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Nordic certification of road marking materials in Denmark 2017–2019

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Abstract

A Nordic certification system for road marking materials, that applies to the countries of Denmark, Iceland, Norway and Sweden, was introduced in 2015. In these countries, a documented product approval is required in order to use a road marking material on roads managed by the national road authorities (Iceland from 2020). Product approval is based on monitored and documented performance measurements of material samples applied on test fields on public roads. The materials are approved (certified) in relation to the number of wheel passages they will stand, with preserved function.

The certification system includes road marking materials for longitudinal and transverse road markings in categories with respect to colour (white, yellow), type (type I, type II, type II inlaid, antiskid, hand application, non-reflective with enhanced durability, and temporary) and thickness (0.4, 0.6, 1.5, 3 and 5 mm).

The present report documents the follow-up performance measurements that were carried out at the Danish test site in 2019, i.e. one-year follow-up measurements for materials applied in 2018 and the two years follow-up measurements for materials applied in 2017. The performance parameters include the coefficient of retroreflected luminance (R_L) under dry and wet conditions, the luminance coefficient under diffuse illumination (Qd), the friction, and the chromaticity in daylight.

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Referat

En nordisk certifiering av vägmarkeringsmaterial introducerades 2015 och omfattar för närvarande Danmark, Island, Norge och Sverige. I dessa länder krävs ett dokumenterat godkännande av vägmarkeringsmaterial som används på vägar som administreras av den statliga väghållaren (Island från och med 2020). Detta godkännande baseras på funktionsmätningar på materialprover som har applicerats på provfält på allmän väg. Materialen godkänns (certifieras) i relation till antalet hjulpassager de klarar med bibehållen funktion.

Certifieringssystemet omfattar vägmarkeringsmaterial för längsgående och tvärgående vägmarkeringar i olika kategorier med avseende på färg (vit, gul), typ (typ I, typ II, nedfräst typ II, friktion, handläggning, slitstarka icke-reflekterande samt temporära) och tjocklek (0,4; 0,6; 1,5; 3 och 5 mm).

Föreliggande rapport dokumenterar resultaten från de uppföljande funktionsmätningar som gjordes på det danska provfältet 2019, det vill säga ettårsuppföljning av material som lades ut 2018 och tvåårsuppföljning av material som lades ut 2017. Funktionsmätningarna omfattar retroreflexion (R_L) i torrt och vått tillstånd, luminanskoefficient (Qd), friktion och färg i dagsljus.

Titel:	Nordisk certifiering av vägmarkeringsmaterial i Danmark 2017–2019
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Preface

A Nordic certification system for road marking materials was introduced in 2015. Certification of products is based on documented performance measurements of material samples applied on test fields on public roads. This report compiles and presents the results of the performance measurements carried out in 2019 on road marking materials applied for certification at the Danish test site in 2017–2018.

Performance measurements of retroreflection, luminance coefficient, friction and chromaticity coordinates were carried out by operators from Ramböll, supervised by staff from VTI.

The road trials are administered as a joint project between Ramböll AB and the Swedish National Road and Transport Research Institute (VTI). Trond Cato Johansen at Ramböll is the project manager and Carina Fors is the project leader at VTI. Michael Ruben Anker Larsen, the Danish Road Directorate, Ásbjörn Ólafsson, the Icelandic Road and Coastal Administration, Bjørn Skaar, the Norwegian Public Roads Administration and Ulf Söderberg, the Swedish Transport Administration constitute a steering committee for the Nordic certification system.

Drammen, October 2019

Trond Cato Johansen
Project Manager

Quality review

Internal peer review was performed on 3 November 2019 by Anna Anund. Carina Fors has made alterations to the final manuscript of the report. Anna Anund examined and approved the report for publication on 4 November 2019. The conclusions and recommendations expressed are the authors' and do not necessarily reflect VTI's opinion as an authority.

Kvalitetsgranskning

Intern peer review har genomförts 3 november 2019 av Anna Anund. Carina Fors har genomfört justeringar av slutligt rapportmanus. Anna Anund har därefter granskat och godkänt publikationen för publicering 4 november 2019. De slutsatser och rekommendationer som uttrycks är författarnas egna och speglar inte nödvändigtvis myndigheten VTI:s uppfattning.

Contents

Summary

Nordic certification of road marking materials in Denmark 2017–2019

by Trond Cato Johansen (Ramböll) and Carina Fors (VTI)

A Nordic certification system for road marking materials, that applies to the countries of Denmark, Iceland, Norway and Sweden, was introduced in 2015. In these countries, a documented product approval is required in order to use a road marking material on roads managed by the national road authorities (Iceland from 2020). Product approval is based on monitored and documented performance measurements of material samples applied on test fields on public roads. Certification in Denmark is based on the results from a test site in Denmark and certification in Iceland, Norway and Sweden is based on the results from a test site in Norway or in Sweden. The certification system includes road marking materials for longitudinal and transverse road markings in categories with respect to colour (white, yellow), type (type I, type II, type II inlaid, antiskid, hand application, non-reflective with enhanced durability, and temporary) and thickness (0.4, 0.6, 1.5, 3 and 5 mm).

