Nordic certification system for road marking materials

Version 9:2022

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Kort sammanfattning

Ett nordiskt certifieringssystem för vägmarkeringsmaterial introducerades under 2015. Systemet baseras på dokumenterade materialtester på provfält, där materialen certifieras utifrån hur många hjulpassager de klarar. Certifieringssystemet omfattar både plana (typ I) och profilerade/våtsynbara (typ II) markeringar, friktionsmaterial (material med förbättrad friktion), temporära markeringar, nedfrästa markeringar (endast Norge), tvärgående markeringar (material för handläggning) samt slitstarka material utan krav på retroreflexion för högtrafikerade belysta vägar.

Materialtester görs på två provfält: ett i Norge och ett i Danmark. Provfälten är placerade på allmän väg och materialen som testas är exponerade för trafik samt för väderförhållanden representativa för de nordiska länderna. Materialen följs upp med funktionsmätningar under ett eller två år. Certifieringen omfattar krav på retroreflexion R_L, luminanskoefficient *Qd*, friktion och färgkoordinater. Antalet hjulpassager som materialen utsätts för mäts årligen. Certifieringssystemet inkluderar även materialidentifiering, vilket möjliggör senare stickprovskontroller vid entreprenader.

Certifieringssystemet baseras på Europastandarderna *EN 1824 Road marking materials – Road trials*, *EN 1436 Road marking materials – Road marking performance for road users*, *EN 12802 Road marking materials – Laboratory methods for identification* samt *EN 1423 Road marking materials – Drop on materials – Glass beads, antiskid aggregates and mixtures of the two*.

Föreliggande dokumentation utgör instruktion för det nordiska certifieringssystemet. Dokumentet beskriver hur certifieringen går till, vilka typer av produkter som kan certifieras och vilka krav som ställs för certifiering. Vidare beskrivs de procedurer och metoder som tillämpas vid utläggning av material, vid mätning av materialens funktion och vid materialidentifiering. Dokumentet ger också specifikationer och praktisk information gällande provplatserna samt gällande anmälan och utläggning av material för certifiering.

Nyckelord

Vägmarkeringsmaterial, certifiering.

Abstract

A Nordic certification system for road marking materials was introduced in 2015. The system is based on documented performance measurements of material samples applied on test fields on public roads. The certification system includes both flat (type I) and structured/profiled (type II) markings, antiskid materials (materials with enhanced friction), temporary markings, inlaid markings (Norway only), materials for hand application and materials with enhanced durability for illuminated high-traffic urban areas.

Material tests are carried out at two test sites: one in Norway and one in Denmark. The test fields are situated on public roads and the tested materials are thus exposed to real traffic conditions and to weather conditions representative for the Nordic countries. The materials are followed up by performance measurements for one or two years. The certification includes requirements on coefficient of retroreflected luminance R_L under dry and wet conditions, luminance coefficient under diffuse illumination *Qd*, friction and chromaticity coordinates. The number of wheel passages is measured at the test sites annually. The certification system includes material identification, which allows for future material sampling and analysis.

The certification system is based on the European standards *EN 1824 Road marking materials – Road trials*, *EN 1436 Road marking materials – Road marking performance for road users*, *EN 12802 Road marking materials – Laboratory methods for identification*, and *EN 1423 Road marking materials – Drop on materials – Glass beads, antiskid aggregates and mixtures of the two*.

This document constitutes the guidelines for the Nordic certification system. The document describes the certification procedure, what type of products that are included in the system and the requirements for certification. Furthermore, the procedures and methods used for application of materials, performance measurement and identification analysis are described. The document also gives specifications and practical information regarding the test sites and regarding registration and application of products for certification.

Keywords

Road marking material, certification.

Preface

A Nordic certification system for road marking materials was introduced in 2015. This implies that a documented product approval will be required in order to use the road marking material on roads managed by national road authorities, in countries that apply the certification system.

A product approval is based on monitored and documented performance measurements of material samples applied on test fields on public roads. The present report describes the certification system and the road trials.

In the first stage, the certification system applies for Norway, Denmark and Sweden. Iceland joined the system in 2019. Finland will not apply the certification system at this stage but may join later.

This publication provides guidelines and specifications for the certification system. The publication is revised each year. The most recent version replaces older versions.

The public road authorities in Denmark, Iceland, Norway and Sweden constitutes the controlling authority of the certification system. In 2022, the road authority representatives in the steering group are Michael Ruben Anker Larsen, Danish Road Directorate, Tine Damkjær, Danish Road Directorate, Ásbjörn Ólafsson, The Icelandic Road and Coastal Administration, Bjørn Skaar, Norwegian Public Roads Administration, Ulf Söderberg, Swedish Transport Administration and Jan-Erik Lundmark, Swedish Transport Administration.

Ramboll and the Swedish National Transport Research Institute (VTI) have the formal and operational responsibility of the certification system, formalised in a joint certification organisation called *NordicCert*. The management team consists of Trond Cato Johansen (project manager), Ramboll, Berne Nielsen, Ramboll, Carina Fors, VTI, Hanna Fager, VTI, and Anna Anund, VTI.

The following people have contributed to the establishment of the certification system: Kenneth Kjemtrup, Danish Road Directorate, Tuomas Österman, Finnish Transport Agency, Lars Petersson, Swedish Transport Administration, Kai Sörensen, Johnsen Consult, Sara Nygårdhs, VTI and Sven-Olof Lundkvist, VTI.

Drøbak, April 2022

Trond Cato Johansen
Project manager

Granskare/Examiner

Anna Anund, VTI.

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1. Introduction

A Nordic certification system, *NordicCert*, for road marking materials was introduced in 2015. The certification system implies that a documented product approval is required in order to use a road marking material on roads managed by the national road authorities, in countries where the certification system applies. The requirements for the use of certified materials are being implemented in national regulations gradually[1].

There are several reasons for introducing a certification system:

- to promote fair competition
- to promote the development of new and better materials
- to obtain better documentation of the use of public funds
- to guarantee that the road authorities get the material paid for
- to improve the quality of the road markings from the road user perspective
- to increase the knowledge about road marking materials.

Product approval is based on monitored and documented performance measurements of material samples applied on test fields on public roads. The certification system includes road marking materials for all types of white and yellow longitudinal markings, as well as antiskid and normal markings for transversal and longitudinal use, temporary markings, as used at roadworks, and inlaid markings (Icelandic-Norwegian-Swedish test site only). From 2019 the certification system also includes materials for hand application, and materials with enhanced durability with no requirement on retroreflectivity for illuminated high-traffic urban areas.

The certification comprises the road marking material (paint, thermoplastic and cold plastic materials) in the applied thickness and with the specified drop on material. For type II markings (road markings with special properties intended to enhance the retroreflection in wet or rainy conditions), the certification comprises the *assembly*, i.e. the material itself, including the drop on material (glass beads and antiskid aggregates), in the applied design put out on the trials.

The certification system is anchored in national guidelines and regulations. Performance requirements include coefficient of retroreflected luminance R_L under dry and wet conditions, luminance coefficient under diffuse illumination *Qd*, friction and chromaticity coordinates. Approval is given in relation to the number of wheel passages the material will withstand.

This publication provides guidelines and specifications for the certification system. The publication is revised each year. The most recent version replaces older versions.

Information referring to regulations, guidelines and practices applied by the public road authorities in the Nordic countries are presented in footnotes. Please contact the respective national road authority for further information. Contact information can be found in Appendix 6.

[1] **Regulations, guidelines and practices in the Nordic countries:** Denmark started to implement requirements for certified materials in 2017, Norway in 2018, Sweden in 2019 and Iceland in 2020. For further information about regulations related to the use of certified road markings materials, please contact the respective national road authority (see Appendix 6).

The procedures for application and measurements are based on the standards *EN 1824 Road marking materials – Road trials* and *EN 1436 Road marking materials – Road marking performance for road users and test methods*.

The certification system may be modified and/or extended later on.

Some terms and definitions are given in Appendix 1.

1.1. Application of the certification system in the Nordic countries

1.1.1. Norway

The certification system applies to roads managed by *the Norwegian Public Roads Administration* (in Norwegian: *Statens vegvesen*) as well as all county roads administrations (*Fylke*).

1.1.2. Sweden

The certification system applies to roads managed by *the Swedish Transport Administration* (in Swedish: *Trafikverket*).

1.1.3. Denmark

The certification system applies to roads managed by *the Danish Road Directorate* (in Danish: *Vejdirektoratet*).

1.1.4. Iceland

The certification system applies to roads managed by *the Icelandic Road and Coastal Administration* (in Icelandic: *Vegagerðin*) from 2020.

1.1.5. Finland

At present, the certification system does not apply to Finland. The Finnish road authorities will decide later when and in which types of contracts a material certification is required. There is also a possibility that Finnish municipalities may apply the certification system later.

The Finnish Transport Infrastructure Agency has no plans for any certification system of its own. When product approval requirements will be introduced in Finland, the Nordic certification system will be followed.

1.2. Roles and responsibilities

The Nordic road authorities constitute the controlling authority of the certification system:

- Danish Road Directorate, Denmark
- Icelandic Road and Coastal Administration, Iceland
- Norwegian Public Roads Administration, Norway
- Swedish Transport Administration, Sweden.

The Swedish National Road and Transport Research Institute (VTI) and Ramboll together have the formal responsibility of the road trials and the material approval, formalised in a joint certification organisation called NordicCert. Ramboll provides the project management of the certification system and is responsible for administration, material application, performance measurements and data handling. The project manager is responsible for the contacts with the road authorities and with the participants. VTI is responsible for documents and reports, supervision of measurements, data analyses and database. VTI is also the financial administrator of the road trials.

The procedures and the guidelines for the road trials and for the certification system have been compiled by a working group with representatives from the road authorities in Norway, Sweden, Denmark and Finland, and from VTI, Ramboll and Johnsen Consult.

The administration of the road trials refers to Ramboll and VTI.

Contact information can be found in Appendix 6.

1.3. Website

Information about NordicCert, including this document, result reports, lists of certified products, pictures and maps, can be found at www.nordiccert.com.

2. Road marking materials

The certification system includes materials for longitudinal as well as transversal markings in the product categories described below. Any type of material for longitudinal or transversal markings can be used, including preformed road markings, provided that the materials comply with current legislation.

The products are tested as applied assemblies, comprising the road marking material (paint, thermoplastic, or cold plastic materials) with a certain thickness and with drop on materials (glass beads, antiskid aggregates) as determined by the manufacturer. For type II markings (see Section 2.1.2), the assembly also includes the design/pattern of the marking.

2.1. Product types

This section describes the product categories that are included in the certification system. Allowed material thicknesses are specified in Section 4.3. The full performance requirement for each product type is given in Section 7.4.

2.1.1. Colour

The certification system includes white and yellow materials.

Other colours may be applied as *Test materials*, see definitions in Section 7.3.

2.1.2. Type I and type II

From 2016, the certification system includes both type I (flat) and type II (structured/profiled road markings intended to enhance the retroreflection in wet or rainy conditions) markings. For type II materials, certification is given for the combination of material and pattern/design that was applied on the test field. The design/pattern is documented by a photo.

Any type of pattern or design is allowed for type II markings[2].

Note: Type II markings may give rise to undesired noise. At present, there are no requirements or guidelines regarding noise levels from road markings in the Nordic countries. Nor are there any standardized methods[3] for measurements of such noise. The certification system will thus not include any performance requirements related to noise for the moment, but it should be noted that road authorities may want to include restrictions regarding noise in tendering procedures later on.

2.1.3. Inlaid markings

Inlaid markings[4] are markings that will be installed in a milled track. The bottom of the milled track will be flat, and the width will be 30–35cm. The depth of the track will be about 7 mm, so that the surface of the marking will stay below the surface of the pavement. The purpose of inlaid markings is

[2] **Regulations, guidelines and practices in the Nordic countries:** In Denmark, Norway and Sweden, the national regulations prescribe that the coverage of profiled markings, i.e. the area that is covered by road marking material relative to the total area (outer bounds) of the road marking, shall be at least 60%.

