, Table 7 except for structured road marking assemblies.

4.1.6 Removability

Removability, as defined in 3.2, shall be tested in order to evaluate whether the preformed road marking material is entirely removable without leaving permanent marks that could confuse the road user during the different weather conditions.

The removability of preformed road markings cannot be determined in the laboratory and shall therefore be tested on the road, in accordance with 5.2.6.

4.1.7 Resistance to UV exposure

UV resistance shall be checked in accordance with 5.2.7. The chromaticity co-ordinates of preformed materials after UV exposure shall comply with the region for white road markings of Table 6 and with region Y2 for yellow road markings in EN 1436:2007+A1:2008, Table 6, respectively for white and yellow preformed road marking.

The preformed materials shall be classified in accordance with Table 2, where $\Delta\beta$ is the difference between the luminance factor before and after UV exposure.

Table 2 — Classes of UV resistance

Colour	Class	$\Delta\beta$
White and yellow	UV0	No value requested
White and yellow	UV2	$\leq$ 0,10

4.2 Preformed Thermoplastic Road Marking with drop-on Materials

Requirements for these products are defined in prEN 1871:2008, 4.2.1 (Test before heat stability for base road marking materials) and in prEN 1871:2008, M.3.2.2 (Night- and Day-time Visibility and Skid Resistance).

Test methods are defined in 5.3 of this European Standard.

4.3 Durability

4.3.1 General

Durability represents the capability of the preformed road marking material to achieve a certain level of performance for each characteristic after being submitted to road trials and/or wear simulator.

The information corresponding to the durability method Road trials or Wear Simulator shall include the specific test conditions applicable to the test.

The following performance characteristics of the road marking assemblies are tested by road trial or wear simulator:

- Retroreflection under vehicle headlamp illumination (see 4.1.3):
  - coefficient of retroreflected luminance R_L expressed as class R on dry conditions (only for retroreflective road marking products);
  - coefficient of retroreflected luminance R_L expressed as class RW during wetness (only for Type II road marking products) and/or;
  - coefficient of retroreflected luminance R_L expressed as class RR during rain (only for Type II road marking products);
- Reflection in daylight or under road lighting (see 4.1.2 and 4.1.4):
  - luminance coefficient under diffuse illumination (Qd) or luminance factor (β);
  - chromaticity co-ordinates (x,y);
- Skid Resistance (SRT vale) (only for non-structured road markings) (see 4.1.5).

4.3.2 Durability on road trials

When a road marking product to be used for permanent road marking is tested according to 5.4.2, the road marking product shall be exposed to at least roll-over class P1 of EN 1824:2011, Table 3. In the case of road trial with studded tyres, class P0 applies and the actual value of wheel passages (to the nearest thousand wheel passages) shall be stated in the test report.

When a road marking product to be used for temporary road marking is tested according to 5.4.2, the road marking product shall be exposed to at least roll-over classes T0; T1 or T2 of Table 3 of EN 1824:2011.

For the requirements of the road marking product specified in 4.1 and 4.2, the results are expressed in terms of a class (with the exception of the colour for which pass/fail criteria is used) for the corresponding roll-over class (P) and accompanied by studded tyres (Y/N).

4.3.3 Durability of on wear simulator - turntable

When a road marking product to be used for permanent road marking is tested according to 5.4.3, the road marking product shall be exposed to at least traffic class P4 of EN 13197:2011, Table 4.

When a road marking product to be used for temporary road marking is tested according to 5.4.3, the road marking product shall be exposed to at least traffic class P1 of EN 13197:2011, Table 4.

For the requirements of the road marking product specified in 4.1 and 4.2, the results are expressed in terms of a class (with the exception of the colour for which pass/fail criteria is used) for the corresponding roll-over class (P).

5 Test methods

5.1 Preparation

5.1.1 General

If not specified in the relevant test method, samples representative of each component of the material shall be taken from storage in accordance with EN 13459.

Smaller representative samples, of sufficient quantity to carry out all the tests required, could be taken from the larger samples.

5.1.2 Preparation of samples of Tape, Preformed Cold Plastic Road Marking and Preformed Thermoplastics Road Marking without drop-on Materials

For preformed materials cut in symbols, legends or other special shapes, where lengths of at least 1 m cannot be sampled, an equivalent area of at least 0,75 m², with a minimum width of 0,15 m and a length suitable for the tests mentioned in 5.2 shall be sampled.

5.1.3 Preparation of samples of Preformed Thermoplastics Road Marking with drop-on Materials

If not specified in the relevant test method, sampling shall be made according to EN 13459.

5.2 Test methods for Tape, Preformed Cold Plastic Road Marking and Preformed Thermoplastics Road Marking without drop-on Materials

5.2.1 General

The requirements of 4.1 apply to the products as they leave the manufacturing site and are therefore intended as laboratory requirements.

NOTE These parameters are not to be confused with the initial measurements, applied for durability purpose, which are carried out in accordance with EN 1824:2011, Table 4, for initial measurements column or after 10 000 wheel passages according to EN 13197. They indicate the performances of the road marking material measured after a short period subsequent to its application.

5.2.2 Day-time visibility (reflection in daylight or under road lighting)

Day-time visibility may be measured either by:

a) the coefficient of luminance under diffuse illumination (Qd), expressed in $mcd \cdot m^{-2} \cdot lx^{-1}$ according to EN 1436:2007+A1:2008, Annex A;

or

b) the luminance factor (β), according to EN 1436:2007+A1:2008, Annex C.

5.2.3 Night-time visibility (retroreflection under vehicle headlamp illumination)

Night-time visibility can be measured in different conditions as follows:

a) coefficient of retroreflected luminance in dry conditions (R), in accordance with EN 1436:2007+A1:2008, Annex B;

b) coefficient of retroreflected luminance with wetness (RW) in accordance with EN 1436:2007+A1:2008, Annex B;

c) coefficient of retroreflected luminance during rain (RR) in accordance with EN 1436:2007+A1:2008, Annex B.

5.2.4 Day-time visibility (Colour in daylight or under road lighting)

Day-time visibility shall be tested in accordance with EN 1436:2007+A1:2008, Annex C.

5.2.5 Skid resistance SRT value (only for non-structured road marking products)

Skid resistance shall be tested in accordance with EN 1436:2007+A1:2008, Annex D.

5.2.6 Removability

The removability of preformed road markings cannot be determined in the laboratory and shall therefore be tested on the road, in accordance with EN 1824:2011, Annex F.