A Danish test site was established in autumn 2015, where between 13 and 32 materials have been applied yearly since then. Approximately two weeks after application, the initial performance of the coefficient of retroreflected luminance R_L under dry and wet conditions, the luminance coefficient under diffuse illumination *Qd*, the friction and the chromaticity in daylight are determined.

Follow-up measurements of the performance parameters mentioned above are carried out one and two years after application. The present report documents the follow-up measurements that were carried out in 2019, i.e. one-year follow-up measurements for materials applied in 2018 and the two years follow-up measurements for materials applied in 2017.

Materials are certified in relation to the number of wheel passages they will stand, with preserved functionality. Depending on the traffic flow, the position in the lane and the exposure time, different roll-over classes (P0–P6, corresponding to ≤50 000–2 000 000 wheel passages, defined by EN 1824) will be reached. For materials applied in 2018, roll-over classes P0, P2, P3, P4 and P5 were reached in 2019 and for materials applied in 2017, roll-over classes P5.5 and P6 was reached in 2019.

Out of the 13 materials applied for certification in 2018, all were approved at the initial measurements and did thus qualify for follow-up measurements. Out of the 13 materials, 7 fulfilled the requirement for roll-over class P5, 9 for class P4, 10 for class P3 and 12 for classes P2 and P0. One material did not fulfil the requirements for any roll-over class.

Seven materials applied in 2017 fulfilled the requirement for class P5 in 2018. The follow-up measurements carried out in 2019 showed that 6 of these materials fulfilled the requirement for class P5.5 and 5 for class P6. Thus, the final result for the 21 materials applied in 2017 is as follows:

- No P-class: 5 materials
- P1: 16 materials
- P2: 16 materials
- P3: 16 materials
- P4: 12 materials
- P5: 7 materials
- P5.5: 6 materials
- P6: 5 materials.

Sammanfattning

Nordisk certifiering av vägmarkeringsmaterial i Danmark 2017–2019

av Trond Cato Johansen (Ramböll) och Carina Fors (VTI)

En nordisk certifiering av vägmarkeringsmaterial introducerades 2015 och avser för närvarande Danmark, Island, Norge och Sverige. I dessa länder krävs ett dokumenterat godkännande av vägmarkeringsmaterial som används på vägar som administreras av den statliga väghållaren (Island från och med 2020). Detta godkännande baseras på funktionsmätningar på vägmarkeringar som har applicerats på provfält på allmän väg. Certifiering i Danmark baseras på resultat från provfält i Danmark, medan certifiering i Island, Norge och Sverige baseras på resultat från provfält i Norge eller i Sverige. Certifieringssystemet omfattar vägmarkeringsmaterial för längsgående och tvärgående vägmarkeringar i olika kategorier med avseende på färg (vit, gul), typ (typ I, typ II, nedfräst typ II, friktion, handläggning, slitstarka icke-reflekterande samt temporära) och tjocklek (0,4; 0,6; 1,5; 3 och 5 mm).

Ett danskt provfält etablerades hösten 2015, där mellan 13 och 32 material har lagts ut för provning varje år sedan dess. Cirka två veckor efter utläggningen görs initiala mätningar av vägmarkeringarnas retroreflexion, R_L i torrt och vått tillstånd, luminanskoefficient, *Qd*, friktion och färg i dagsljus.

Uppföljande mätningar av ovan nämnda funktionsparametrar görs ett respektive två år efter utläggning. Föreliggande rapport dokumenterar resultaten från de uppföljande mätningar som gjordes 2019, det vill säga ettårsuppföljning av material som lades ut 2018 och tvåårsuppföljning av material som lades ut 2017.

Materialen certifieras i relation till antalet hjulpassager de tål med bibehållen funktion. Beroende på trafikflöde, position i körfältet och exponeringstid, uppnås olika hjulpassageklasser (P0–P6, motsvarande ≤50 000–2 000 000 hjulpassager) som definieras av europastandarden EN 1824. På provfältet som lades ut 2018 uppnåddes klasserna P0, P2, P3, P4 och P5 under 2019 och på provfältet som lades ut 2017 uppnåddes klasserna P5.5 och P6 under 2019.

Av de 13 material som lades ut 2018 för certifiering godkändes samtliga vid de initiala mätningarna och de kvalificerade sig därmed för uppföljande mätningar. Av de 13 materialen uppfyllde 7 kraven för hjulpassageklass P5, 9 för klass P4, 10 för klass P3 och 12 för klass P2 och P0. Ett material uppfyllde inte kraven för någon hjulpassageklass.