[3] The European Committee for standardization (CEN) is currently working with methods and requirements in the working group "*Test methods and requirements for (positive and negative) noise produced by structured road markings*" (CEN/TC226/WG2/EP5).

[4] **Regulations, guidelines and practices in the Nordic countries:** Inlaid markings are in regular use in Norway, where several public tenders specify such markings. In Sweden, inlaid markings are currently being tested but they are not yet specified in public tenders. Please contact the respective national road authority for further information.

to extend the functional lifetime of the markings, as snowploughs will not affect markings that are placed below the surface of the pavement.

Inlaid markings can be applied in white or yellow colour, as type II, on the Icelandic-Norwegian-Swedish test site.

2.1.4. Antiskid material

From 2017, the certification system includes white road marking assemblies intended to provide enhanced antiskid properties[5]. Such road markings are sometimes used in urban areas with street lighting, for instance for pedestrian crossings. For antiskid materials there is no requirement for coefficient of retroreflected luminance, R_L. However, the requirement for friction is higher than for ordinary materials, see Section 7.4.

2.1.5. Materials for hand application

From 2019, the certification system includes materials for hand application, typically used for marking pedestrian crossings, text and symbols on the pavement. Materials for hand application can be registered either as retroreflective, with specified requirements on the coefficient of retroreflected luminance, R_L, or as non-retroreflective, where there is no requirement on R_L. The requirement on friction is higher than for ordinary type I materials but lower than that for antiskid materials. The requirements on luminance coefficient under diffuse illumination, *Qd* and chromaticity coordinates are identical to those for ordinary type I materials. Materials for hand application can be applied in white or yellow colour.

2.1.6. Materials with enhanced durability

From 2019, the certification system includes materials with enhanced durability for longitudinal application in illuminated urban areas with a high number of wheel passages. For this product type, there is no requirement on coefficient of retroreflected luminance, R_L. Requirements on luminance coefficient under diffuse illumination, *Qd*, friction and chromaticity coordinates are identical to those for ordinary type I materials. Materials with enhanced durability are applied as type I markings in white or yellow colour.

At the Icelandic-Norwegian-Swedish test site, three years of follow-up measurements are needed to reach higher wheel passage classes than P5, see also Section 7.5.

2.1.7. Temporary markings

Temporary yellow markings are typically in use when traffic must be redirected due to roadworks. At the road trials, the temporary markings will be followed up within 6 months of the application. Winter conditions will not be included in the follow up period. Materials will be certified according to the achieved roll-over class for temporary road markings, see also Section 7.5.

Temporary markings can be applied in white or yellow colour.

2.2. Content of material and system

All ingredients/components of the material, including binder and premix beads, are parts of the material. The system includes both the material and the drop on material, and this means that the certification is valid only for the specific material (type of binder, amount of pigment, amount of glass beads etc.) and the specific drop on material applied on the test field.

[5] In a previous version of this document (version 4:2017) materials with enhanced antiskid properties were called “friction materials”.

2.2.1. Use of alternative drop on system

The only exception from the rule regarding the content of the material is the drop on material: the certification allows for change of drop on materials, provided that the technical specifications and performance of the products are equivalent to those that were originally used on the road trials. The type - and relative amount - of antiskid aggregates in the drop on material must be same as certified on the trials.

The use of alternative drop on materials must be applied for by the material supplier and approved in accordance with a separate procedure, governed by NordicCert. The application procedure is described in detail in Appendix 3. NordicCert is the only organization that can authorize the applications. Approved changes apply to all contractors and are valid for one year with automatic renewal unless NordicCert informs otherwise. Applications for alternative drop on systems must be handed in latest April 15 for the coming season by sending the application form found on the NordicCert webpage to application.nordiccert@vti.se. A decision will be received no later than May 15, provided that all requested documentation is handed in. In 2022 the applications will be handled continuously and promptly with no deadline for application.

If no application for alternative drop on materials is made, the material will only be considered approved using the drop on that was used on the road trials and which is the basis for the certificate's approval.

In the case of extraordinary events, such as material shortages or delivery problems, NordicCert can approve alternative drop on systems during the season. Such an application will be handled promptly, but with no promised maximum processing time.

2.3. Product documentation

For all products applied on the test fields, the following product documentation must be handed in together with the registration form:

- Road marking material (paint, thermoplastic and cold plastic materials): Product data sheet, see Appendix 4.
- Road marking material (paint, thermoplastic and cold plastic materials): Safety data sheet (SDS), see Appendix 4.
- Road marking material (paint, thermoplastic and cold plastic materials): Manufacturer’s declaration of constituents, see Appendix 4.
- Drop on material: Product data sheet, see Appendix 4.
- Drop on material: Safety data sheet (SDS), see Appendix 4.
- Drop on material: Declaration of Performance (DoP), see below.

Drop on materials (glass beads and antiskid aggregates) must bear CE marking and shall be in accordance with EN 1423. Their properties shall be documented by the *Declaration of Performance* (DoP) according to the specifications and classes given in the named standard. The CE marking shall be affixed on the packaging of the product.

Registered materials must not be applied on the test field unless the documentation is complete. For further information, see Appendix 4.

Drop on materials that have not yet undergone the CE marking process may (only) be used with road marking materials (paint, thermoplastic and cold plastic materials) registered and applied on the test field as *test materials*, see Section 7.3.

2.4. Requirements regarding health, environment, and safety

Materials applied on the test field must comply with current chemicals-, health-, safety-, and environmental legislation and practice in the Nordic countries. Materials must not contain any heavy metals or other materials that are in violation of legislation. Volatile organic compounds (VOCs) shall not exceed 2% by weight of any materials.

The use of yellow lead chromate pigments is not allowed in the Nordic countries.

Solvent based paint is prohibited in the Nordic countries and is thus not allowed on the test field.

Cold plastic materials are allowed on the road trials, but they are currently not used in the Nordic countries.

3. Test sites

The road trials of the certification system in 2022 are carried out in Norway and Denmark. The locations of the test sites are shown in Figure 1.

The reason for having two test sites is the differences between Norway, Sweden, and Iceland (and Finland) on one hand, and Denmark on the other hand, with respect to climate and the use of studded tyres. See also Section 7.1.

Figure 1. Locations of the test sites. (Image: Modified from Hayden120, CC BY-SA 3.0, Wikimedia Commons).

3.1. The Icelandic-Norwegian-Swedish test site

The present Icelandic-Norwegian-Swedish test site was established in 2017.

3.1.1. Location

The Icelandic-Norwegian-Swedish test site is currently located in Hedmark, close to Haslemoen in eastern Norway, approximately 180 km northeast of Oslo, Norway. The location is intended to represent the average climate conditions in Norway and Sweden (and Finland).

The road used for the test site is road Rv2, from Haslemoen and southeast approximately 5 km. The GPS coordinates for the test site in WGS84 DDM are:

- N 60° 38.665
- E 11° 52.755

Signs with the text *prøvefelt vegoppmerking* (English: *Test field, road markings*) inform drivers about the test site.

3.1.2. Road characteristics

The road used for the test site is a two-lane rural road located in an open landscape, Figure 2. The road is straight and relatively flat and without any major junctions. The posted speed limit is 90 km/h. From 2020, the southbound lane is used for the test field.

Figure 2. The road used for the Icelandic-Norwegian-Swedish test site. (Photo: Trond Cato Johansen, Ramboll).

The width of the road is 9 m. Each lane is 3.15 m from the edge of a milling track in the middle to the edge of a milling track at the edge line. The shoulders are 1.00 m, 0.65 m outside the milling track.

The road surface in the southbound lane consists of a stone matrix asphalt (SMA) of type SKA 11 that was installed in 2019. The roughness class is RG2 i.e., the mean texture depth (MTD) is in the range of 0.60–0.90 mm, see Table 2 in EN 1824.

3.1.3. Traffic volume

The annual average daily traffic (AADT) is approximately 3 200 vehicles per day (*AADT data: the Norwegian Public Roads Administration, 2021, available at https://www.vegvesen.no/trafikkdata/*). The proportion of heavy vehicles is approximately 15% of the total number of vehicles.

Measurements of the traffic volume and the transversal distribution of wheel passages are carried out at the test site annually, see Section 3.3.

3.1.4. Climatic conditions

The average temperature during the last five years (Jan 2017–Dec 2021) was 5.9˚C. The highest and lowest temperatures registered were 32.8˚C and -24.3˚C, respectively. The average annual precipitation during the last five years was 658 mm. The average snow depth in December–March (Jan 2017 – Dec 2021) was 17 cm and the largest snow depth was 60 cm. (*Weather data: Norsk klimaservicecenter, available at https://seklima.met.no/observations/*)

The Köppen classification of the test site is Dfb, close to the boundary of the Dfc climate zone, based on data for the period 1986–2010 (Kottek et al. 2006). The large areas in the inlands in the north of Finland, Norway and Sweden belong to climate zone Dfc, while the most densely populated areas in

the south of Finland and Sweden and along the south and west coasts of Norway belong to climate zones Dfb and Cfb. The climatic class according to EN 1824 is C3.

During wintertime, the road is salted and cleared from snow by a snowplough (steel blade). The road entrepreneur will be asked to be careful when clearing the road at the test site, however no guarantee can be given that damages from the winter maintenance will be completely avoided.

The weather conditions at the test site will be registered continuously during the road trials, see Section 3.4.

3.1.5. Studded tyres

Studded tyres are permitted in Norway from 1 November to the first Sunday after Easter. (In the northern areas of Nordland, Troms and Finnmark, it is permitted to begin using studded tyres from 15 October.) There is no data available regarding the proportion of vehicles with studded tyres on the test site road, but in Hamar, which is located around 60 km northwest of the test site, the proportion of cars with studded tyres is 45% and it can be estimated[6] that the proportion of cars with studded tyres is 50–55% on the test site road. Heavy vehicles may use studded tyres but can also have non-studded winter tyres.

3.2. The Danish test site

A new Danish test site will be established in 2022.

3.2.1. Location

The Danish test site is located on Jutland, approximately 100 km west of Aarhus, Denmark. The road used is road 15, between the villages Havnstrup and Albæk. The GPS coordinates in WGS84 DDM for the test site are:

- N 57˚ 07.449
- E 08˚ 50.144

Warning signs with subpanels inform drivers about the test site, Figure 3.

Figure 3. Warning sign. (Photo: Kai Sörensen).

3.2.2. Road characteristics

The road used for the test site is a two-lane rural road surrounded by an open landscape, Figure 4. The road is relatively straight and flat and without any major junctions. The posted speed limit is 80 km/h. The test field will be placed in one of the driving lanes. The direction is still to be decided.

The width of the road is about 8.5 m. Each lane is 3.30 m wide. There are bike lanes on the shoulders.

[6] According to Jon Haglund at the Norwegian Public Roads Administration.

The road surface consists of asphalt of type SMA8/11 that was placed in 2021. The mean texture depth (MTD) is in the range of 0.60–0.90 mm, i.e. the roughness class is RG2.

Figure 4. The road used for the Danish test site. (Photo: Trond Cato Johansen, Ramboll).

3.2.3. Traffic volume

The annual average daily traffic (AADT) is approximately 8 500 vehicles per day (*AADT data: the Danish Road Directorate, 2020*). The proportion of heavy vehicles is approximately 6% of the total number of vehicles.

Measurements of the traffic volume and the transversal distribution of wheel passages are carried out at the test site annually, see Section 3.3.