5.2.7 Resistance to UV exposure

The samples shall be tested in accordance with EN ISO 4892-3 for 168 h under lamp type II (UVB - 313) in cycles of 8 h of radiation at (60 ± 2) °C and 4 h of condensation at (50 ± 2) °C.

5.3 Test method for Preformed Thermoplastics Road Marking with drop-on Materials

For these products, the general provisions in Clause 4 of prEN 1871:2008 as well as the test methods defined in 4.2 (thermoplastic marking material) of prEN 1871:2008 and M.3.2.2 (Night- and Day-time Visibility and Skid Resistance) of prEN 1871:2008 apply.

5.4 Durability

5.4.1 General

Test methods for determining the following performance characteristics of the road marking products are stated in 5.4.2 and 5.4.3 below:

— Retroreflection under vehicle headlamp illumination (see 4.1.3):

  — coefficient of retroreflected luminance R_L expressed as class R on dry conditions (only for retroreflective road marking products);

  — coefficient of retroreflected luminance R_L expressed as class RW during wetness (only for Type II road marking products) and/or;

  — coefficient of retroreflected luminance R_L expressed as class RR during rain (only for Type II road marking products);

— Reflection in daylight or under road lighting (see 4.1.2 and 4.1.4):

  — luminance coefficient under diffuse illumination (Qd) or luminance factor (β);

  — chromaticity co-ordinates (x,y);

— Skid Resistance (SRT vale) (only for non-structured road markings) (see 4.1.5).

5.4.2 Durability on road trials

Durability on road trials shall be tested in accordance with EN 1824. Testing conditions shall be reported as in EN 1824:2011, Clause 8, for the required roll-over classes (P). For studded tyres roll-over class P0 the report shall include the actual value of wheel passages (to the nearest thousand wheel passages).

5.4.3 Durability on wear simulator: turntable

Durability on the wear simulator shall be tested in accordance with EN 13197. Testing conditions shall be reported as in EN 13197:2011, Clause 9 for the required traffic classes (P).

6 Evaluation of conformity

6.1 General

The compliance of preformed road marking materials to the requirements of this standard and with the stated values (including classes) shall be demonstrated by:

— initial type testing and type testing,

— factory production control by the manufacturer, including product assessment.

The manufacturer shall always retain the overall control and shall have the necessary means to take responsibility for the product.

6.2 Initial type testing and Type Testing

6.2.1 General

Initial type testing and type testing shall be performed to demonstrate compliance with this European Standard.

All essential characteristics for which the manufacturer declares performances are subject to Initial Type Testing. In addition, the need to perform Type Tests applies to all other characteristics included in a standard when the manufacturer claims compliance, unless the standard gives provisions (e.g. use of previously existing data, CWFT and conventionally accepted performance) for declaring performances without performing tests.

Tests previously performed in accordance with the provisions of this standard, may be taken into account provided that they were made to the same or a more rigorous test method, under the same system of attestation of conformity on the same product or products of similar design, construction and functionality, such that the results are applicable to the product in question.

NOTE Same system of attestation of conformity means testing by an independent third party under the responsibility of a product certification body.

For the purposes of testing, the manufacturer's products may be grouped into families, where it is considered that the results for one or more characteristics from any one product within the family are representative for that same characteristics for all products within that same family (a product may be in different families for different characteristics).

Products may be in different families for different characteristics.

Reference to the test method standards should be made to allow the selection of a suitable representative sample.

Therefore Type Tests or Initial Type Testing shall be performed for all characteristics included in the standard for which the manufacturer declares performances, including that Identification is performed as in Annex A for Tape, Preformed Cold Plastic road marking and Preformed Thermoplastic road marking without drop-on materials and performed as in EN 12802 for Preformed Thermoplastic road marking with drop-on materials:

— at the beginning of the production of a new or modified preformed road marking materials,

— at the beginning of a new or modified method of production (where this may affect the stated properties); or

they shall be repeated for the appropriate characteristic(s), whenever a change occurs in the preformed road marking materials, in the raw material or in the supplier of the components, or in the production process (subject to the definition of a family), which would affect significantly one or more of the characteristics.

Where components are used whose characteristics have already been determined, by the component manufacturer, on the basis of compliance with other product standards, these characteristics need not be re-assessed. The specifications of these components shall be documented, as shall be included in the inspection scheme for ensuring their compliance.

Preformed road marking materials marked in accordance with appropriate harmonised European Standards may be presumed to have the performances stated with that marking, although this does not replace the responsibility of the preformed road marking materials designer to ensure that the preformed road marking materials as a whole assembly is correctly designed and its components have the necessary performance values to meet the design.

6.2.2 Test samples, testing and compliance criteria

The number of samples to be tested/assessed for Initial Type Testing and Type Testing shall be in accordance with Table 3.

Table 3 — Number of samples to be tested and compliance criteria

Characteristic				**Requirement and Compliance criteria**	**Assessment method**	**No. of samples**
Essential characteristics	Night-time visibility	Retroreflection under headlamp illumination	Coefficient of retroreflected luminance R_L on dry	4.1.3 a) 4.2*	5.2.3 a) 5.3*	1
			Coefficient of retroreflected luminance R_L during wetness	4.1.3 b) 4.2*	5.2.3 b) 5.3*	1
			Coefficient of retroreflected luminance R_L during rain	4.1.3 c) 4.2*	5.2.3 c) 5.3*	1
	Day-time visibility	Reflection in daylight or under road lighting	Coefficient under diffuse illumination Qd	4.1.2 a) 4.2*	5.2.2 a) 5.3*	1
			Luminance factor β	4.1.2 b) 4.2*	5.2.2 b) 5.3*	1
		Colour	Chromaticity co-ordinates (x,y)	4.1.4 4.2*	5.2.4 5.3*	1
	Skid resistance		SRT units	4.1.2 4.2*	5.2.5 5.3*	1
Removability			Y/N description	4.1.6	5.2.6	1
Resistance to UV exposure			Classes of UV resistance	4.1.7	5.2.7	1
Test before heat stability			Chromaticity co-ordinates (x,y) and luminance factor β	4.2*	5.3*	1
			Softening point	4.2*	5.3*	1
			Alkali resistance	4.2*	5.3*	1
			Cold impact resistance	4.2*	5.3*	1
			UV ageing	4.2*	5.3*	1
Durability			Road trials (Roll over class)	4.3.2 4.3.2*	5.4.2 5.4.2*	1
			Turntable-wear simulator (Traffic class)	4.3.3 4.3.3*	5.4.3 5.4.3*	1
* Applies for preformed thermoplastics with drop-on materials.						