Sju material som lades ut 2017 uppfyllde kraven för klass P5 under 2018. De uppföljande mätningarna som gjordes 2019 visade att 6 av dessa material uppfyllde kraven för klass P5.5 och 5 för klass P6. De slutgiltiga resultaten för de 21 material som lades ut för certifiering 2017 är således:

- Ingen P-klass: 5 material
- P1: 16 material
- P2: 16 material
- P3: 16 material
- P4: 12 material
- P5: 7 material
- P5.5: 6 material
- P6: 5 material.

1. Introduction

A Nordic certification system for road marking materials, *NordicCert*, that applies to the countries of Denmark, Iceland, Norway and Sweden, was introduced in 2015. In these countries, a documented product approval is required in order to use a road marking material on roads managed by the national road authorities (Iceland from 2020). Product approval is based on monitored and documented performance measurements of material samples applied on test fields on public roads. Certification in Denmark is based on the results from a test site in Denmark and certification in Iceland, Norway and Sweden is based on the results from a test site in Norway or in Sweden. The results from the Icelandic-Norwegian-Swedish test site are presented in a separate report (Johansen and Fors, 2019).

The first round of material tests in Denmark started in October 2015, when 32 materials were applied at a test site located in Hornbæk. In 2016, a new Danish test site was established close to Gørlev, were 22 materials, whereof 20 for certification and 2 for manufacturer's internal test, were applied. In 2017, 2018 and 2019, another 21, 13 and 18 materials respectively, were applied for certification in Gørlev.

Follow-up measurements of the performance parameters coefficient of retroreflected luminance R_L under dry and wet conditions, luminance coefficient under diffuse illumination *Qd*, chromaticity in daylight and friction are carried out one year and two years after application. Thus, in 2019, two-years follow-up measurements for materials applied in 2017 and one-year follow-up measurements for materials applied in 2018 were carried out.

Materials are certified in relation to the number of wheel passages they will stand. Measurements of the transversal distribution of wheel passages have been carried out at the test sites, and roll-over classes (P-classes, defined by EN 1824) have been determined for each of the nine lines of road marking materials that were applied in the lane (see also Section 2.2). For materials applied at the Danish test site in 2017, the P-classes P1, P2, P3, P4 and P5 were reached in 2018 and P-classes P5.5 and P6 were reached in 2019. For materials applied at the Danish test site in 2018, the P-classes P0, P2, P3, P4 and P5 were reached in 2019.

The certification system is further described in the document *Nordic certification system for road marking materials – Version 6:2019* (Fors and Johansen, 2019) which is a public report available at www.vti.se/en/publications and at www.nordiccert.com. The document (and its previous versions) is referred to as *NCSRM-X:201x* in the present report.

Lists of certified materials from 2015 onwards are available at www.nordiccert.com.

1.1. Aim

The aim of this report is to compile and present the results of the follow-up performance measurements carried out in 2019 on the materials applied at the Danish test site in 2017 and in 2018, i.e. the report presents which materials have been certified for use in Denmark, for the P-classes mentioned above. Results for higher P-classes for materials applied in 2018 will be published after the two-years follow-up measurements in 2020.

The report includes results of materials registered as *certification materials*. Results of materials registered as *test materials* will be available only to the specific manufacturer.

2. Test site

The test site in Gørlev, Denmark, was established in 2016. Materials have been applied in 2016, 2017, 2018 and 2019.

2.1. General

The road used for the test site is a two-lane rural road surrounded by an open landscape, Figure 1. The road is relatively straight and flat and without any major junctions. It has an annual average daily traffic (AADT) of around 8 100 vehicles/day and the posted speed limit is 80 km/h. The width of the road is 7.1 m and each lane is 3.30 m wide. The road surface consists of asphalt of type SMA8 that was placed in 2015. The averaged mean texture depth (MTD) is approximately 0.67 mm, i.e. the roughness class is RG2.

Figure 1. The road used for the Danish test site in Gørlev (photo: Trond Cato Johansen, Ramböll).

The Köppen (climatic) classification of the test site is Cfb, based on data for the period 1951–2000 (Kottek, Grieser, Beck, Rudolf and Rubel, 2006). The climatic class of the Danish test site according to the European Standard EN 1824 is C3, i.e. Cfb with winter maintenance. The extent of winter maintenance may vary a lot between years.

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

Further details can be found in the *NCSRM-6:2019.*

2.2. Material application

Each marking material was applied as a row of nine longitudinal lines in the direction of the traffic. The length of the lines was 2.5 m and the width was 0.15 m. The distance between two adjacent rows of lines was at least 2 m. The lines are numbered from right to left in the driving direction, i.e. line 1 is the one next to the edge line and line 9 is the one next to the centre line.

2.3. Traffic volume and wheel passages

Measurements of wheel passages are carried out yearly, in order to determine roll-over classes (P-classes) for the lines, see also Section 4.2. The P-classes for 2019 are based on wheel passage measurements carried out in September 2018. The number and type of vehicles and their lateral position were registered by a portable traffic analyser based on coaxial cable technique, developed at VTI. The measurement equipment was placed in the middle of the test field applied in 2018. Wheel passages were registered for one week.