3.2.4. Climatic conditions

The annual average temperature during the years 2017–2021 was 8.8˚C. The highest and lowest temperatures registered were 32.3˚C and -17.9˚C, respectively. On average, the temperature was below 0˚C 80 days per year. The annual average precipitation was 996 mm and the average number of sun hours was 1 568. (*Weather data: www.dmi.dk*)

The Köppen classification of the test site is Cfb, based on data for the period 1986–2010 (Kottek et al. 2006). The climate zone Cfb covers the whole of Denmark, the southern parts of Sweden and the south and west coasts of Norway. The climatic class of the Danish test site according to EN 1824 is C3, i.e. Cfb with winter maintenance. The extent of winter maintenance may vary a lot between years.

During wintertime, the road is salted and cleared from snow by a snowplough (rubber blade or steel blade).

The weather conditions at the test site will be registered continuously during the road trials, see Section 3.4.

3.2.5. Studded tyres

Studded tyres are permitted in Denmark from 1 November to 15 April. The number of cars with studded tyres is low (estimation: about 5%).

3.3. Measurements of wheel passages

The number of wheel passages and the transversal distribution of wheel passages is measured annually at the test sites. The assessment of wheel passages is conducted after the markings have been applied, in order to account for any influence on vehicles' lateral position from the markings.

The measurement equipment that is used is based on coaxial cable technique, which provides data with high accuracy. Data is collected during approximately one week in the autumn or in the spring (i.e. studded tyres are not used when data is collected). The measurements of wheel passages are carried out by VTI.

From the collected data, the distribution of wheel passages is calculated according to the procedures described in Annex B in EN 1824. Roll-over classes will then be determined from the calculated distributions, see Section 7.5.

3.4. Measurements of weather conditions

The following data is registered at the test sites each year:

- annual average temperature
- average summer temperature
- average winter temperature
- highest temperature
- lowest temperature
- annual precipitation
- number of sun hours (not available for the Icelandic-Norwegian-Swedish test site)
- number of weeks with snow (in Denmark: snow or frost)
- number of times the snow plough has operated
- number of times the road has been salted.

Meteorological data is retrieved from *Yr* (which is a joint service by *the Norwegian Meteorological Institute* and *the Norwegian Broadcasting Corporation*), *the Norwegian Centre for Climate Services* and *the Danish Meteorological Institute* (DMI), respectively. Information about winter maintenance is obtained from the road entrepreneurs.

4. Application of road marking materials

The application of road marking materials at the test sites is based on EN 1824. Details are given below.

4.1. Application pattern

The application pattern is based on the longitudinal pattern described in Section 5.2.3 in EN 1824. Each marking material is applied as a row of longitudinal lines in the direction of the traffic. Specifications:

- nine longitudinal lines in a row in the lane and, at the Icelandic-Norwegian-Swedish test site, a tenth line on the shoulder
- length of the lines: 2.5 m
- width of the lines: 0.15 m
- distance between two adjacent lines: 0.15 m
- distance between two adjacent rows of lines: depends on the number of materials/rows, but at least 1 m.

The position of the lines will be pre-marked. The administration of the road trials is responsible for the application of pre-markings. The position of the lines will also be measured after application.

The tenth line on the shoulder serves as a reference without any wheel passages.

For inlaid markings, there will be a milled flat track over two sections in line positions 2, 3, 9 and 10 (the lines are numbered from right to left, i.e. line 1 is the line on the shoulder and line 10 is the one next to the centre line). Inlaid markings will be applied in those milled tracks. The other line positions will be filled with the same type of markings but will not be inlaid. The administration of the road trials is responsible for the milling of tracks.

4.2. Application method

Preferably, materials shall be applied using self-propelled road marking equipment of maximum 3 500 kg. Application by hand is permitted, e.g. in case the supplier does not have a self-propelled machine. Due to practical reasons of precision and not having newly applied markings run over, heavy truck mounted equipment is to be avoided[7]. The application method will be documented in the certification report.

Materials intended for hand application should be applied by hand on the test site.

4.3. Material thickness

Materials can be applied in five thicknesses:

- 0.4 mm wet (example: paint). Maximum thickness allowed at application: 0.45 mm wet
- 0.6 mm wet (example: paint). Maximum thickness allowed at application: 0.65 mm wet
- 1.5 mm (example: spray plastic). Maximum thickness allowed at application: 2.0 mm

[7] If there is no other possibility for application, a special approval for using heavy truck mounted equipment must be given beforehand by the administration of the road trials. The manufacturer then must apply for the approval by contacting the project leader (see Appendix 6) at latest at the last day for registering materials.

- 3.0 mm (example: extruded thermoplastic). Maximum thickness allowed at application: 3.5 mm
- 5.0 mm (Structured/profiled type II markings and antiskid materials only. Example: thermoplastic and cold plastic). Maximum thickness allowed at application: 5.5 mm.

Prefab and tape shall be applied in commercially available thicknesses.

The thickness is measured when the material is applied. For each row of lines, a steel plate is placed in the end of two of the lines that are expected to reach the highest number of wheel passages. One plate is to be applied with drop on material, and the other is to be applied without any drop on. When material is applied on those lines, the length of the lines should be lengthened so that material is applied also on the steel plates. The thickness of the material is then measured on the steel plate. In addition, the thicknesses of a random sample of lines (other than those with the highest P-class) will be measured by a portable measurement tool.

The thickness of the material is measured on the sample plate without any drop on glass beads or aggregates.

The steel plates are weighed before and after application, so that the volume applied can be controlled, and the mean thickness be calculated.

If the thickness of any of the lines is greater than the maximum thickness allowed, these lines are disqualified and excluded from the road trial. Lines that fulfil the requirements on thickness will be approved for continued participation, but this however implies that there is a risk that the material cannot be certified for certain P-classes.

4.4. Application of drop on materials

Drop on materials must be packed in the original manufacturing package, labelled with the product name, the manufacturer, and the CE marking. The package(s) of drop on materials must be unopened.

The rate of application of drop on materials will be determined according to EN 1824. The amount of drop on materials, as registered and recorded during application at the road trials, will be issued in the eventual certificate of the road marking material.

4.5. Weather conditions at application

Suppliers are to verify that the weather conditions during application of their materials are within acceptable limits. Meteorological data at application will be registered.

4.6. Practical information about the application of materials

The test sites will be open for application of materials for approximately one or two weeks. Suppliers will get instructions on when and where to apply their materials. The application will be organized so that the risk of materials being spoiled by weather, traffic or other suppliers' equipment or presence is minimized.

The lane where the markings will be applied will be closed during application and for a few hours after application. The administration of the road trials will be responsible for the closing of the road.

Suppliers are responsible for masking the road surface during application of their materials, to avoid spill and damage of other materials. Roofing felt or tar paper is suitable for this purpose, but also other types of masking materials can be acceptable. The suppliers are responsible for the masking and for the availability of masking materials.

4.7. Practical information about customs bill of entry to Norway

As Norway is not a member of the European Union, a registration of machinery and equipment, when entering the country, is necessary. This is an easy and inexpensive procedure. Your Chamber of Commerce will issue an ATA carnet for this purpose. The documents are to be presented to the customs office at the border upon entering the country. The ATA carnet is also to be presented to the customs office when leaving Norway.

4.8. Suppliers' responsibilities

The supplier, or its representative, is responsible for its products during installation on the test field and has to verify a correct application of its materials. A protocol for each material applied on the test field is to be signed by the participant and the administration of the road trials, see Appendix 5.

Suppliers are obliged to:

- Apply their own materials on the test field(s) at their own cost.
- Follow the instructions given by the administration of the road trials on-site.
- Provide the administration of the road trials with samples of each material (see Chapter 6).
- Bring unopened packages of drop on materials.
- Assure that the material samples taken from the application machine are homogeneous and representative for the material in use.
- Mask the road surface during application of their materials, to avoid spill and damage of other materials. The supplier is responsible for the masking and availability of masking materials, see also Section 4.6.
- Make sure that all personnel working on the road at the test sites have a minimum level of road safety training.

After the road trials have been closed for application, the participant, or its representative, is not allowed to enter the test field to perform their own measurements without a permission granted by the road administration in charge. For all kind of activities on the road trials, it is necessary to have an approved traffic safety plan. This plan will also describe the necessary level of warning systems and safety barriers. The participant will have to cover all costs for such a plan and all necessary safety equipment. Please contact the administration of the road trials for contact details of the respective road administrations and of suppliers of safety barriers.

The administration of the road trials will arrange an "open day" at the test sites in May-June each year, when participants can visit the test site and assess the condition of their materials. More information about the open days will be sent out by email.

5. Performance measurements

Performance measurements are based on EN 1824 and EN 1436.

5.1. Periodicity of measurements

Initial measurements of all materials are carried out approximately two weeks after application. Follow-up measurements are carried out after approximately one year and, if the supplier wishes, after two years. At the Icelandic-Norwegian-Swedish test site, three year follow-up measurements are offered, see also Sections 2.1.6 and 8.1. After two (and three) years, higher P-classes will have been reached, which implies that the material may be certified for a higher P-class. Follow-up measurements for temporary markings are carried out after approximately 1–3 months.

Dates for the follow-up measurements are decided after the annual measurements of wheel passages, see also Sections 3.3 and 7.5. The follow-up measurements are usually carried out in August–September.

In case a material does not fulfil the requirements stated in Chapter 7 at the initial measurements, the material will be excluded from the certification program. If the participator wishes, the excluded materials can have a continued follow-up as a *Test material*, see Section 7.3.

In case a material that was registered for two years follow-up measurements does not fulfil the requirements in the highest P-class in year one, no measurements will be carried out in year two, unless the participator asks for it.

If a participator wants continued follow-up for materials that did not fulfil the requirements either at the initial measurements or in the highest P-class in year one, a request must be sent by email to the administration of the road trials, at latest on June 30 in the year when the follow-up measurements are to be carried out.

5.2. Performance parameters

The following parameters are included in the certification system:

- coefficient of retroreflected luminance, R_L dry
- coefficient of retroreflected luminance, R_L wet (type II markings only)
- luminance coefficient under diffuse illumination, *Qd*
- friction
- chromaticity coordinates, x, y.

Performance requirements are given in Chapter 7.

5.3. Measurement details

The coefficient of retroreflected luminance, R_L, and the luminance coefficient under diffuse illumination, *Qd*, are measured in three points on each line, within a 0.15 x 1.5 m large area centered on the line, in accordance with Figure 2 in EN 1824. The parameter values are calculated as the average of the three measurements. Measurements of R_L and *Qd*, are done using an *LTL-XL* or an *LTL3500* (Delta, Denmark).

For measurements of the coefficient of retroreflected luminance R_L on wet markings, water is poured on the measurement area 60 s before the measurements are carried out.

Friction is measured along the centre of each line (one measurement per line), on wet markings. Measurements are carried out using a *Portable Friction Tester version 4* (PFT), which has a proven correlation with the *Skid Resistance Tester* (SRT), see (Wälivaara 2007).

Chromaticity coordinates are measured in one point on each line. A *Konica Minolta Spectrophotometer CM-2500c* or *CM-25cG* is used to measure the chromaticity coordinates. The chromaticity coordinates of yellow materials in retroreflected light are measured by an *LTL3500* (Delta, Denmark). If necessary, more than one measurement point is selected.

All measurements are carried out in the direction of the traffic. Measurements are performed on dry markings in dry weather conditions. The markings are not cleaned before carrying out the measurements, but polluted measurement points will be avoided.

Measurements that involve wetting of the markings, i.e. coefficient of retroreflected luminance R_L on wet markings and friction, are carried out after the measurements of the coefficient of retroreflected luminance R_L on dry markings, luminance coefficient under diffuse illumination *Qd* and chromaticity coordinates.

All measurement equipment will be calibrated according to procedures recommended by the respective manufacturer.

6. Material identification

An identification analysis is carried out on road marking materials (paint, thermoplastic and cold plastic materials) applied and certified on the test fields, with the purpose of making it possible for the road authorities to assure that a material that is used in a contract corresponds to the material tested and certified at the test field.