6.2.3 Test reports

All Type Tests, Initial Type Tests and their results shall be documented in test reports.

All test reports shall be retained by the manufacturer for at least 10 years after the last date of production of the preformed road marking materials to which they relate.

6.3 Factory production control (FPC)

6.3.1 General

The manufacturer shall establish, document and maintain an FPC system to ensure that the products placed on the market comply with the stated performance characteristics.

The FPC system shall consist of written procedures, regular inspections and tests and/or assessments and the use of the results to control raw and other incoming materials or components, equipment, the production process and the product.

All the elements, requirements and provisions adopted by the manufacturer shall be documented in a systematic manner in the form of written policies and procedures.

This production control system documentation shall ensure a common understanding of conformity evaluation and enable the achievement of the required product characteristics and the effective operation of the production control system to be checked.

Factory production control therefore brings together operational techniques and all measures allowing maintenance and control of the compliance of the product with this European Standard.

6.3.2 Requirements

6.3.2.1 General

The manufacturer is responsible for organising the effective implementation of the FPC system.

Tasks and responsibilities in the production control organisation shall be documented and this documentation shall be kept up-to-date.

The responsibility, authority and the relationship between personnel that manages, performs or verifies work affecting product conformity, shall be defined. This applies in particular to personnel that need to initiate actions preventing product non-conformities from occurring, actions in case of non-conformities and to identify and register product conformity problems. Personnel performing work affecting product conformity shall be competent on the basis of appropriate education, training, skills and experience for which records shall be maintained.

In each factory, the manufacturer may delegate the action to a person having the necessary authority to:

— identify procedures to demonstrate conformity of the product at appropriate stages;

— identify and record any instance of non-conformity;

— identify procedures to correct instances of non-conformity.

The manufacturer shall draw up and keep up-to-date documents defining the factory production control which he applies.

The manufacturer's documentation and procedures should be appropriate to the product and manufacturing process.

The FPC system should achieve an appropriate level of confidence in the conformity of the product. This involves:

a) the preparation of documented procedures and instructions relating to factory production control operations, in accordance with the requirements of the reference European Standard;

b) the effective implementation of these procedures and instructions;

c) the recording of these operations and their results;

d) the use of these results to correct any deviations, repair the effects of such deviations, treat any resulting instances of non-conformity and, if necessary, revise the FPC to rectify the cause of non-conformity.

Where subcontracting takes place, the manufacturer shall retain the overall control of the product and ensure that he receives all the information that is necessary to fulfil his responsibilities according to this European Standard.

If the manufacturer has part of the product designed, manufactured, assembled, packed, processed and/or labelled by subcontracting, the FPC of the subcontractor may be taken into account, where appropriate for the product in question.

The manufacturer who subcontracts all of his activities may in no circumstances pass these responsibilities on to a subcontractor.

Manufacturers having an FPC system, which complies with EN ISO 9001:2008 standard and which addresses the requirements of this European Standard are recognised as satisfying the FPC requirements of the Council Directive 89/106/EEC.

6.3.2.2 Equipment

6.3.2.2.1 Testing

All weighing, measuring and testing equipment shall be calibrated or verified and regularly inspected according to documented procedures, frequencies and criteria.

6.3.2.2.2 Manufacturing

All equipment used in the manufacturing process shall be regularly inspected and maintained to ensure use, wear or failure does not cause inconsistency in the manufacturing process.

Inspections and maintenance shall be carried out and recorded in accordance with the manufacturer’s written procedures and the records retained for the period defined in the manufacturer's FPC procedures.

6.3.2.3 Raw materials and components

The specifications of all incoming raw materials and components shall be documented, as shall the inspection scheme for ensuring their compliance. In case supplied kit components are used, the attestation of conformity level of the component shall be that given in the appropriate harmonised technical specification for that component.

6.3.2.4 Design process

The factory production control system shall document the various stages in the design of the preformed road marking materials, identify the checking procedure and those individuals responsible for all stages of design.

During the design process itself, a record shall be kept of all checks, their results, and any corrective actions taken.

This record shall be sufficiently detailed and accurate to demonstrate that all stages of the design phase, and all checks, have been carried out satisfactorily.

6.3.2.5 Traceability and marking

Individual product packages of preformed road marking materials shall be identifiable and traceable with regard to their production origin. The manufacturer shall have written procedures ensuring that processes related to affixing traceability codes and/or markings are inspected regularly.

6.3.2.6 Controls during manufacturing process

The manufacturer shall plan and carry out production under controlled conditions.

6.3.2.7 Product testing and evaluation

The manufacturer shall establish procedures to ensure that the stated values of the characteristics he declares are maintained. The characteristics, and the means of control, are described in Table 4 for Tape, Preformed Cold Plastic and Thermoplastic without drop-on material. For Preformed Thermoplastic with drop-on materials, EN 13212:2011, Table 3 applies.

Table 4 — Testing and minimum frequency for Tape, Preformed Cold Plastic Road Marking and Preformed Thermoplastic without drop-on materials

Characteristic		Minimum frequency of tests
On semi finished product (for self-adhesive road markings)	Adhesive - Mass per unit area (in accordance with Annex F of this standard)	At least once a day per each product
On final product	Colour and luminance factor (x,y; β)	Every 2 000 m²
	Daytime visibility (Qd)	Every 2 000 m²
	Retroreflection (RL/RW/RR)	Every 2 000 m²
	Skid resistance value (SRT)	Every 2 000 m²
	Ash content	Every 5 000 m²

6.3.2.8 Non-complying products

The manufacturer shall have written procedures (including recall procedures) which specify how non-complying products shall be dealt with.

Any such events shall be recorded as they occur and these records shall be kept for the period defined in the manufacturer's written procedures.

6.3.2.9 Corrective action

The manufacturer shall have documented procedures that instigate action to eliminate the cause of non-conformities in order to prevent recurrence.

6.3.2.10 Handling, storage and packaging

The manufacturer shall have procedures providing methods of product handling and shall provide suitable storage areas preventing damage or deterioration.

6.3.3 Product specific requirements

The FPC system shall:

— address this European Standard and

— ensure that the products placed on the market comply with the stated performance characteristics.

The FPC system shall include a product specific FPC, which identifies procedures to demonstrate compliance of the product at appropriate stages, i.e.:

a) the controls and tests to be carried out prior to and/or during manufacture according to a frequency laid down in the FPC test plan, and/or

b) the verifications and tests to be carried out on finished products according to a frequency laid down in the FPC test plan.

If the manufacturer uses only finished products, the operations under b) shall lead to an equivalent level of compliance of the product as if FPC had been carried out during the production.