On average, 3 703 vehicles were registered per day. 91.5 % were passenger cars, 8.0 % were heavy vehicles (trucks and buses) and 0.5 % were other vehicles (two-wheelers and working vehicles). The traffic flow was the highest on Friday (4 323 vehicles) and the lowest on Sunday (2 459 vehicles). The registered traffic flow was compared to AADT information provided by the Danish road directorate, and it was found that the latter (per lane) was 4.5 % higher. Our wheel passage data was thus adjusted according to the AADT data (i.e. increased by 4.5 %).

The transversal distribution of wheel passages tends to move closer to the centre line in darkness compared to daylight. At the test site, passenger vehicles were positioned 6 cm more to the left and heavy vehicles were positioned 8 cm more to the left in darkness. This was adjusted for by calculating normalized wheel passage curves for daylight and darkness, and multiplying them by the amount of traffic that passes in daylight and darkness, for each week during the year.

Figure 2 shows the distribution of wheel passages for the average week, adjusted for AADT data and for variations in distribution due to the light conditions.

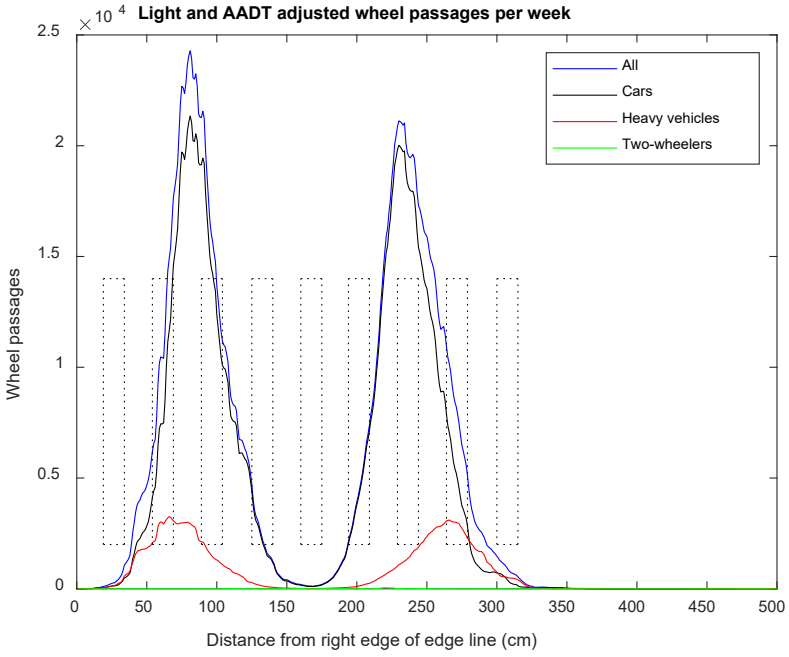

Figure 2. Wheel passages per week at the Danish test field established in 2018 in Gørlev, adjusted for AADT and light conditions (see Section 2.3). The dashed areas correspond to the nine lines. Please note that the shoulder is to the left in the figure, i.e. line 1 is the leftmost line. The number of two-wheelers are too few to be visible in the figure.

Table 1 shows the number of wheel passages per line and week for the test field of 2018, as an average for the 15 cm wide lines (corresponding to the measurement area, see Figure 3–Figure 5).

Table 1. Number of wheel passages per line and week, at the test field of 2018 in Gørlev. Line 1 is the one next to the edge line, see also Figure 3.

Line	Line 1	Line 2	Line 3	Line 4	Line 5	Line 6	Line 7	Line 8	Line 9
Number of wheel passages per week	264	10 600	16 236	2 409	120	4 208	19 965	8 142	957

On the test field of 2017, line 3 and line 7 were selected for P-classes P5.5 and P6 and they had 11 831 and 18 606 wheel passages per week, respectively (see also Section 4.2.1). The lines are positioned somewhat more to the left compared to the lines on the test field of 2018, why the number of wheel passages differs from those in Table 1.

2.4. Weather conditions 2018–2019

The weather conditions from August 2018 to August 2019 are shown in Table 2.

Table 2. Weather conditions at the Danish test site in Gørlev, from August 2018 to August 2019.

Weather parameter	Value
Annual average temperature	9.8 °C
Average summer temperature (Apr-Sep)	14.4 °C
Average winter temperature (Oct-Mar)	5.2 °C
Highest temperature	31.1 °C
Lowest temperature	-5.1 °C
Annual precipitation	556 mm
Number of sun hours per month	151 h
Number of weeks with snow or frost	8
Number of times the snow plough has operated	5
Number of times the road has been salted	52

Weather data was retrieved from *the Danish Meteorological Institute* (DMI), at the following places: Flakkebjerg approximately 28 km south of the test site (temperature, sun hours, snow/frost) and Rye close to the test site (precipitation). Information about snow plough operations and salting was obtained from the Danish road directorate.