6.1. Samples for identification

Samples of the base material and of the drop on material are taken from all products that are applied on the test fields. Samples are taken directly from the application machine during installation at the test field, if possible. In case the application of materials is carried out without using a self-propelled machine, the material sample will be taken directly from the boiler/heating kettle (thermoplastics) or the material container used at the trial site (paint and cold plastics). If the base material is a multi-component material, samples will be taken from each component. The sampling is done by the administration of the road trials.

Two samples are taken from each base material and from each drop on material.

The samples will be stored in an indoor climate-controlled environment.

6.2. Identification analysis

Samples of the base material of assemblies which have fulfilled the requirements for certification in a P-class will be sent to an accredited testing laboratory for identification analysis according to EN 12802:2001 and EN 12802:2011, provided that the manufacturer requests a certificate for the product, see also Section 7.8. The analysis of the sample will be considered the Initial Type Testing (ITT) of the material.

The result of the identification analysis will be compared with the manufacturer's declaration of constituents of the material (see also Appendix 4). Any deviations between the analysis result and the values declared by the manufacturer shall be within the tolerances defined in EN 12802.

Manufacturers may request copies of the analysis reports of their own products, from the administration of the road trials.

6.3. Factory production control

The manufacturers, participating in the Nordic certification system, are obliged to have a system for factory production control (FPC), following the requirements in EN 13212 and the detailed description in Appendix 2. The manufacturer is responsible for implementing the FPC system.

To maintain the validity of published product certificates, annual audits of the manufacturing process and the FPC system is required. The audits must be executed by a Notified body formally notified to EAD 230011-00-0106 and/or accredited against EN ISO/IEC 17065 or EN/IEC 17021, experienced, and specialized in the analyses of road marking products and the surveillance of the relevant production process. The audit shall not only confirm that a FPC system is in place, but it must also verify that the system is implemented. A copy of the audit report, carried out in the same year and containing all necessary information according to the requirements in Appendix 2, must be sent to NordicCert latest December 31 each year for renewal of the product certificate.

In the case that road marking materials or drop on materials are manufactured by another supplier under licence, the same requirements are placed on a FPC system for that supplier as if the material had been manufactured internally. Annual audits of the FPC system of the external supplier according to the requirements in this document is mandatory for renewal of the product certificate.

All certified materials that are relevant for delivery in the countries where the certification system applies must be included in the annual audit.

If a manufacturer wishes to withdraw a product from certification for one or several years, no audit report of the FPC is required. If the material is re-introduced, an audit report must be handed in again to activate the certification. The report must not be older than one year.

For materials that have been applied to the test fields, but where no certificate has been required from the manufacturer, an audit report of the FPC system must be submitted before the certificate can be issued.

6.4. Assessment system

The Norwegian Public Roads Administration, the Swedish Transport Administration, and the Danish Road Directorate apply an assessment system for materials used in contracts. Material analyses will be carried out both randomly and in case the road authority has reason to believe that the purchased material does not correspond to the product specification.

The assessment system is further described in the report *Method description – assessment of road marking materials used in contracts – Version 2:2019* (Johansen and Fors, 2019).

7. Certification

7.1. General

The certification system applies to Denmark, Iceland, Norway and Sweden.

7.1.1. Iceland, Norway and Sweden

In Iceland, Norway and Sweden, material certification based on the results from the Icelandic-Norwegian-Swedish test site will be required in order to use the road marking material on roads managed by the national road authorities.

7.1.2. Denmark

In Denmark, the material certification will be based on the results from the test site in Denmark, and the documentation will be required in order to use the road marking material on roads managed by the national road authority.

7.1.3. Finland

At present the certification system does not apply to Finland. If Finland decides to join the certification system later, material certifications received from the Icelandic-Norwegian-Swedish road trials will be valid in Finland.

7.2. The certification procedure

The certification procedure consists of several steps and requirements, which are explained in Figure 5. In year 0, the manufacturer registers the material for the certification procedure and applies the material at the test site. Provided that requirements 1–5 are fulfilled, initial performance measurements are carried out. If the material fulfils the performance requirements, it qualifies for follow-up measurements in year 1.

If the material fulfils the performance requirements in one or more P-classes (see Section 7.4) in year 1, the manufacturer may request an identification analysis of the material. If the result of the analysis agrees with the manufacturer's declaration of constituents, a certificate is issued.

If the manufacturer has registered the material for 2- or 3-years follow-up, additional performance measurements are carried out in year 2 and 3, provided that the material fulfilled the performance requirements in the highest P-class in the year before. If the material fulfils the requirements in a higher P-class, the certificate is updated.

From year 3 onwards, the validity of the certificate is maintained provided that annual audits of the manufacturing process and the factory production control are carried out and approved.

Activities that require actions from the manufacturer are:

- Registration of the material, including paying registration fee and submitting necessary product documents.
- Application of the material at the test site.
- Requesting identification analysis of the materials the manufacturer wants to have certified.
- Ensuring that annual audits of the manufacturing process and the factory production control are carried out, and to submit a verification of the audit to the administration of NordicCert.

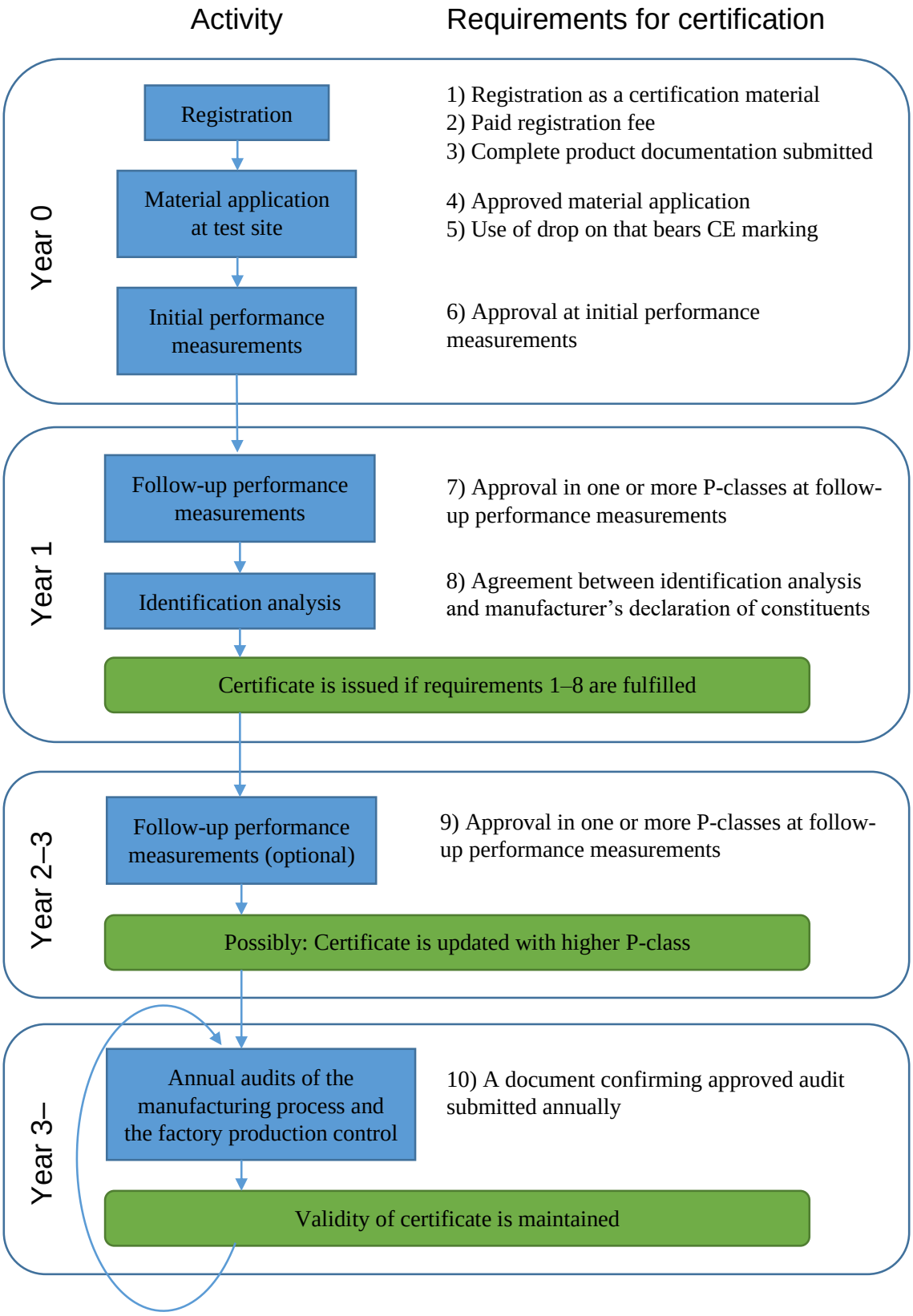

Figure 5. The certification procedure.

7.2.1. Requirements for certification

The requirements for certification are summarized as follows:

- Registration as a certification material (see Section 7.3)
- Paid registration fee (see Section 8.1)
- Complete product documentation (see Section 2.3 and Appendix 4)
- Approved material application (see Sections 4.1–4.5)
- The drop on material used bears CE marking (see Section 2.3)
- Approval at initial performance measurements (see Sections 5.1 and 7.4)
- Approval in one or more P-classes at the follow-up performance measurements (see Sections 5.1, 7.4–7.5)
- Verification of the manufacturer's declaration of constituents by the identification analysis of the sample taken at the test field (see Section 6.2)

To maintain the validity of the certificate, annual audits of the manufacturing process and the factory production control is required (see Section 6.3).

7.3. Certification materials and test materials

Suppliers will have to register their material(s) either as a *certification material,* or as a *test material*, before the material is applied on the test field.

- **Certification material:** The material is applied on the test field for certification purposes, which implies that it will receive certification for use in Iceland, Norway and Sweden, or Denmark, provided that it fulfils the performance requirements. Application and performance measurements will be done in accordance with the procedures described in this report. The results of the materials registered as certification materials will be published in a public report, see Section 7.7. The administration of the road trials may use de-identified data for research purposes.
- **Test material:** The material is applied on the test field for test purposes only. The application and the performance measurement will be done in the same way as for certification materials. The results of the performance measurements will be available to the administration of the road trials, to the supplier of the material as well as to the steering group. The results will be confidential to other suppliers. The administration of the road trials may however use de-identified data for research purposes. Materials registered as test materials **cannot** receive certification. Test materials may be applied on the Icelandic-Norwegian-Swedish as well as on the Danish test site.

The certification comprises the road marking material (paint, thermoplastic and cold plastic materials) in the applied thickness and with the specified drop on material. Materials that are applied as type I markings are certified (provided that they fulfil the performance requirements) for use as type I markings. Materials that are applied as type II markings are certified for use as type II markings only, and as assemblies, i.e. the combination of the material and the design/pattern applied on the test field. Similarly, products that are certified as inlaid markings, antiskid materials, temporary markings, materials for hand application or materials with enhanced durability are certified for the intended use only.

7.4. Performance requirements

The performance requirements include four parameters for type I markings and five parameters for type II markings which are given in Table 1. These requirements apply also to inlaid markings. Table 2 shows the requirements for materials for hand applications and Table 3 shows the performance requirements for materials with enhanced durability and for temporary markings. Table 4 shows the performance requirements for antiskid materials.

Table 1. Performance requirements for type 1 and type II markings, including inlaid markings.

Performance parameter	**Type I, white**	**Type I, yellow**	**Type II, white**	**Type II, yellow**
Coefficient of retroreflected luminance, R_L dry [mcd/m²/lx]	≥ 150	≥ 100	≥ 150	≥ 100
Coefficient of retroreflected luminance, R_L wet [mcd/m²/lx]	n/a	n/a	≥ 35	≥ 35
Luminance coefficient under diffuse illumination, *Qd* [mcd/m²/lx]	≥ 130	≥ 100	≥ 130	≥ 100
Friction, [PFT units]	≥ 0.52	≥ 0.52	≥ 0.52	≥ 0.52
Chromaticity coordinates, x, y	*	**	*	**

*) Type I and II white – Chromaticity coordinates, x, y – According to EN 1436.
**) Type I and II yellow – Chromaticity coordinates, x, y – Includes both daytime (class Y1) and night-time colour (class RC1), according to EN 1436:2018.