If the manufacturer carries out parts of the production himself, the operations under b) may be reduced and partly replaced by operations under a). Generally, the more parts of the production that are carried out by the manufacturer, the more operations under b) may be replaced by operations under a).

In any case, the operation shall lead to an equivalent level of compliance of the product as if FPC had been carried out during the production.

NOTE Depending on the specific case, it can be necessary to carry out the operations referred to under a) and b), only the operations under a) or only those under b).

The operations under a) refer to the intermediate states of the product as on manufacturing machines and their adjustment, and measuring equipment, etc. These controls and tests and their frequency shall be chosen based on product type and composition, the manufacturing process and its complexity, the sensitivity of product features to variations in manufacturing parameters, etc.

The manufacturer shall establish and maintain records that provide evidence that the production has been sampled and tested. These records shall show clearly whether the production has satisfied the defined acceptance criteria and shall be available for at least three years.

These records shall be available for inspection.

Where the product fails to satisfy the acceptance measures, the provisions for non-conforming products shall apply, the necessary corrective action shall immediately be taken and the products or batches not conforming shall be isolated and properly identified.

Once the fault has been corrected, the test or verification in question shall be repeated.

The results of controls and tests shall be properly recorded. The product description, date of manufacture, test method adopted, test results and acceptance criteria shall be entered in the records under the signature of the person responsible for the control/test.

With regard to any control result not meeting the requirements of this European Standard, the corrective measures taken to rectify the situation (e.g. a further test carried out, modification of manufacturing process, throwing away or putting right of product) shall be indicated in the records.

Individual products or batches of products and the related manufacturing documentation shall be completely identifiable and retraceable.

6.3.4 Initial inspection of factory and of FPC

Initial inspection of factory and FPC shall be carried out when the production process has been finalised and in operation.

The factory and FPC documentation shall be assessed to verify that the requirements in 6.3.2 and 6.3.3 are fulfilled. During the inspection it shall be verified:

a) that all resources necessary for the achievement of the product characteristics required by this European Standard are in place and correctly implemented, and

b) that the FPC-procedures in accordance with the FPC documentation are followed in practice, and

c) that the product complies with the initial type testing/type samples, for which compliance with this European Standard has been verified.

All locations where final products or at least final testing of the relevant product is performed, shall be assessed to verify that the above conditions a) to c) are in place and implemented.

If the FPC system covers more than one product, production line or production process, and it is verified that the general requirements are fulfilled when assessing one product, production line or production process, then the assessment of the general requirements does not need to be repeated when assessing the FPC for another product, production line or production process.

All assessments and their results shall be documented in the initial inspection report.

6.3.5 Continuous surveillance of FPC

Surveillance of the FPC shall be undertaken once a year.

The surveillance of the FPC shall include a review of the FPC test plan(s) and production processes(s) for each product to determine if any changes have been made since the last assessment or surveillance. The significance of any changes shall be assessed.

Checks shall be made to ensure that the test plans are still correctly implemented and that the production equipment is still correctly maintained and calibrated.

The records of tests and measurement made during the production process and to finished products shall be reviewed to ensure that the values obtained still correspond with those values for the samples submitted to type testing and that the correct actions have been taken for non-compliant devices.

6.3.6 Procedure for modifications

If modifications are made to the product, production process or FPC system that could affect any of the product characteristics required by this standard, then all the essential characteristics for which the manufacturer declares performance, which may be affected by the modification, shall be subject to Initial Type Testing, except as described in 6.2.1 and 6.3.7.

Where relevant, a re-assessment of the factory and of the FPC system shall be performed for those aspects, which may be affected by the modification.

All assessments and their results shall be documented in a report.

6.3.7 One-off products, pre-production products (e.g. prototypes) and products produced in very low quantity

The preformed road marking materials produced as a one-off, prototypes assessed before full production is established, and products produced in very low quantities (less than 10 Tm per year) are assessed as follows.

For type assessment, the provisions of 6.2.1, 3rd paragraph apply, together with the following additional provisions:

— in case of prototypes, the test samples shall be representative of the intended future production and shall be selected by the manufacturer;

— on request of the manufacturer, the results of the type assessment of prototype samples may be included in a certificate or in test reports issued by the involved third party.

The FPC system of one-off products and products produced in very low quantities shall ensure that raw materials and/or components are sufficient for production of the product. The provisions on raw materials and/or components shall apply only where appropriate.

The manufacturer shall maintain records allowing traceability of the product.

For prototypes, where the intention is to move to series production, the initial inspection of the factory and FPC shall be carried out before the production is already running and/or before the FPC is already in practice. The following shall be assessed:

— the FPC-documentation; and

— the factory.

In the initial assessment of the factory and FPC, it shall be verified:

a) that all resources necessary for the achievement of the product characteristics required by this European Standard will be available, and

b) that the FPC-procedures in accordance with the FPC-documentation will be implemented and followed in practice, and

c) that procedures are in place to demonstrate that the factory production processes can produce a product complying with the requirements of this European Standard and that the product will be the same as the initial type testing/type samples, for which compliance with this European Standard has been verified.

Once series production is fully established, the provisions of 6.3 shall apply.

7 Marking and labelling

The packaging of preformed road marking materials shall show the following information:

a) the number and year of this European Standard, EN 1790:2013;

b) the manufacturer's trade mark;

c) the description of preformed road marking material;

d) the colour;

e) the size and shape;

f) the batch number and date of manufacture;

g) the intended use of the product (permanent, temporary, substrate types) and any limitations for use of the product.

Where the above information is also required as part of the regulatory marking, compliance with the requirement for regulatory marking shall be deemed to satisfy the requirements of this clause without the need for repetition.

Other additional information related to tests carried out on preformed road marking, such as Road site location name, percentage (%) of heavy vehicles, resistance to UV radiation or removability, may be included on the label whenever they are of different significance, do not overlap with the regulatory marking and are not neither confusing nor impairing the legibility and visibility of the that regulatory marking.

Annex A
(normative)

Identification of preformed road marking materials

A.1 General

Since preformed road marking materials consist of a complex multilayer structure, usual laboratory methods cannot be applied, unless allowing wide tolerances and using a combination of different methods. Ash content can be useful for identification (see A.2).

The composition can be determined better by means of fingerprinting, as described in A.3.

A.2 Ash content

The ash content shall be determined using the method described in Annex B.

A.3 Fingerprinting

A.3.1 General

Fingerprinting is a method for characterisation of preformed road marking materials which is used for product identification.