3. Performance measurements

3.1. General

Measurements of all performance parameters were carried out by operators from Ramböll, supervised by an observer from VTI. All measurement equipment was calibrated according to procedures recommended by the respective manufacturer.

Performance measurements were carried out in August 2019.

3.2. Methods and measuring instruments

3.2.1. Coefficient of retroreflected luminance R_L and luminance coefficient under diffuse illumination *Qd*

The coefficient of retroreflected luminance, R_L, and the luminance coefficient under diffuse illumination, *Qd*, were measured using an *LTL-XL* (Delta, Denmark). Measurements were taken at three points along the centre line, Figure 3. The result of an individual line was calculated as the average of the three measurements.

The coefficient of retroreflected luminance, R_L, under wet conditions was measured on type II markings (i.e. road markings with special properties intended to enhance the retroreflection in wet or rainy conditions), with the same instrument and measurement points as described above. Approximately 3 litres of clean water was poured over the measurement area, and measurements were carried out 60 seconds afterwards.

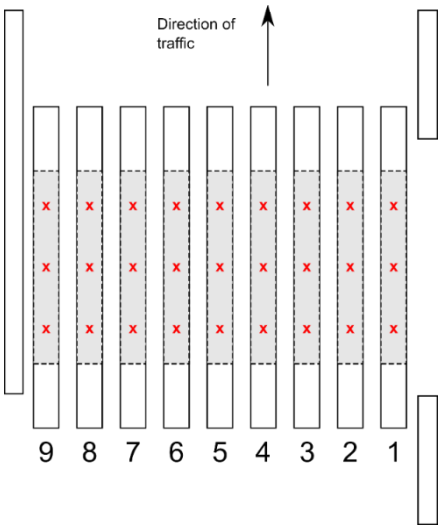

Figure 3. The measurement points (red crosses) for R_L and Qd were placed along the centre line within the measurement area (grey) defined by EN 1824.

The markings were not cleaned before the measurements, but in case a substantial part of the measurement area was abnormally dirty (e.g. oil stain), the instrument was moved in the longitudinal direction to the closest area not affected by abnormal dirt.

Some marking lines were too worn to be measured. If the measurement area of the marking lines were worn in a way that made representative measurements impossible, these single lines were not measured. However, other marking lines of the same product, that were not equally worn, were measured.

3.2.2. Chromaticity coordinates

Chromaticity (colour) coordinates were measured in one point on each line, located at the centre of the line, Figure 4. A *Spectrophotometer CM-2500c* and a *Spectrophotometer CM-25cG* (Konica Minolta, Japan) were used to measure the colour coordinates.

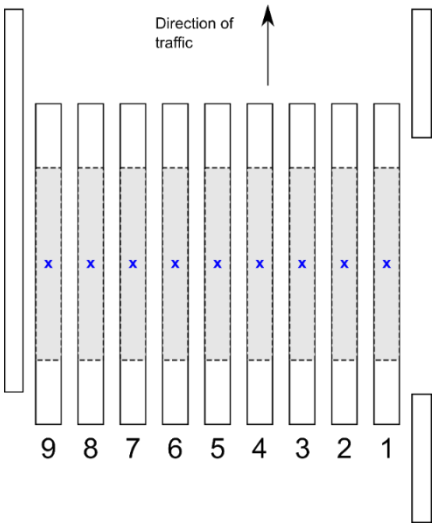

Figure 4. The measurement points (blue crosses) for chromaticity coordinates were placed in the centre of the lines.

For materials with a high degree of wear, the measurement was taken at an area where the material was intact, if possible. For materials that had a very non-homogenous surface (due to unevenly distributed drop-on), an area that appeared to represent the average surface of the material was selected as measurement point. In some cases, several measurement points were selected, to ensure correct chromaticity coordinates. These points had to be located within the grey area in Figure 4.

The markings were not cleaned before the measurements, but in case a substantial part of the measurement area was abnormally dirty (e.g. oil stain), the instrument was moved to the closest area not affected by abnormal dirt.

3.2.3. Friction

Friction measurements were carried out using a *Portable Friction Tester version 4,* PFT (Coralba, Sweden), along the centre of each line, Figure 5. The PFT takes a sample approximately every 1.9 cm and thus, about 70 samples are taken on each line. The result of an individual line is calculated as the average of all samples from that line.

In case there were any notches, joints or other abnormalities on the marking surface, the measurement area/line was either reduced or moved somewhat, so that no samples were taken from the abnormality.

Friction was measured on wetted markings. The friction measurements were always carried out after the measurements of the coefficient of retroreflected luminance, R_L, the luminance coefficient under diffuse illumination, *Qd*, and chromaticity coordinates.