Table 2. Performance requirements for materials for hand application.

Performance parameter	**Materials for hand application, retroreflective, white**	**Materials for hand application, retroreflective, yellow**	**Materials for hand application, non-retroreflective, white**	**Materials for hand application, non-retroreflective, yellow**
Coefficient of retroreflected luminance, R_L dry [mcd/m²/lx]	≥100	≥ 100	n/a	n/a
Coefficient of retroreflected luminance, R_L wet [mcd/m²/lx]	n/a	n/a	n/a	n/a
Luminance coefficient under diffuse illumination, *Qd* [mcd/m²/lx]	≥ 130	≥ 100	≥ 130	≥ 100
Friction, [PFT units]	≥ 0.65	≥ 0.65	≥ 0.71	≥ 0.71
Chromaticity coordinates, x, y	*	**	*	**

*) Materials for hand application, retroreflective and non-retroreflective, white – Chromaticity coordinates, x, y – According to EN 1436.
**) Materials for hand application, retroreflective and non-retroreflective, yellow – Chromaticity coordinates, x, y – Includes both daytime (class Y1) and night-time colour (class RC1), according to EN 1436:2018.

Table 3. Performance requirements for materials with enhanced durability and for temporary markings.

Performance parameter	Materials with enhanced durability, white	Materials with enhanced durability, yellow	Temporary markings, white	Temporary markings, yellow
Coefficient of retroreflected luminance, R_L dry [mcd/m²/lx]	n/a	n/a	≥ 150	≥ 200
Coefficient of retroreflected luminance, R_L wet [mcd/m²/lx]	n/a	n/a	n/a	n/a
Luminance coefficient under diffuse illumination, *Qd* [mcd/m²/lx]	≥ 130	≥ 100	≥ 130	≥ 130
Friction, [PFT units]	≥ 0.52	≥ 0.52	≥ 0.52	≥ 0.52
Chromaticity coordinates, x, y	*	**	*	***

*) Materials with enhanced durability and temporary markings, white – Chromaticity coordinates, x, y – According to EN 1436.
**) Material with enhanced durability, yellow – Chromaticity coordinates, x, y – Includes both daytime (class Y1) and night-time colour (class RC1), according to EN 1436:2018.
***) Temporary markings, yellow – Chromaticity coordinates, x, y – Includes both daytime (class Y2) and night-time colour (class RC1), according to EN 1436:2018.

Table 4. Performance requirements for antiskid materials.

Performance parameter	Antiskid materials, white
Coefficient of retroreflected luminance, R_L dry [mcd/m²/lx]	n/a
Coefficient of retroreflected luminance, R_L wet [mcd/m²/lx]	n/a
Luminance coefficient under diffuse illumination, *Qd* [mcd/m²/lx]	≥ 130
Friction, [PFT units]	≥ 0.71
Chromaticity coordinates, x, y	*

*) Antiskid materials, white – Chromaticity coordinates, x, y – According to EN 1436.

Friction will be measured by a PFT, see also Section 5.3. A PFT value of 0.52 corresponds to an SRT value of 50 (class S2 in EN 1436), whereas a PFT value of 0.65 corresponds to an SRT value of 60 (S4). A PFT value of 0.71 corresponds to an SRT value of 65 (S5). In practice, the requirements on friction stated in Table 1–Table 3 are lowered by 0.05 units to take into account the uncertainty when translating from SRT to PFT units (see also the public result reports).

At the initial measurements, the performance parameters are calculated as averages of the nine lines in the lane. For inlaid markings, the performance parameters are calculated as averages of the markings applied in the four milled tracks. At the follow-up measurements, the performance parameters are calculated as averages of the measurement points of one of the lines that belong to a certain P-class, see also Section 7.5.

As the average is the most representative value of the performance of the material, the performance of individual lines will not be evaluated at the initial measurement. This implies that there might be individual lines that do not fulfil the requirements, but as long as the average does, the material will be

approved. This also implies that if the average is below any of the values in Table 1, all lines will be disqualified, regardless of whether individual lines fulfil the requirements.

Materials that do not fulfil the performance requirements at the initial measurement will be excluded from the certification program.

7.5. Certification in relation to roll-over classes

Materials will be certified in relation to the number of wheel passages it will stand. The nine lines on the test field will be exposed to different numbers of wheel passages, which means that different roll-over classes will be reached on different lines.

Roll-over classes according to EN 1824 will be determined from the measurements of wheel passages (see Section 3.3), for each of the nine lines (see Section 4.1), Table 5–Table 6. The tenth line on the shoulder at the Icelandic-Norwegian-Swedish test site will have no wheel passages and will thus not be included in the calculation of the performance parameters for certification purposes.

Materials will be certified for a certain roll-over class (P-class for permanent road markings or T-class for temporary road markings). In order to be certified, all relevant performance requirements (see Section 7.4) must be fulfilled for that particular class.

In case two or more of the nine lines represent the same roll-over class, the line most representative for the class will be chosen for analysis and the performance parameters of this line will be used as the result for that class. The same line will be used for all materials.

The materials must fulfil the requirements for all classes lower than certified for, provided that the lower classes exist on the test field. Example: For a material to be certified as a P3 material, the performance requirements must be fulfilled also for classes P0, P1 and P2.

If a material has been certified for a certain P-class after one year (i.e. at the 1-year follow-up measurement), this certification is valid irrespective of the results of the measurements after two years. The 2-year follow-up measurements will merely be used to evaluate whether the material fulfils the requirement for a higher P-class than what it already is certified for.

The expected roll-over classes for permanent road markings range from P0 to P4 after one year and P5 after two years at the Icelandic-Norwegian-Swedish test site. At the Danish test site, roll-over classes P0–P5 are expected after one year and P5.5–P6 after two years. The time needed to reach the different P-classes will be derived from the measurements of wheel passages, and possibly the points in time for the performance measurements will be adjusted to obtain data representing all (possible) P-classes.

Table 5. Roll-over classes for permanent road markings, EN 1824.

Roll-over class	Number of wheel passages
P0	≤ 50 000
P1	Between 50 000 and 60 000
P2	100 000 (± 20 000)
P3	200 000 (± 40 000)
P4	500 000 (± 100 000)
P5	1 000 000 (± 200 000)
P5.5	1 500 000 (± 150 000)
P6	2 000 000 (± 200 000)
P7	4 000 000 (± 400 000)

Table 6. Roll-over classes for temporary road markings, EN 1824.

Roll-over class	Number of wheel passages
T0	≤ 50 000
T1	Between 50 000 and 60 000
T2	100 000 (± 20 000)

7.6. Validity of certification

Materials that have received certification from the Icelandic-Norwegian-Swedish test site are approved for use in Iceland, Norway and Sweden. Materials that have received certification from the Danish test site are approved for use in Denmark.

A certification is valid for one year and is automatically renewed until the material is changed or until the requirements are changed. Annual audits of the manufacturing process and the FPC system are required for renewal of issued certificates, see also Section 6.3.

Certifications from other European countries are not valid in Iceland, Norway, Sweden, and Denmark due to climatic conditions and/or the use of studded tyres.

7.7. Publications

The results of the follow-up performance measurements of all materials registered as certification materials are published in public reports yearly. Results, i.e. the measured (averaged) values of each performance parameter for each P-class and for each material, are published regardless of whether the material fulfils the requirements or not. The names of the supplier and of the material are published along with the results.

The reports are freely available from www.nordiccert.com and www.vti.se.

The results of the initial measurements are compiled in reports which are distributed to the participants. Materials that are not approved at the initial measurements will not be included in the result reports of the follow-up measurements.

Report forms for registration, application and performance measurements can be found in Appendix 4–5.

7.8. Certificates

7.8.1. Requesting certificates

When the results reports have been published, the manufacturer must request certificates for its products. When a certificate is requested, an identification analysis of the base material is carried out (see Section 6.2). The certificate is issued provided that the identification analysis verifies the manufacturers declaration of constituents and that all other requirements for certification are fulfilled (see Section 7.2). Certificates must be requested within 10 years after the material was initially applied to the test fields.

Certificates are issued in digital form (pdf file with an electronic seal). Certificates are issued after the one-year follow-up performance measurements, regardless of whether the material is registered for one, two or three years follow-up. After the two (and three) years follow-up measurements, new certificates will be issued for materials that fulfils the requirements in higher P-classes. An example of the certificate is shown in Figure 6.

The certificates have a unique identification code (the material ID) that corresponds to the certified material. Certificates issued after one year have the version number “Y1” while certificates issued after two years have the version number “Y2”.

7.8.2. Commercial product names

The product name on the certificate will be identical to that in the registration form. If the manufacturer wishes, there is a possibility to request new certificates with commercial product names. To request a new certificate, the following is required:

- Verification from an accredited[8] laboratory that the product content is identical to the product that was applied on the test field.
- A signed declaration from the participant by person with a legally binding signature, verifying that the materials are identical.

[8] The laboratory shall be accredited according to EN 1871 or to EN 12802.

Certificate

Nordic certification of road marking materials

Date of issue: 2018-03-21
Material ID: TPXW 15-38-DK

Product description	
Producer:	Road marking products A/S Hovedgaden 11, 1234 Copenhagen, Denmark
Material name:	Road marking material DK127
Commercial material name(s):	-
Material type:	Thermoplastic extrusion/screed ☒ Type I ☐ Type II ☐ Friction
Colour of material:	White
Valid for thickness, base material [mm]:	±
Drop on aggregate:	Glass bead products A/S, Dropon glass 810-125 20%
Application method, base material:	Extrusion/screed

Application on test site			
Year of application:	2015	Road surface temperature [°C]:	13
Month of application:	October	Ambient temperature [°C]:	15
Application method:	Hand screed	Relative humidity [%]:	75
Thickness at application [mm]:	3.0	Wind speed [m/s]:	3

Test field characteristics			
Test site:	Rte 237, Hornbæk, Denmark	AADT:	3600
Road surface type:	Flexfalt type 6	Speed limit [km/h]:	80
Year of installation:	2008	Lane width [m]:	3.45
Roughness class (EN 1824):	RG1	Heavy vehicles [%]:	4
Climatic class (EN 1824):	C3	Studded tyres (winter) [%]:	5

Meteorological data	Year 1	Year 2
Annual average temperature [°C]:	9.5	8.7
Average summer temperature (Apr-Sep) [°C]:	14.3	13.4
Average winter temperature (Oct-Mar) [°C]:	4.8	4.1
Annual precipitation [mm]:	692	633
Number of sun hours per month [h]:	126	137
Number of weeks with snow/frost:	7	7
Number of times the snow plough has operated:	5	3
Number of times the road has been salted:	57	44

NORDIC CERT RAMBØLL vti

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Date of issue: 2018-03-21
Material ID: TPXW 15-38-DK

Certification			
Achieved roll-over class:	P3	Valid in countries:	Denmark

Performance requirements and results		
Performance parameter	Requirement	Result*
Coefficient of retroreflected luminance, R_L dry [mcd/m²/lx]:	150	192
Coefficient of retroreflected luminance, R_L wet [mcd/m²/lx]:	-	-
Luminance coefficient under diffuse illumination, Qd [mcd/m²/lx]:	130	155
Friction, [PFT units]:	0.52	0.72
Chromaticity coordinates, daytime, x, y:	**	0.3359, 0.3528
Chromaticity coordinates, night-time, x, y:	-	-, -

*) Result in achieved roll-over class
**) White markings: according to EN 1436. Yellow markings: daytime according to class Y1 in EN 1436, night-time according to ASTM D6628.