As preformed products are multilayer constructions and may have structured surfaces, it is essential to perform fingerprinting on representative samples.

Fingerprinting is based upon the combination of different qualitative test methods:

— Thermogravimetric analysis (TGA);

— FT-IR spectroscopy of the TGA residue;

— Attenuated Total Reflectance (ATR) FT-IR spectroscopy of the adhesive layer.

A.3.2 Thermogravimetric analysis (TGA)

Test method is described in Annex C.

As TGA is performed on sample sizes in the milligram range, representative sample preparation is essential. Testing as large as possible or taking multiple samples will improve the fingerprinting for complex structures.

A.3.3 FT-IR spectroscopy of the TGA residue

Test method is described in Annex D.

A.3.4 Attenuated Total Reflectance (ATR) FT-IR spectroscopy of the adhesive layer

Test method is described in Annex E.

A.4 Tolerances

Tolerances are shown in Table A.1.

For the initial testing of a material, tolerances apply to the manufacturers declared values for the properties tested and the initial test results shall be within the tolerances in Table A.1.

When the values fall inside the tolerances then the values initially declared by the manufacturer are considered to be verified.

When values fall outside of the tolerances, there are four possibilities:

— the manufacturer can decide that the test be terminated;

— by agreement between the participants the test can be repeated with the same samples;

— by agreement between the participants the test can be repeated with new samples;

— by agreement between the participants the manufacturer can submit revised declared values.

For re-identification of a material, it may not be necessary to test all of the values, the reference values for the properties tested shall be the values declared by the manufacturer.

Table A.1 — Tolerances

Parameter	Maximum relative deviation	Maximum absolute deviation
Ash Content	-	± 3

Annex B
(normative)

Test method for Ash content

B.1 Principle

This annex specifies a method for determining the residue obtained by calcinating materials under fully specified conditions.

The determination of the ash content constitutes a standard and comparative means for estimating the content of minerals in the materials.

B.2 Apparatus

B.2.1 Flat bottom evaporating basin, of capacity approximately 25 ml

B.2.2 Laboratory balance, accurate to 0,1 mg

B.2.3 Oven with natural ventilation

B.2.4 Sand bath

B.2.5 Electric muffle furnace, capable of being raised to a temperature of (900 ± 20) °C

B.2.6 Desiccator

B.3 Procedure

Take a sample of the product as described in EN 13459 and weight a portion of approximately 2 g.

Carry out all the weightings to within 0,1 mg.

Carry out the operations on three separate test portions.

Calcinate the empty evaporating basin in the electric muffle furnace for half an hour at (900 ± 20) °C; remove it and place it in the desiccator to cool.

Weight the evaporating basin; let M_o be its mass.

Place the test portion in the evaporating basin and weight; let M_1 be the mass.

Start calcinating gradually by placing the evaporating basin in on a laboratory burner until no fumes appear. Take care to avoid igniting that will lead to loss of material.

Then calcinate in the electric muffle furnace for 2 h at (900 ± 20) °C.

Remove the evaporating basin and allow it to cool in the desiccator and weigh it.

Let M_2 be the mass of the evaporating basin and the calcinated product.

B.4 Results

Express the result by the arithmetic mean of three measurements, calculated as a percentage of the initial mass of the test portion, using the expression:

$$\frac{M_2 - M_0}{M_1 - M_0} \times 100$$

where M_2-M_0 is the mass of the ash content of the sample and M_1-M_0 is the initial mass of the sample.

Each of the individual measurements shall not be less than 2 units percentage of the mean value.

B.5 Test report

The test report shall refer to this standard and shall give the following details:

— type and identification of the product,

— result of the test, expressed in accordance with Clause 4,

— details not laid down in the standard,

— date of the test.

Annex C
(normative)

Thermogravimetric analysis (TGA)

C.1 Principle

In thermogravimetry, a gradual degradation of the sample ingredients occurs with rising temperature. The position of the degradation steps on the abscissa is characteristic for the chemical compound which is degraded. The height of the step on the ordinate corresponds to the degraded mass of this compound.

Under the same test conditions, the thermogravimetric curve of the sample to be examined shall match the thermogravimetric curve of the reference samples (spectral match).

C.2 Apparatus and Procedure

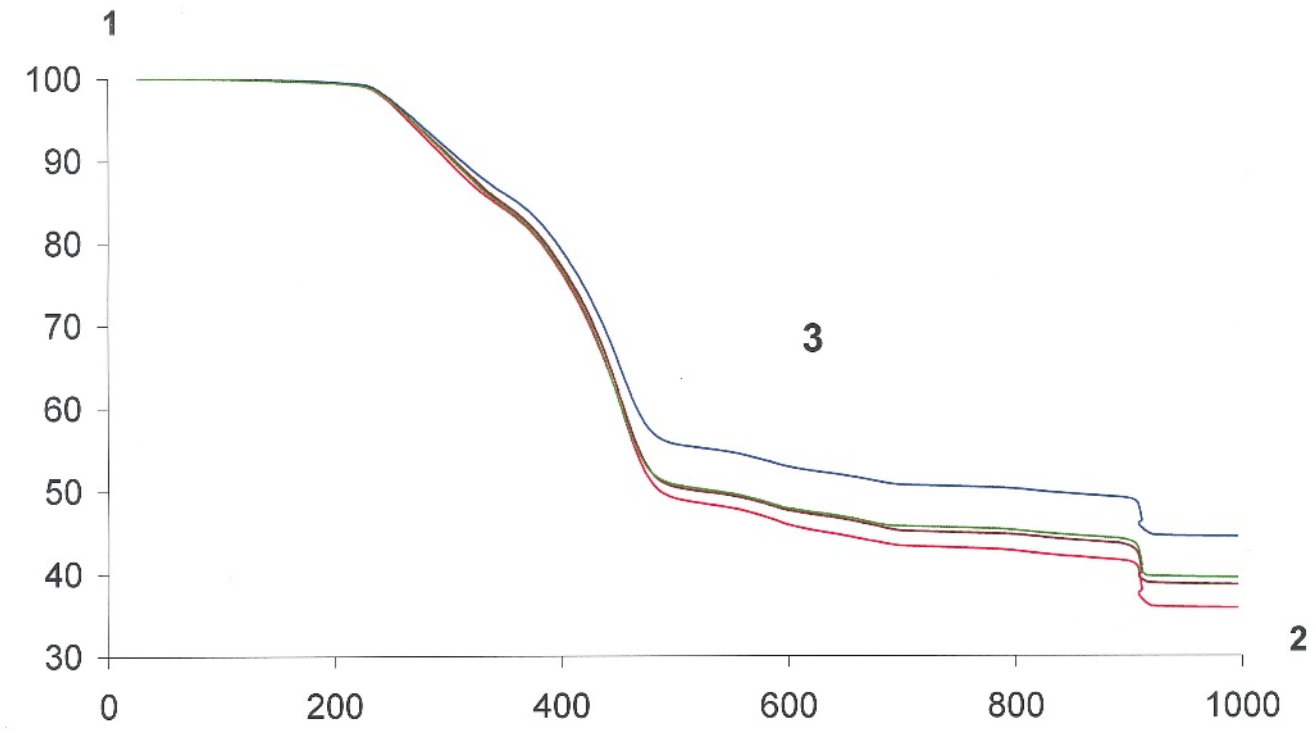
Test shall be executed as qualitative analysis referring to EN ISO 11358.