The PFT instrument is further described in Wälivaara (2007).

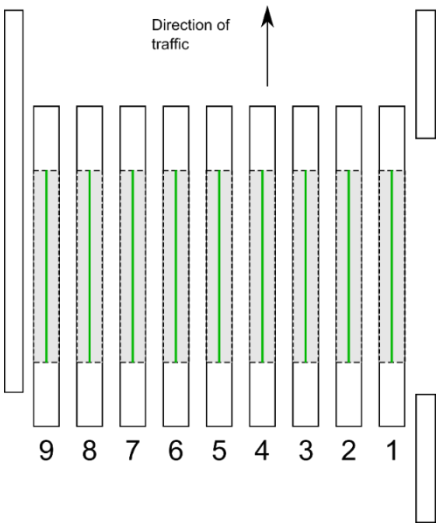

Figure 5. The measurement areas (green lines) for friction.

3.2.4. Measurement values that do not fulfil the performance requirements

In case a measured value was just below the performance requirement (see Section 4.1), extra measurements were taken to assure a correct result. If the new measurement values fulfilled the requirements, this was regarded as the final result and the material was thus approved with respect to that parameter. If the new measurements did not fulfil the requirements, the original measurement was regarded as the final result, i.e. the material was not approved.

3.3. Weather conditions

During the measurements, the weather was shifting between sunshine and cloudy. The air temperature was approximately 20˚ C (morning) – 25˚ C (day/evening). All performance measurements of $R_{L,dry}$, *Qd* and chromaticity coordinates were carried out on absolutely dry markings.

4. Performance requirements

4.1. Performance parameters

The performance requirements include four parameters for type I markings[1], five parameters for type II markings[2] and three parameters for antiskid materials, which are given in Table 3.

Table 3. Performance requirements.

Performance parameter	White markings	Applies to marking type	Antiskid materials
Coefficient of retroreflected luminance, R_L dry [mcd/m^2/lx]	≥ 150	I, II	-
Coefficient of retroreflected luminance, R_L wet [mcd/m^2/lx]	≥ 35	II	-
Luminance coefficient under diffuse illumination, *Qd* [mcd/m^2/lx]	≥ 130	I, II	≥ 130
Friction, [PFT units]	≥ 0.52	I, II	≥ 0.71
Chromaticity coordinates, x, y	*	I, II	*

*) According to EN 1436:2018

Regarding friction, a PFT value of 0.52 corresponds to an SRT value of 50 (class S2 in EN 1436), whereas a PFT value of 0.71 corresponds to an SRT value of 65 (S5). See also Section 4.1.1.

4.1.1. Special considerations regarding friction

A PFT value of 0.52 corresponds to a *Skid Resistance Tester* (SRT) value of 50. The translation from PFT units into SRT units and vice versa results in an uncertainty of approximately 10 % (Wälivaara, 2007). Consequently, there is a risk that a reading of a value just below 0.52 PFT units, in fact has 50 SRT units and therefore should fulfil the requirement.

In order to minimize the risk that materials are rejected because of the uncertainty when translating PFT units into SRT units, the required limit for approval was lowered by approximately 10 % or 0.05 PFT units, from 0.52 to 0.47 for type I and type II markings, and from 0.71 to 0.66 for antiskid materials.

4.2. Certification in relation to P-classes

Materials are certified in relation to the number of wheel passages they will stand. The nine lines within the driving lane are exposed to different numbers of wheel passages, which means that different roll-over classes are reached on different lines at different times.

Roll-over classes according to EN 1824 are determined from the measurements of wheel passages for each line, Table 4.

Materials are thus certified for a certain roll-over class (P-class). In order to be certified, all four (type I markings), five (type II markings) or three (antiskid materials) performance requirements must be fulfilled for that particular class.

[1] Type I refers to flat markings.

[2] Type II refers to markings with special properties intended to enhance the retroreflection in wet or rainy conditions.

Certification is given based on the follow-up measurements one and two years after application. No certification is given based on the initial measurements that are carried out a few weeks after application.

At the follow-up measurements, the performance parameters are defined as the registered value of the line which is the most representative of a certain P-class (see section 4.2.1).

The materials have to fulfil the requirements for all classes lower than that it is certified for, provided that the lower classes exist on the test field. Example: In order for a material to be certified as a P3 material, the performance requirements have to 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 one-year follow-up measurement), this certification is valid irrespective of the results of the measurements after two years. The two-year follow-up measurements are merely used to evaluate whether the material fulfils the requirement for a higher P-class than what it is already certified for.

Table 4. Roll-over classes, EN 1824.