Roll-over classes, EN 1824		Climatic cycles
Roll-over class	Number of wheel passages	
P0	≤ 50 000	1
P1	Between 50 000 and 60 000	1
P2	100 000 ± 20 %	1
P3	200 000 ± 20 %	1
P4	500 000 ± 20 %	2
P5	1 000 000 ± 20 %	-
P5.S	1 500 000 ± 20 %	-
P6	2 000 000 ± 20 %	-

Type II profile/pattern	
Profile/pattern: -	Coverage [%]: -

The certification is valid until the material is changed or until the requirements are changed. Further information can be found in *Nordic certification system for road marking materials – Version 4:2017* which is available at www.vti.se.
The certificate is issued by Rambøll and VTI.

Signature	Signature
Trond Cato Johansen, Rambøll trond-cato.johansen@ramboll.se, +47 90 53 65 05	Carina Fors, VTI carina.fors@vti.se, +46 10 20 41 41

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Figure 6. An example of the certificate.

7.9. Lists of certificated products

Updated lists of valid certificates are available at www.nordiccert.com.

7.10. Complaints

Complaints related to measurement results and certification must be sent to the administration of the road trials within two weeks after the result report has been distributed to the participants, preferably by email. The administration of the road trials will handle the complaint and make a decision.

A copy of the decision will be sent to the road authority representatives (see Appendix 6).

7.11. Use of logotype

NordicCert's logotype may be used on labels of the packages of certified road marking materials (paint, thermoplastic and cold plastic materials).

The logotype version to be used on packages is available on www.nordiccert.com, under the *Documents* tab.

8. Registration and practical information

The registration form for participation in the road trials can be found in Appendix 4. To be accepted for participation, the registration form must be completely filled out and all required documents must be enclosed.

Preferably, the information specified in the registration form and in the product documentation shall not be changed after the registration deadline. If changes are necessary, they are handled when the material is applied at the test field. It is the responsibility of the supplier to inform the administration of the road trials about any changes in the registration information or in the product documentation when the material is applied at the test field. The changes must be documented in the application report (Appendix 5). It is also the responsibility of the supplier to hand in new product documentation, if any changes are made. Please note that no changes will be handled from the registration deadline date until the day of application.

An invitation to participate in the road trials, including the registration form and deadline for registration is sent out during the spring by the administration of the road trials.

8.1. Participant fee and other costs

A fee is charged for each material applied on the test fields. For type I, type II and antiskid materials, and for materials for hand application and with enhanced durability, there are two (or three, see below) options:

- 1-year follow-up: Includes administration, performance measurements after two weeks (initial) and after one year (follow-up), and documentation of the results.
  Participant fee: SEK 40 000.
- 2-years follow-up: Includes administration, performance measurements after two weeks (initial) after one year and after two years (follow-up), and documentation of the results.
  Participant fee: SEK 55 000.

For temporary markings and inlaid markings, the following fees apply:

- Temporary markings: 1-3 months follow-up measurements, and documentation of the results.
  Participant fee: SEK 40 000.
- Inlaid markings: Includes administration, milling of the tracks, performance measurements after two weeks (initial) after one year and after two years (follow-up), and documentation of the results.
  Participant fee: SEK 60 000.

Optional 3-years follow-up for materials registered for 2-years follow-up at the Icelandic-Norwegian-Swedish test field: the participant can request 3-years follow-up measurements for materials that have fulfilled the highest P-class after two years. The request must be submitted to the administration of the road trials by 30 June in year three.
Participant fee (additional): **SEK 25 000.**

The same participant fees apply to certification materials and test materials.

The participant fee will be charged before the application of materials. If payment has not been received, materials must not be applied on the test field.

Costs for application of materials (cost of labour, material, equipment) are paid by the supplier.

The administration of the road trials will bear the costs for closing of the road, pre-marking, plates for thickness measurements and containers for material samples.

8.2. Processing of personal data

The name, email address and phone number of the contact person stated on the registration form are stored in digital form and is accessible only to the administration of the road trials. The information is used for communication regarding the certification process. The information will be kept after the certification process of the material is finished, to facilitate further communication. The stored information will be deleted if the manufacturer asks to change contact persons or upon request by the contact person. Further information on the processing of personal data can be found at VTI´s website.

References

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Appendix 1. Terms and definitions

AADT	*Annual average daily traffic*, a measure of traffic flow.
Antiskid material	A material with enhanced antiskid (friction) properties, see also Section 2.1.4
Certification material	A material that is applied on the test field for certification purposes, see also Section 7.3.
Chromaticity coordinates, x, y	Describes the colour of the material. See also EN 1436.
Coefficient of retroreflected luminance, R_L	Retroreflection under vehicle headlamp illumination. See also EN 1436.
Friction	The force resisting the relative motion between two surfaces that are sliding against each other.
Inlaid marking	Inlaid markings are markings that are installed in a milled track, see also Section 2.1.3.
Luminance coefficient under diffuse illumination, *Qd*	Reflection in daylight. See also EN 1436.
Material for hand application	Materials for hand application are typically used for marking pedestrian crossings, text and symbols on the pavement, see also Section 2.1.5.
Material with enhanced durability	Materials intended for longitudinal application in illuminated urban areas with a high number of wheel passages, with no requirement on coefficient of retroreflected luminance, R_L, see also Section 2.1.6.
P-class	The P-class (synonym: roll-over class) describes the number of wheels passing over a point of a road surface within a specified period of time, for permanent road markings. See also Section 7.5 and EN 1824.
PFT	*Portable Friction Tester*, an instrument for measurement of friction. See also Sections 5.3 and 7.4
Roughness class	Describes the roughness of a road surface. See also EN 1824.
SDS	*Safety Data Sheet*, a documentation of the properties and safe use of chemicals.
SRT	*Skid Resistance Tester*, an instrument for measurement of skid resistance (friction). See Skid resistance in EN 1436.
T-class	The T-class (synonym: roll-over class) describes the number of wheels passing over a point of a road surface within a specified period of time, for temporary road markings. See also Section 7.5 and EN 1824.
Temporary marking	Temporary yellow markings are typically in use when traffic must be redirected due to roadworks, see also Section 2.1.7.
Test material	A material that is applied on the test field for test purposes, see also Section 7.3. Test materials **cannot** receive certification.
Type I marking	A flat marking.
Type II marking	A structured/profiled marking with enhanced wet night visibility.

Appendix 2. Factory production control

General

The FPC system shall consist of written procedures with clear tasks and responsibilities, regular inspections, and tests and/or assessments of incoming raw material and components, equipment, the manufacturing process, and the final product. Which test methods that are to be used and the tolerances for the results of each test shall be specified in the FPC system. All procedures, requirements, and results must be documented in a systematic manner and be kept up to date. All operations and results must be recorded.

The FPC system must be designed to ensure that all manufactured products conform to the declared performance characteristics and declared constituents, verified by the initial type testing (ITT). In this case, the ITT is the certified material, with its characteristics declared by documentation handed in by the manufacturer at the time for application at the test fields, and the identification of properties and constituent as determined by analysis of a material sample from the test fields, analyzed according to EN 12802. The FPC system must include procedures for at least the items described in the requirements below. The requirements are based on EN 13212 and EAD 230011-00-0106. The documents can be used as a guide to set up the FPC system, but none of the documents in their entirety can be used to replace the requirements in this instruction.

FPC system requirements

Records and documentation

The manufacturer must have a system for documentation of every step in the production processes from purchasing/delivery of incoming raw materials to storage and delivery of finished products. The records must contain all results from tests used for control of the raw materials, to control the manufacturing process, and to control the final product. The records must include everything that is necessary for traceability and shall include information of the customer of the product.

Responsibilities and competences of personnel

The responsibility, authority and the relationship between personnel that manages, performs, or verifies work affecting product conformity, shall be defined. Personnel performing work that affects product conformity must have relevant competence (appropriate education, training, skills, and experience) and records of this must be maintained. It must also be clear which person that has the overall responsibility for the factory production control and its implementation, and which persons that have responsibility for individual parts of it.

Control and testing of incoming raw materials

The specifications of all incoming raw materials and components shall be documented. There must be an inspection scheme for ensuring all incoming raw material’s conformity and this must be documented. The manufacturer shall have documented procedures and instructions for:

- the use of the relevant materials from approved suppliers,
- the conformity control and testing of all raw materials, for example binders, pigments, fillers, additives, and premix glass beads,
- drop on materials shall be CE-marked, and this must be documented, regardless of whether the material is manufactured by another supplier or in the case of internal production. The manufacturer must keep a record of which drop on material product specifications that work with their respective road marking material (paint, thermoplastic, or cold plastic).

Maintenance and control of functionality of production equipment

All equipment used in the manufacturing process shall be regularly inspected and maintained to ensure that wear or failure does not cause inconsistency in the manufacturing process. The inspections and maintenance shall be carried out in accordance with the manufacturer's written procedures and be documented.

Control of the production process

The manufacturer shall plan and carry out production under controlled conditions. The manufacturer shall have a scheme of the production plant equipment, including the entire production process, from the incoming of the raw material to the storage of the final products. The manufacturing process shall be documented, for example by a flowchart indicating related documents and responsibilities. Processes which are undertaken by subcontractors shall be documented by the manufacturer or the subcontractor as if done on the site of the manufacturer. Control of the production process includes instructions for manufacturing and formulas for different materials.

Maintenance, calibration and functionality of laboratory and testing equipment

All equipment shall be calibrated or verified and regularly inspected according to documented procedures, frequencies, and criteria. The results must be documented. The laboratory for internal control must have the measuring and test equipment necessary to carry out tests according to EN 1871, EN 1790, EN 1423, EN 1424, and EN 12802, for each product type described below. The manufacturer may call upon an external laboratory to carry out the necessary tests and analyses. The mutual obligations of the manufacturer and the external laboratory shall be defined in a written agreement.

Final testing

Test methods, threshold values and tolerances shall be taken from respective product standard; EN 1871, EN 1790, EN 1423, EN 1424, and EN 12802. The minimum frequency of final testing for each product and evaluation as part of FPC shall be as given in Table 7. For cold plastic road markings and preformed road markings, production control and final conformity control shall be according to the requirements in EN 13212.

"Batch" is defined as an amount of product produced as one complete operation not being part of a continuous process.

Table 7. Control plan and minimum frequency of tests according to requirements in EN 13212.

Material/component	Property	Minimum frequency of tests
Paint	Viscosity	Every batch
	Density	Every batch
	Solid content or ash content	Every batch
Thermoplastics (before heat stability tests)	Softening point or indentation	At least once a day for each product
	Binder content or ash content	At least once a day for each product
	Color and luminance factor (x,y; β)	At least once a day for each product
Premix glass beads	Granulometry	Every batch but at least every 5 000 kg
	Quality (defective beads)	Every batch but at least every 5 000 kg
	Refractive index (except for class A glass beads)	Every batch but at least every 5 000 kg
	Surface treatment	Every batch but at least every 5 000 kg
	Dangerous elements (Pb, As, Sb)	Every 1 000 t but at least once a month

Handling, storage, packing and labelling of final product

The manufacturer shall have procedures for product handling and shall provide suitable storage areas. Stored and delivered products must be identifiable and traceable to their production origin with labels including at least trade name, batch number, date of production and date of end of use. In case of bulk delivery, the system shall provide a suitable method for traceability. The manufacturer shall have written procedures ensuring that processes related to affixing traceability codes and markings are inspected regularly.

Instructions to the customer

At delivery to the customer, there must be instructions for handling, storage, and application of the product. The application instructions must include information on which drop on materials that are approved as alternatives by NordicCert (including as a minimum the name of the manufacturer and the product name).