C.3 Results and Test Report

The result of the test is expressed as spectral match.

This means that all degradation steps shall occur and be in the same position on the abscissa and minor variations in the step height are tolerable.

An example of spectral match is shown in Figure C.1.



Key
1 (ordinate) weight in %
2 (abscissa)temperature in °C
3 (curves) preformed products A, B, C, D

Figure C.1 — Example

TGA test conditions for the example in Figure C.1:

1. From room temperature to 450 °C under nitrogen at 10 °C/min;

2. keep 20 min 450 °C;

3. switch to synthetic air and go up to 1 000 °C at 10°C/min.

Annex D
(normative)

FT-IR spectroscopy of the TGA residue

D.1 Principle

The purpose of this test is to determine the infrared spectrum of the residue remaining after thermogravimetric analysis (referred as TGA residue below).

D.2 Apparatus

D.2.1 Infrared spectrometer, automatically recording FT-IR spectra, range 4 000 cm-1 to 400 cm-1 with an optical resolving power better than 5 cm-1 throughout the spectral range using an ordinate with a scale of 0 % to 100 % transmission.

D.2.2 Agate mortar or mechanical grinding accessories

D.2.3 Potassium bromide (KBr) of spectroscopic grade purity and dryness

D.3 Procedure

D.3.1 Sample preparation

h) Grind together TGA residue and KBr in the agate mortar until the TGA residue is well dispersed. If necessary, use mechanical or low temperature grinding accessories.

i) Transfer the powder mixture in the die and place the die in a suitable press to obtain the KBr pellet.

j) Remove the KBr pellet avoiding contact with the faces. Check if the KBr pellet is translucent and the sample is homogeneously distributed.

D.3.2 Recording the spectrum

Place the pellet in the sample holder of spectrometer and record the IR spectrum.

D.4 Results

Under the same test conditions, the IR spectrum of the sample to be examined shall match the IR spectrum of the reference samples. This means that all absorptions/transmission peaks shall be present and no significant additional peaks shall occur.

The relative ratio of the peak heights shall not change significantly.

Annex E
(normative)

Test method for ATR FT-IR spectroscopy of the adhesive layer

E.1 Principle

The purpose of this test is to determine the infrared spectrum of the adhesive layer through Attenuated Total Reflectance (ATR) technique.

E.2 Apparatus

E.2.1 Infrared spectrometer, automatically recording ATR FT-IR spectra, range 4 000 cm^{-1} to 400 cm^{-1} with an optical resolving power better than 5 cm^{-1} throughout the spectral range using an ordinate with a scale of 0 % to 100 % transmission, with ATR crystal and accessories.

E.3 Procedure

Stick carefully the sample to the ATR crystal in order to ensure good contact between the sample and the crystal.

Record the IR spectrum by multi-reflection of the adhesive layer.

E.4 Results

Under the same test conditions, the IR spectrum of the sample to be examined shall match the IR spectrum of the reference samples. This means that all absorptions/transmission peaks shall be present and no significant additional peaks shall occur.

The relative ratio of the peak heights shall not change significantly.

Annex F
(normative)

Preformed self-adhesive road marking – Test method for determination of mass per unit area of the adhesive

F.1 Scope and field application

This annex specifies a method for determining the mass per unit area of the adhesive that is coated onto preformed road marking.

F.2 References

EN ISO 2286-2, *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 (ISO 2286-2)*

F.3 Sampling

Two situations can occur:

a) the adhesive is applied by transfer to the road marking and can be sampled as adhesive layer on protective release film(s);

b) the adhesive is directly coated on the road marking; in this case, the adhesive layer has to be sampled directly from the coating machine by means of release film(s).

F.4 Apparatus

F.4.1 Balance, accurate to ± 10 mg.

F.4.2 Cutter, capable of cutting, from the sample of adhesive layer, a test piece of area (100 ± 1) cm^2.

F.4.3 It has been found convenient to use a circular cutter for this purpose, but **square or rectangular test pieces** may be used provided they are within the accuracy specified above.

F.5 Preparation of test samples

Using the cutter (F.4.2), cut three test pieces from the sample, from positions spaced reasonably evenly and close to the diagonal across the width of the sample so that the full width of the adhesive layer is represented.

F.6 Procedure

Weigh the adhesive with protective release films; let m_1 be the total mass.

Peel off the release films and weigh the films; let m_2 and m_3 be the masses of the films.

If the adhesive layer has only one protective release film, let m_3 be zero.

F.7 Calculation and expression of results

For each of the three test pieces, calculate the mass of adhesive m_a, in grams, using the formula:

$$m_1 - (m_2 + m_3)$$

For each of the three test pieces, calculate the mass of adhesive per unit area M_a, in grams per square metre, using the formula:

$$M_a = m_a * 10^4 / A$$

where

A is the area of the test piece, in square centimetres.

Calculate the mean of the three determinations, expressing the final results to the nearest 1 g/m^2.

Take this mean as the mass per unit area of the adhesive under test.

F.8 Test report

The test report shall include the following information:

— a reference to this standard;

— type and identification of the product;

— result of the test, expressed in accordance with Clause 7;

— details of any deviations from the procedure specified;

— date of the test.

Annex ZA
(informative)

Clauses of this European Standard addressing the provisions of the EU Construction Products Directive

ZA.1 Scope and relevant characteristics

This European Standard has been prepared under Mandate M/111 “Circulation Fixtures” given to CEN by the European Commission and the European Free Trade Association.

The clauses of the European Standard shown in this annex meet the requirements of the mandate given under the EU Construction Products Directive (89/106/EEC).

Compliance with these clauses confers a presumption of fitness of the preformed road marking materials covered by this annex for the intended uses indicated herein; reference shall be made to the information accompanying the CE marking.