Roll-over class	**Number of wheel passages**
P0	≤ 50 000
P1	Between 50 000 and 60 000
P2	100 000 ± 20 %
P3	200 000 ± 20 %
P4	500 000 ± 20 %
P5	1 000 000 ± 20 %
P5.5	1 500 000 ± 20 %
P6	2 000 000 ± 20 %

4.2.1. P-classes at the Danish test site 2019

For materials applied at the test site in Gørlev in 2017, P-classes P1, P2, P3, P4 and P5 were reached in 2018, and P-classes P5.5 and P6 were reached in 2019. For materials applied in 2018, P-classes P0, P2, P3, P4 and P5 were reached in 2019 and P5.5 and P6 are expected to be reached in 2020. All P-classes were represented by one line, Table 5–Table 6.

Table 5. P-classes at the Danish test site in Gørlev, for materials applied in 2017.

Roll-over class	**Lines**	**Measured**
P0	-	-
P1	Line 1	May 2018
P2	Line 4	May 2018
P3	Line 6	May/August 2018
P4	Line 8	August 2018
P5	Line 7	August 2018
P5.5	Line 3	August 2019
P6	Line 7	August 2019

Table 6. P-classes at the Danish test site in Gørlev, for materials applied in 2018.

Roll-over class	**Lines**	**Measured**
P0	Line 5	August 2019
P1	-	-
P2	Line 4	August 2019
P3	Line 6	August 2019
P4	Line 8	August 2019
P5	Line 7	August 2019
P5.5	-	Summer 2020 (expected)
P6	-	Summer 2020 (expected)

5. Certification of materials applied in 2017

Table 7–Table 12 show the certification of road marking materials in P-classes P1–P6 for materials applied at the test site in Gørlev in 2017. **A** means approved and **NA** not approved material. Empty cells imply that the material was not approved in a lower P-class.

Only materials that were approved at the initial measurements and that participate as *certification materials* with two years follow-up are included in the tables below.

Measurement data per material and P-class can be found in Appendix 1.

5.1. White road markings

5.1.1. Type I

5.1.1.1. Material thickness 1.5 mm

Table 7. Certification of road marking materials for use on Danish roads, roll-over classes P1–P6. White type I materials, 1.5 mm, applied in 2017.

Manufacturer *Material*	**P1**	**P2**	**P3**	**P4**	**P5**	**P5.5**	**P6**
Kelly Bros White Spray Briteline Plus	**A**	**A**	**A**	**A**	**NA**		

5.1.1.2. Material thickness 3 mm

Table 8. Certification of road marking materials for use on Danish roads, roll-over classes P1–P6. White type I materials, 3 mm, applied in 2017.

Manufacturer *Material*	P1	P2	P3	P4	P5	P5.5	P6
Ennis Flint Preform 1 D2017.6	A	A	A	A	NA		
Ennis Flint Preform 2 D2017.7	A	A	A	A	A	NA	
Ennis Flint Screed/Extr. D2017.1	A	A	A	A	A	A	A
Ennis Flint Screed/Extr. D2017.2	A	A	A	A	A	A	A
Ennis Flint Screed/Extr. D2017.3	A	A	A	A	NA		
Geveko Markings PREMARK DK171	A	A	A	NA			
Geveko Markings PREMARK DK172	A	A	A	NA			
Geveko Markings ViaTherm DK24	A	A	A	NA			
Geveko Markings ViaTherm DK35	A	A	A	NA			
Geveko Markings ViaTherm Viking II	NA						
Hot Mix Hot Mix 3000 kombi white	A	A	A	A	NA		

5.1.2. Type II

5.1.2.1. Material thickness 3 mm

Table 9. Certification of road marking materials for use on Danish roads, roll-over classes P1–P6. White type II materials, 3 mm, applied in 2017.

Manufacturer *Material*	P1	P2	P3	P4	P5	P5.5	P6
Ennis Flint Screed/Extr. D2017.4 *Profile/pattern:* Flat	NA						

5.1.2.2. Material thickness 4 mm

Table 10. Certification of road marking materials for use on Danish roads, roll-over classes P1–P6. White type II materials, 4 mm, applied in 2017.

Manufacturer *Material*	P1	P2	P3	P4	P5	P5.5	P6
Geveko Markings ViaTherm DK28 Agglo *Profile/pattern:* Agglo	A	A	A	A	NA		
Geveko Markings ViaTherm DK36 Agglo *Profile/pattern:* Agglo	A	A	A	A	A	A	NA
Kelly Bros Cold White MMA *Profile/pattern:* Agglo	NA						

5.1.3. Antiskid

5.1.3.1. Material thickness 3 mm

Table 11. Certification of road marking materials for use on Danish roads, roll-over classes P1–P6. White antiskid materials, 3 mm, applied in 2017.

Manufacturer *Material*	P1	P2	P3	P4	P5	P5.5	P6
Ennis Flint Screed/Extr. D2017.5	A	A	A	A	A	A	A
Hot Mix Hot Mix 3000 white_F	A	A	A	A	A	A	A

5.1.3.2. Material thickness 4 mm

Table 12. Certification of road marking materials for use on Danish roads, roll-over classes P1–P6. White antiskid materials, 4 mm, applied in 2017.