Conformity control

Conformity of the final product with the certified product must be verified by identification testing as a part of the annual audit. The test sample shall be representative of the product. Sampling shall be carried out from either the production line, from final products in storage, or from reference samples in storage. There must be several reference samples that the auditor can select from independently. Identification testing must be performed according to EN 12802 by a laboratory accredited to ISO/IEC 17025 for those methods. The product is analysed and compared to the manufacturer's declaration of constituents, verified by the analysis of the original material sample from the test fields (ITT). Tolerances, expressed in maximum relative deviation or maximum absolute deviation, are specified in EN 12802:2011. The results of the analysis and the comparison to the declaration must be included in the audit report.

Handling of non-conforming products and claims from clients

The manufacturer must have written procedures which specify how non-conforming products shall be dealt with. When non-conformity occurs, it must be recorded, and the records kept for the period defined in the manufacturer's written procedures. Products or batches that are not conforming to the declared performance must be isolated and properly identified. If the non-conformity can be corrected, a repeated verification of conformity shall be carried out. To prevent non-conformities to re-occur, the manufacturer shall also have documented procedures that initiates measures to eliminate the cause.

If products have been delivered before all the results of the testing is available, a procedure and records shall be maintained for notifying customers of the non-conformity. There must also be a complaint register that contain a short chronological view of the received complaints concerning the products, identifying the source of complaint, its content, and its follow-up. The complaint register shall contain the additional documents relating to the treatment of the complaint.

Appendix 3. Procedure for application of alternative drop on materials to an existing certificate

Application and approval process

- Only the holder of the certificate can apply for registration of an alternative drop on system. Once the application is approved, the approval applies to all contractors.
- Application is made by filling out a form available at www.nordiccert.com. The form must be signed by a representative for the owner of the certificate with a legally binding signature, certifying that the drop on systems technical specifications are equivalent, and that the performance of the alternative drop on system will be the same as the drop on system used on the road trails.
- The application must contain following information:
    - Manufacturer and commercial name for the drop on system used on the road trials when the certificate was originally issued.
    - Manufacturer and commercial name for the alternative drop on system.
    - Declaration of performance (DoP) and full technical specifications for both drop on glass beads and anti-skid aggregates must be submitted for the products for which the application relates. The documents must contain all the necessary information to enable NordicCert to assess whether the products are equivalent to the certified material (see requirements below). If the documents handed in at the time for registration at the test field lack important information, supplemental information will be required.
- The application is sent to NordicCert with all requested information.
- NordicCert will review the given information and return with an approval or a dismissal of the application. In the case of a dismissal a motivation will be given.
- Approved systems will be added to the certificates in the coming annual update but will be valid from the date of approval.
- Approved drop on systems for each road marking product will be presented on the website.
- It is possible to apply for several alternative drop on systems. A fee will be charged for each system.
- The fee for application of an alternative drop on system is SEK 7000.
- Permits for alternative drop on materials are valid for one year and are renewed automatically, unless otherwise is informed (see withdrawal process below).

Requirements for approval

It is the responsibility of the certificate owner to ensure that the provided documents contain the information needed for NordicCert to assess if the products are equivalent or not. For an alternative drop on system to be approved, technical specifications and Declaration of performance (DoP) must be equivalent for both products. The alternative drop on system must have the same type of coating, refractive index, granulometry, and anti-skid aggregate. The type of anti-skid aggregates must be the same as certified in the road trials, i.e., if the certificate was issued with glass-grain anti-skid aggregates, glass grains must be used. The relative amount of anti-skid aggregates in the drop on

system must be the same as certified on the road trials. All products must bear the CE marking in accordance with EN 1423:2012.

The parameters given in Table 8 shall be clearly stated in the documentation and must be the same for both products.

Table 8. Requirements for drop on glass bead and anti-skid aggregate parameters.

Drop on glass beads	**Requirement**
Surface treatment of the glass beads	The type of surface coating of the glass beads must be the same, and the type must be declared (e.g. moisture proof, adhesion, floatation, or other type). If no information is provided, it will be assumed that the product does not have any type of coating. If there are combinations of coatings, this must be stated.
Refractive index	The value of the refractive index must be given, and the class (A, B or C) must be the same.
Granulometry	The size gradation of the glass beads must be given in a table with cumulative retained mass and following the requirements for number of sieves and sieve size in EN 1423.
Dangerous substances	The class must be stated and be Class 1: ≤ 200 ppm (mg/kg)
Anti-skid aggregates	
Granulometry	The size gradation of the anti-skid aggregates must be given in a table with cumulative retained mass and following the requirements for number of sieves and sieve size in EN 1423.
Dangerous substances	The class must be stated and be Class 1: ≤ 200 ppm (mg/kg)
Resistance to fragmentation (friability)	The measured value must be given and must be equal or higher.
Chromaticity co-ordinates for non-transparent aggregates	The (x,y) color coordinates must be given.
Luminance factor for non-transparent aggregates.	The measured value must be given and must be equal or higher.

Withdrawal process

If the conditions change, for example if it comes to NordicCert's knowledge that the products do not perform equally, or that the conditions for product approval change due to for example updates of underlying standards, certifications, legislation or the like, the permit can be withdrawn. In that case, this will be announced as soon as possible after a formal decision has been taken and will apply from January 1 the following year. The certificate holder will be informed by email. Complaints must be filed within 20 working days after the information was communicated. If the certificate holder wishes to withdraw alternative drop on materials from its certificates, this is done in writing to NordicCert and applies from January 1 the following year.

Appendix 4. Specifications and forms to be used by the manufacturer

Below are specifications and forms to be used by the manufacturer:

- Specifications for the product data sheet of the road marking material (paint, thermoplastic and cold plastic materials)
- Specifications for the product data sheet of the drop on material
- Specifications for the safety data sheets (SDS)
- Form for the manufacturer's declaration of constituents
  (will be sent out with the invitation email)
- Form for registration for the road trials
  (will be sent out with the invitation email)
- Form for requesting certificates with commercial names
  (can be downloaded from www.nordiccert.com)
- Form for application of alternative drop on material to an existing certificate
  (can be downloaded from www.nordiccert.com)

Specification: Product data sheet for road marking materials

As a minimum, the product sheet of the road marking material (paint, thermoplastic and cold plastic materials) should include the following information:

- Name of material
- Manufacturer and contact information
- Country of origin
- Field(s) of application
- Technical data (if relevant): colour, density, thinner, content (%) of components (eg. binder, solvent, glass beads)
- Application instructions (if relevant):
    - Preparation of material
    - Preparation of road surface
    - Weather restrictions
    - Recommendations on layer thickness
    - Recommendations on drop on material
    - Recommendations on application technique
- Packaging information
- Storage information

Specification: Product data sheet for drop on materials

As a minimum, the product sheet of the drop on material should include the following information:

- Name of material
- Manufacturer and contact information
- Country of origin
- Technical specification (if relevant), see Table 8
- Application instructions (if relevant)
- Affirmation that the product is in accordance with EN 1423
- Packaging information
- Storage information

Specification: Safety data sheets (SDS)

Safety data sheets (SDS) for road marking materials (paint, thermoplastic and cold plastic materials) and for drop on materials must be compiled according to the REACH regulations.

For further information, see:

Understanding REACH (echa.europa.eu)
Guidelines for compilation of safety data sheets (each.europa.eu)

Form: Manufacturer's declaration of constituents

Nordic Certification of Road Marking Materials

Manufacturer's declaration of constituents

Company			
Manufacturer:	Insert text here.		
Contact person:	Insert text here.		
Phone:	Insert text here.		
E-mail:	Insert text here.		
Material			
Name of material:	Insert text here.		
Material type:	☐ Thermoplastic ☐ Cold plastic ☐ Waterborne paint ☐ Other		
Date of production:	Insert text here.		
Batch number:	Insert text here.		
Test site:	☐ Denmark ☐ Norway-Sweden	Year:	Insert text here.
Position at test site (*To be filled in by the administration of the road trials*):			

Constituents	
Density [g/cm³]: *Only relevant for waterborne paint*	Insert text here.
Solids content [w.-%]: *Only relevant for waterborne paint*	Insert text here.
Binder content [w.-%]: *Including other organic constituents such as organic pigments but excluding solvent*	Insert text here.
Titanium dioxide content [w.-%]: *Given in relation to total mass*	Insert text here.
Type of titanium dioxide: *Purity [%] and type (rutile or anatase)*	Insert text here.
Type of binder: *Type (alkyd, C5/C9-hydrocarbon), any plasticizer, other addititves*	Insert text here.
Type of pigment and inorganic substance: *For example: titanium dioxide, dolomite, sand, talc.*	Insert text here.
Glass bead content [w.-%]: *Only relevant for thermoplastics and cold plastics* *(Content of glass beads, anti skid aggregates and coarse particles insoluble in HCl)*	Insert text here.

Signature	
Place and date:	Insert text here.
Signature:	
Clarification of signature:	Insert text here.

Version 2022-05-05

Form: Registration for the road trials

Nordic Certification of Road Marking Materials

Registration of Material

Company			
Manufacturer:	Insert text here.		
Contact person:	Insert text here.		
Phone:	Insert text here.		
E-mail:	Insert text here.		
Address: *(Street address, postal code, city, country)*	Insert text here.	Address on certificates: *(Street address etc or web address. Max 50 characters)*	Insert text here.
Invoicing information			
Invoicing address: *(street address, postal code, city, country OR email address)*	Insert text here.	Reference: (optional)	Insert text here.
		VAT number:	Insert text here.

Material		
Name of material:	Insert text here.	
Country of origin:	Insert text here.	
Material type:	☐ Thermoplastic extrusion/screed ☐ Cold plastic ☐ Thermoplastic spray ☐ Paint ☐ Thermoplastic preformed ☐ Other: Insert text here.	
Density of material: *(When applied)*	Insert text here.	
Name of drop on: *(Full product name, including producer, size distribution, percentage of antiskid material etc)*	Insert text here.	The drop on material bears CE marking: ☐ Yes ☐ No
Rate of application of drop on components:	Insert text here.	
Test site:	☐ Danish test site ☐ Icelandic-Norwegian-Swedish test site	
Certification or test:	☐ Certification material ☐ Test material	
Marking type:	☐ Type I marking ☐ Type II marking, profile/pattern: Insert text here. ☐ Type II inlaid marking *(Norway only)*, profile/pattern: Insert text here. ☐ Antiskid material ☐ Material for hand application, retroreflective ☐ Material for hand application, non-retroreflective ☐ Material with enhanced durability ☐ Temporary marking	

Colour:	☐ White ☐ Yellow ☐ Other: Insert text here. *("Other" is only allowed for test materials)*
Intended thickness at application:	☐ 0.4 mm ☐ 1.5 mm ☐ 5.0 mm *(type II and antiskid materials only)* ☐ 0.6 mm ☐ 3.0 mm
Application method at test field:	☐ Self-propelled machine ☐ By hand
Application method at normal use:	☐ Extrusion/screed ☐ Spray ☐ Manually w/heater
Follow-up:	☐ 1 year, SEK 40 000 ☐ 2 years, SEK 55 000 ☐ 2 years, inlaid markings, SEK 60 000 *(Norway only)* ☐ Temporary markings, SEK 40 000

Signature	
To be accepted for participation, the registration form must be completely filled out and all required documents must be enclosed. The participant fee must be paid before application on the test field.	
I hereby certify that the material complies with current chemicals legislation and practice in the Nordic countries:	☐ Yes
The following documentation is enclosed with the registration form (mandatory)*:	

Document:	Filename:
☐ Product sheet, road marking material	Insert text here.
☐ Product sheet, drop on materials	Insert text here.
☐ Safety Data Sheet (SDS), road marking material	Insert text here.
☐ Safety Data Sheet (SDS), drop on materials	Insert text here.
☐ Manufacturer's declaration of constituents	Insert text here.
☐ Declaration of Performance, drop on materials	Insert text here.

Place and date:	Insert text here.
Signature:	
Clarification of signature:	Insert text here.