This annex establishes the conditions for the CE marking of the preformed road marking materials intended for the uses indicated in Table ZA.1 and shows the relevant clauses applicable.

This annex has the same scope as the relevant part in Clause 1 of this standard related to the aspect covered by the mandate and is defined by Table ZA.1.

Table ZA.1 — Relevant clauses for preformed road marking materials to be used as permanent road markings in circulation areas

Product: Tape, preformed Cold Plastic and preformed Thermoplastic with or without drop-on materials **Intended use:** Permanent road markings in circulation areas			
Essential characteristics	**Requirement clauses in this and other European Standards**	**Levels and/or classes**	**Notes**
Night-time visibility: Retroreflection under vehicle headlamp illumination: - Coefficient of retroreflected luminance (R_L) on dry conditions (only for retroreflective products)	4.1.3 a) 4.2*	-	Tested acc. to 5.2.3 a). Expressed as class (R) Tested acc. to 5.3. Expressed as class (R)*
- Coefficient of retroreflected luminance (R_L) during wetness (only for type II products)	4.1.3 b) 4.2*	-	Tested acc. to 5.2.3 b). Expressed as class (RW) Tested acc. to 5.3. Expressed as class (RW)*
and /or - Coefficient of retroreflected luminance (R_L) during rain(only for type II products)	4.1.3 c) 4.2*	-	Tested acc. to 5.2.3 c). Expressed as class (RR) Tested acc. to 5.3. Expressed as class (RR)*
Day-time visibility: Reflection in daylight or under road lighting - Luminance coefficient under diffuse illumination Qd or Luminance factor β	4.1.2 a) or 4.1.4 b) 4.2*	-	Tested acc. to 5.2.2 a) or 5.2.2 b). Expressed as class Tested acc. to 5.3. Expressed as class*
- Chromaticity co-ordinates (*x*,*y*)	4.1.4 4.2*	-	Tested acc. to 5.2.4. Expressed as pass/fail Tested acc. to 5.3. Expressed as pass/fail*
Skid resistance (only for non structured road marking products)	4.1.5 4.2*	-	Tested acc. to 5.2.5. Expressed as class Tested acc. to 5.3. Expressed as class*
Durability on road trials: - Retroreflection under vehicle headlamp illumination - RL (only for retroreflective products) - Rw (only for type II products) and /or - RR (only for type II products) - Reflection in daylight or under road lighting - Qd or - β - (*x*,*y*) - Skid Resistance(only for non structured road marking products)	4.3.2 4.3.2*	- - - - - - - -	Tested according to 5.4.2 and expressed as class for each of the corresponding roll-over class (P) and accompanied by studded tyres (Y/N)

Table ZA.1 *(continued)*

Durability on turntable: - Retroreflection under vehicle headlamp illumination - RL(only for retroreflective products) - RW(only for type II products) and /or - RR(only for type II products) - Reflection in daylight or under road lighting - Qd or - β - (x,y) - Skid Resistance(only for non structured road marking products)	4.3.3 4.3.3*	- - - - - - - -	Tested according to 5.4.2 and expresses as class for each of the corresponding traffic class (P)
* Applies for preformed thermoplastics with drop-on materials.			

The requirement on a certain characteristic is not applicable in those Member States where there are no regulatory requirements on this characteristic for the intended end use of the product. In this case, manufacturers placing their products on the market of these Member States are not obliged to determine nor declare the performance of their products with regard to this characteristic and the option “No performance determined” (NPD) in the information accompanying the CE marking (see ZA.3) may be used. The NPD option cannot be used, however, for durability and where the characteristic is subject to a threshold level.

ZA.2 Procedure for the attestation of conformity of Tape, Preformed Cold Plastic and Preformed Thermoplastic without drop-on materials

ZA.2.1 System of Attestation of Conformity

The system of attestation of conformity of preformed road marking materials indicated in Table ZA.1 established by EC Decision 1996/579/EC (*OJEU L254 of 1996-10-08*) as amended by EC Decision 1999/453/EC (*OJEU L178 of 1999-07-14*) as given in Annex III of the mandate for circulation fixtures is shown in Table ZA.2 for the indicated intended uses and relevant class.

Table ZA.2 — System of Attestation of Conformity

Products	Intended use(s)	Level(s) or class(es)	Attestation of conformity system(s)
- Road marking products: - Permanent marking tapes and preformed road markings (with or without drop-on materials, removable or non-removable) put on the market with indications on types and proportions of drop-on materials, when relevant	For circulation areas		1
System 1: See CPD Annex III.2.(i), without audit-testing of samples.			

The attestation of conformity of preformed road marking materials in Table ZA.1 shall be according to the evaluation of conformity procedures indicated in Table ZA.3 resulting from the application of the clauses of this or other European Standard indicated therein.

Table ZA.3 — Assignment of evaluation of conformity tasks for Tape, Preformed Cold Plastic and Preformed Thermoplastic with or without drop-on materials under system 1

Tasks		Content of the task	Evaluation of conformity clauses to apply
Tasks under the responsibility of the manufacturer	Factory production control (FPC)	Parameters related to the essential characteristics of Table ZA.1 relevant for the intended use which are declared	6.3.2
	Further testing of samples taken at factory according to the prescribed test plant	Essential characteristics of Table ZA.1 relevant for the intended use which are declared	6.3.2.7
Tasks under the responsibility of the product certification body	Initial type testing	Essential characteristics of Table ZA.1 relevant for the intended use which are declared	6.2
	Initial inspection of factory and of FPC	Parameters related to the essential characteristics of Table ZA.1 relevant for the intended use which are declared. Documentation of the FPC	6.3.4
	Continuous surveillance, assessment and approval of FPC	Parameters related to the essential characteristics of Table ZA.1 relevant for the intended use which are declared. Documentation of the FPC	6.3.5

ZA.2.2 EC certificate of conformity

When compliance with the system of attestation of conformity is achieved, the certification body shall draw up the EC certificate of conformity, which entitles the manufacturer to affix the CE marking. The EC certificate of conformity shall include:

a) name, address and identification number of the certification body;

b) name and address of the manufacturer, or his authorised representative established in the EEA and place of production;

NOTE The manufacturer may also be the person responsible for placing the product onto the EEA market, if he takes responsibility for CE marking.

c) description of product (Type, trade name, nature, and colour);

d) provisions to which the product conforms (Annex ZA of this European Standard);

e) particular conditions applicable to the use of the product: all relevant information concerning the description of road marking material for which the product conforms;

f) the certificate number;

g) name of, and position held by, the person empowered to sign the certificate.

The above mentioned EC certificate of conformity shall be presented in the language or languages of the Member State in which the product is intended to be used.

ZA.3 CE marking and labelling

The manufacturer or his authorised representative established within the EEA is responsible for the affixing of the CE-marking. The CE-marking symbol to affix in accordance with Directive 93/68/EEC and shall be shown on the product together with identification number of the certification body, the name or identifying mark of the manufacturer and the number of the EC certificate of conformity.

The above-mentioned information together with the information listed below shall be placed on the accompanying commercial documents:

— description of the product;

— last two digits of the year in which the CE marking was affixed;

— number and the year of this European Standard;

— name identifying the product;

— information on those relevant essential characteristics listed in Table ZA.1 which are to be declared as indicated in Table ZA.1.

The “No performance determined” (NPD) option cannot be used for durability and where the characteristic is subject to a threshold level. Otherwise the NPD option may be used when and where the characteristic for a given intended used is not subjected to regulatory requirements in the Member State of destination.

Figure ZA.1 gives an example of the information to be given on the on the product.

Figure ZA.2 shows the CE information to be given in the accompanying commercial documentation.

CE **AnyCo Ltd, PO Box 21, B-1050** XXXXX	*CE marking, consisting of the “CE”-symbol given in Directive 93/68/EEC* *Name or identifying mark of the manufacturer* *Identification number of the certification body*
01234-CPD-00234	*EC Certificate number*

Figure ZA.1 — Information to be placed on the product

CE 01234	*CE marking, consisting of the "CE"-symbol given in Directive 93/68/EEC.* *Identification number of the certification body*
AnyCo Ltd, PO Box 21, B-1050 **13** 01234-CPD-00234	*Name or identifying mark and registered address of the producer* *Last two digits of the year in which the marking was affixed* *EC Certificate number*
EN 1790:2013 Preformed road marking material reference (Tape *Type II-White-Structured*)	*No. of European Standard* *Description of product*
NIGHT-TIME VISIBILITY	*Information on essential characteristics*
Retroreflection under vehicle headlamp illumination: - Coefficient of retroreflected luminance (R_L) on dry conditions **R5** - Coefficient of retroreflected luminance (R_L) during wetness **RW5**	
DAY-TIME VISIBILITY	
Reflection in daylight or under road lighting: - Luminance coefficient under diffuse illumination Qd **Q4** - Chromaticity co-ordinates (*x*,*y*) **Pass / White**	
DURABILITY ON ROAD TRIALS (studded tyres No)	
Retroreflection under vehicle headlamp illumination: - R_L (on dry conditions) **R4/P5** **R3/P5.5** - R_L (during wetness) **RW4/P4** **RW2/P5** - Reflection in daylight or under road lighting: - Qd **Q3/P5.5** - (*x*,*y*) **(Pass / White) / P5.5**	
DURABILITY ON WEAR SIMULATOR_TURNTABLE	
Retroreflection under vehicle headlamp illumination: - R_L (on dry conditions) **R5/P6** **R4/P7** - R_L (during wetness) **RW4/P6** **RW2/P7** Reflection in daylight or under road lighting: - Qd **Q3/P7** - (*x*,*y*) **(Pass / White) / P7**	

Figure ZA.2 — Example of CE marking information, in the accompanying commercial documentation, for a structured preformed road marking material

Bibliography

[1] EN ISO 2286-2, *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 (ISO 2286-2)*

[2] EN ISO 9001:2008, *Quality management systems — Requirements (ISO 9001:2008)*

[3] ISO 5725-2, *Accuracy (trueness and precision) of measurement methods and results — Part 2: Basic method for the determination of repeatability and reproducibility of a standard measurement method*

[4] ISO 11664-2:2007, Colorimetry — *Part 2: CIE standard illuminants*

[5] CIE Publication 17.4:1986, *International lighting vocabulary*

This page deliberately left blank

This page deliberately left blank

British Standards Institution (BSI)

BSI is the national body responsible for preparing British Standards and other standards-related publications, information and services.

BSI is incorporated by Royal Charter. British Standards and other standardization products are published by BSI Standards Limited.

About us

We bring together business, industry, government, consumers, innovators and others to shape their combined experience and expertise into standards -based solutions.

The knowledge embodied in our standards has been carefully assembled in a dependable format and refined through our open consultation process. Organizations of all sizes and across all sectors choose standards to help them achieve their goals.

Information on standards

We can provide you with the knowledge that your organization needs to succeed. Find out more about British Standards by visiting our website at bsigroup.com/standards or contacting our Customer Services team or Knowledge Centre.

Buying standards

You can buy and download PDF versions of BSI publications, including British and adopted European and international standards, through our website at bsigroup.com/shop, where hard copies can also be purchased.

If you need international and foreign standards from other Standards Development Organizations, hard copies can be ordered from our Customer Services team.

Subscriptions

Our range of subscription services are designed to make using standards easier for you. For further information on our subscription products go to bsigroup.com/subscriptions.

With **British Standards Online (BSOL)** you'll have instant access to over 55,000 British and adopted European and international standards from your desktop. It's available 24/7 and is refreshed daily so you'll always be up to date.

You can keep in touch with standards developments and receive substantial discounts on the purchase price of standards, both in single copy and subscription format, by becoming a **BSI Subscribing Member**.

PLUS is an updating service exclusive to BSI Subscribing Members. You will automatically receive the latest hard copy of your standards when they're revised or replaced.

To find out more about becoming a BSI Subscribing Member and the benefits of membership, please visit bsigroup.com/shop.

With a **Multi-User Network Licence (MUNL)** you are able to host standards publications on your intranet. Licences can cover as few or as many users as you wish. With updates supplied as soon as they're available, you can be sure your documentation is current. For further information, email bsmusales@bsigroup.com.

BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK

Revisions

Our British Standards and other publications are updated by amendment or revision.

We continually improve the quality of our products and services to benefit your business. If you find an inaccuracy or ambiguity within a British Standard or other BSI publication please inform the Knowledge Centre.

Copyright

Useful Contacts:

Customer Services
Tel: +44 845 086 9001
Email (orders): orders@bsigroup.com
Email (enquiries): cservices@bsigroup.com

Subscriptions
Tel: +44 845 086 9001
Email: subscriptions@bsigroup.com

Knowledge Centre
Tel: +44 20 8996 7004
Email: knowledgecentre@bsigroup.com

Copyright & Licensing
Tel: +44 20 8996 7070
Email: copyright@bsigroup.com

bsi.

...making excellence a habit.™