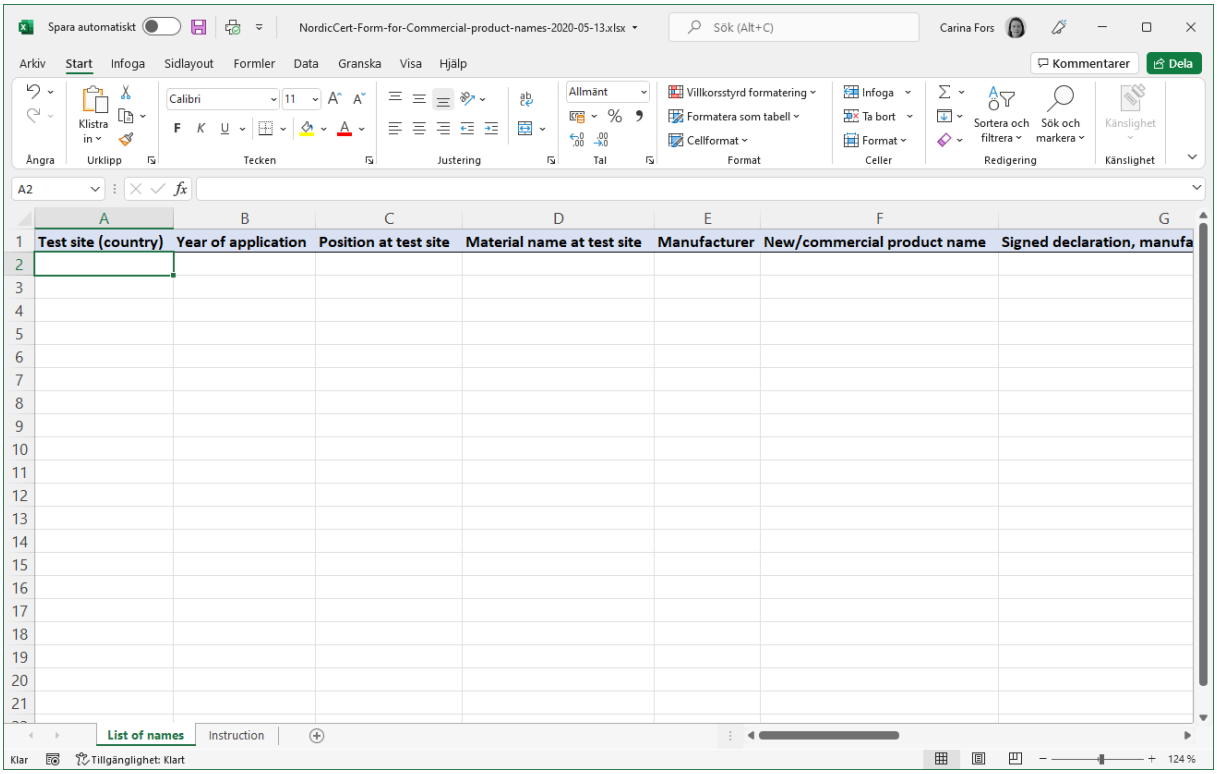
*) Due to the circumstances in 2021, the documentation does not have to be submitted with the registration form in July. A request for the documentation will be sent out later, when the final decision about material application in 2021 has been taken.

To be filled in by the administration of the road trials

Date	
Material ID	

Form: Request of certificates with commercial names

The form for requesting certificates with commercial names can be downloaded from www.nordiccert.com.



Form: Application of alternative drop on material to an existing certificate

The form for application of alternative drop on material to an existing certificate can be downloaded from www.nordiccert.com.

Nordic Certification of Road Marking Materials

Application of alternative drop-on material

Company			
Manufacturer:	Insert text here.	Phone:	Insert text here.
Contact person:	Insert text here.	E-mail:	Insert text here.
Invoicing information			
Invoicing address: *(Street address, postal code, city, country, OR email address)*	Insert text here.	Reference: *(optional)*	Insert text here.
		VAT number:	Insert text here.
Material			
Name of material:	Insert text here.		
Material ID:	Insert text here.		

Drop-on system used at the road trials	
Manufacturer:	Insert text here.
Product name:	Insert text here.
Type of surface treatment of the glass beads:	Insert text here.
Refractive index of glass beads: *Value and class (A, B or C)*	Insert text here.
Granulometry of glass beads:	Given as a table in the documentation
Dangerous substances in glass beads [ppm or mg/kg]: *Value and class (0 or 1)*	Insert text here.
Amount of anti-skid aggregates in the mixture [%]:	Insert text here.
Type of anti-skid aggregates:	Insert text here.
Granulometry of anti-skid aggregates:	Given as a table in the documentation
Dangerous substances in anti-skid aggregates [ppm or mg/kg]: *Value and class (0 or 1)*	Insert text here.
Resistance to fragmentation (friability): *Value*	Insert text here.
Chromaticity co-ordinates for non-transparent aggregates *(x,y) color coordinates*	Insert text here.

Luminance factor for non-transparent aggregates. *Value*	Insert text here.
Documentation:	☐ Declaration of Performance (DoP) ☐ Full technical specification
Alternative drop-on system	
Manufacturer:	Insert text here.
Product name:	Insert text here.
Type of surface treatment of the glass beads:	Insert text here.
Refractive index of glass beads: *Value and class (A, B or C)*	Insert text here.
Granulometry of glass beads:	Given as a table in the documentation
Dangerous substances in glass beads [ppm or mg/kg]: *Value and class (0 or 1)*	Insert text here.
Amount of anti-skid aggregates in the mixture [%]:	Insert text here.
Type of anti-skid aggregates:	Insert text here.
Granulometry of anti-skid aggregates:	Given as a table in the documentation
Dangerous substances in anti-skid aggregates [ppm or mg/kg]: *Value and class (0 or 1)*	Insert text here.
Resistance to fragmentation (friability): *Value*	Insert text here.
Chromaticity co-ordinates for non-transparent aggregates *(x,y) color coordinates*	Insert text here.
Luminance factor for non-transparent aggregates. *Value*	Insert text here.
Documentation:	☐ Declaration of Performance (DoP) ☐ Full technical specification
Signature	
I hereby assure that the drop-on system's technical specifications are equivalent, and that the performance of the alternative drop-on system will be the same as the drop-on system used on the road trials.	☐ Yes ☐ No

Name:	Insert text here.
Place and date:	Insert text here.
Signature:	

Nordic Certification of Road Marking Materials

Application of alternative drop-on material

Administrator's notes		
Date for when the application and all requested information was received:		Insert text here.
The application of use of an alternative drop-on material is::	☐ Approved	☐ Not approved
Motivation *(if not approved)*	Insert text here.	
The permit for the alternative drop-on material is valid for one year and is renewed automatically, unless otherwise is informed. Further information can be found in the document *Nordic certification system for road marking materials* which is available at www.vti.se. The permit is issued by Ramboll and VTI.		
Signature Trond Cato Johansen, Ramboll trond.cato.johansen@ramboll.no, +47 90 53 65 05		Signature Hanna Fager, VTI Hanna.fager@vti.se, +46 13 20 42 51

Appendix 5. Specifications and forms to be used by NordicCert

Below are specifications and forms to be used by the administration of the road trials (NordicCert):

- Specifications for performance measurements
- Form for application of material at the test site

Specification: Performance measurements

The following information is registered during the performance measurements:

- Date
- Test site
- Type of measurement (Initial, 1 year, 2 years, 3 years)
- Operators
- Meteorological data
    - Road marking temperature (˚C)
    - Ambient temperature (˚C)
    - Relative humidity (%)
- For each material:
    - Material ID
    - Position on test site
- For each relevant line of each material (if relevant):
    - $R_{L\text{-}dry}$ (mcd/m^2/lx), three values
    - $R_{L\text{-}wet}$ (mcd/m^2/lx), three values
    - *Qd*, (mcd/m^2/lx), three values
    - Friction, (PFT units), one value
    - Colour, x
    - Colour, y
    - Colour NTY, x
    - Colour NTY, y
    - Comments

Form: Application of material at the test site

Nordic Certification of Road Marking Materials

Application of Material

Test site			
Test site:		Position on test site:	
Manufacturer			
Manufacturer:		Phone:	
Contact person:		Email:	
Material			
Material ID:		Cert or test:	
Name of material:		Material type:	
Country of origin:		Marking type:	
Density:		Type II profile:	
Name of drop on:		Colour:	
Rate of appl.:		Thickness:	
Follow-up:		App method normal use:	

Application			
App method at test field:		Thickness at application *(measured using a steel plate)*:	
Date of application:		_____ mm ☐ Approved ☐ Not approved	
Installed by (contractor):		Thickness samples:	
Application device:		Number:____ ☐ Approved ☐ Not approved	
CE marking, drop on material:	☐ Yes ☐ No	Average thickness: _____ mm	
Type II:	The type of profile has been documented by a photo:	☐ Yes	Coverage:

Meteorological data			
Road surface temperature (˚C):		Wind speed (m/s):	
Ambient temperature (˚C):		Humidity (%):	

Comments
☐ Changes have been made

Supplier's signature			
I hereby approve the application of the material and its participation in the road trials:		☐ Yes ☐ No	
Name:		Signature:	
Place and date:			
Administrator's signature			
The material fulfils the requirements for participation in the road trial:		☐ Yes ☐ No	
Name:		Signature:	
Place and date:			

Appendix 6. Contact information

Road authority representatives

Name	Organisation	E-mail	Phone
Michael Ruben Anker Larsen	The Danish Road Directorate, Denmark	mil@vd.dk	+45 7244 7120
Ásbjörn Ólafsson	The Icelandic Road and Coastal Administration, Iceland	asbjorn.olafsson@vegagerdin.is	+354 522 1123
Björn Skaar	The Norwegian Public Roads Administration, Norway	bjorn.skaar@vegvesen.no	+47 915 02 030
Ulf Söderberg	The Swedish Transport Administration, Sweden	ulf.a.soderberg@trafikverket.se	+46 771 921 921

Administration of the road trials

Name	Organisation	E-mail	Phone
Trond Cato Johansen (Project leader)	Ramboll, Norway	trond.cato.johansen@ramboll.no	+47 905 365 05
Carina Fors	The Swedish National Road and Transport Research Institute (VTI), Sweden	carina.fors@vti.se	+46 709 430 436

For questions about the road trials and the certification system, please contact Trond Cato Johansen.

For questions related to national guidelines, tendering, and contracts, please contact the respective road authority representative.

Application forms for registration for the road trials (including product documentation), request of certificates with commercial names and alternative drop on material is to be submitted by email to application.nordiccert@vti.se

ABOUT VTI

The Swedish National Road and Transport Research Institute (VTI), is an independent and internationally prominent research institute in the transport sector. Our principal task is to conduct research and development related to infrastructure, traffic and transport. We are dedicated to the continuous development of knowledge pertaining to the transport sector, and in this way contribute actively to the attainment of the goals of Swedish transport policy.

Our operations cover all modes of transport, and the subjects of pavement technology, infrastructure maintenance, vehicle technology, traffic safety, traffic analysis, users of the transport system, the environment, the planning and decision making processes, transport economics and transport systems. Knowledge that the institute develops provides a basis for decisions made by stakeholders in the transport sector. In many cases our findings lead to direct applications in both national and international transport policies.

VTI conducts commissioned research in an interdisciplinary organisation. Employees also conduct investigations, provide counseling and perform various services in measurement and testing. The institute has a wide range of advanced research equipment and world-class driving simulators. There are also laboratories for road material testing and crash safety testing.

In Sweden VTI cooperates with universities engaged in related research and education. We also participate continuously in international research projects, networks and alliances.

The Institute is an assignment-based authority under the Ministry of Infrastructure. The Institute holds the quality management systems certificate ISO 9001 and the environmental management systems certificate ISO 14001. Certain test methods used in our labs for crash safety testing and road materials testing are also certified by Swedac.

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