Manufacturer *Material*	P1	P2	P3	P4	P5	P5.5	P6
Geveko Markings ViaTherm DK65 HF	A	A	A	A	A	A	A

5.2. Summary of the results

Out of the 21 materials applied for certification at the Danish test site in Gørlev in 2017, 16 have received certification in one or more P-classes. The final result, including materials with one and two years follow-up, per material category and P-class is shown in Table 13.

Detailed results for P-classes P1–P5 can be found in the report *Nordic certification of road marking materials in Denmark 2016–2018* (Johansen and Fors, 2018).

Table 13. Summary of the final results for materials applied at the Danish test site in 2017. Number of certified materials per material category and P-class.

	White						
	Type I		Type II		Antiskid		
P-class	**1.5 mm**	**3 mm**	**3 mm**	**4 mm**	**3 mm**	**4 mm**	***Total***
No P-class	-	3	1	1	-	-	*5*
P1	1	10	-	2	2	1	*16*
P2	1	10	-	2	2	1	*16*
P3	1	10	-	2	2	1	*16*
P4	1	6	-	2	2	1	*12*
P5	-	3	-	1	2	1	*7*
P5.5	-	2	-	1	2	1	*6*
P6	-	2	-	-	2	1	*5*

6. Certification of materials applied in 2018

Table 14–Table 15 show the certification of road marking materials in P-classes P0, P2, P3, P4 and P5 for materials applied at the test site in Gørlev in 2018. **A** means approved and **NA** not approved material. Empty cells imply that the material was not approved in a lower P-class.

Only materials that were approved at the initial measurements and that participate as *certification materials* with one or two years follow-up are included in the tables below.

Measurement data per material and P-class can be found in Appendix 1.

6.1. White road markings

6.1.1. Type I

Material thickness 3 mm

Table 14. Certification of road marking materials for use on Danish roads, roll-over classes P0, P2, P3, P4 and P5. White type I materials, 3 mm, applied in 2018.

Manufacturer *Material*	**P0**	**P2**	**P3**	**P4**	**P5**
Ennis Flint Preform1 D2018.6	**A**	**A**	**A**	**A**	**A**
Ennis Flint Preform2 D2018.7	**A**	**A**	**A**	**A**	**A**
Ennis Flint Screed Extrusion D2018.1	**A**	**A**	**A**	**A**	**A**
Ennis Flint Screed Extrusion D2018.2	**A**	**A**	**NA**		
Ennis Flint Screed Extrusion D2018.3	**A**	**A**	**NA**		
Geveko Markings ViaTherm AW-60E	**A**	**A**	**A**	**A**	**A**
Geveko Markings ViaTherm DK18-69E	**A**	**A**	**A**	**A**	**NA**

6.1.2. Type II

Material thickness 5 mm

Table 15. Certification of road marking materials for use on Danish roads, roll-over classes P0, P2, P3, P4 and P5. White type II materials, 5 mm, applied in 2018.

Manufacturer *Material*	**P0**	**P2**	**P3**	**P4**	**P5**
Ennis Flint Multidot D2018.5 *Profile/pattern:* Dots	A	A	A	A	A
Ennis Flint Profile1 D2018.8 *Profile/pattern:* Longflex	A	A	A	A	A
Ennis Flint Screed Extrusion D2018.4 *Profile/pattern:* Dots	A	A	A	A	A
Geveko Markings ViaTherm DK18-69 Agglo *Profile/pattern:* Agglo	A	A	A	A	NA
Geveko Markings ViaTherm DK26-62 Agglo *Profile/pattern:* Agglo	A	A	A	NA	
Geveko Markings ViaTherm DK34-65 LongDot *Profile/pattern:* LongDot	NA				

6.2. Summary of the results

Out of the 13 materials applied for certification at the Danish test site in Gørlev in 2018, 12 have received certification in one or more P-classes after one year. 7 materials fulfilled the requirement for roll-over class P5, 9 fulfilled the requirement for roll-over class P4, 10 fulfilled the requirements for roll-over class P3 and 12 fulfilled the requirement for roll-over classes P2 and P0. One material did not fulfil the requirement for any roll-over class. The result per material category and P-class is shown in Table 16.

The 7 materials that have fulfilled the requirement for roll-over class P5 have the opportunity to receive certification in roll-over classes P5.5 and P6, which are expected to be reached in 2020.

Table 16. Summary of the results after one year for materials applied at the Danish test site in 2018. Number of certified materials per material category and P-class.

	White		
	Type I	**Type II**	
P-class	**3 mm**	**5 mm**	***Total***
No P-class	-	1	*1*
P0	7	5	*12*
P2	7	5	*12*
P3	5	5	*10*
P4	5	4	*9*
P5	4	3	*7*
P5.5	*	*	*
P6	*	*	*

*) Result will be published in 2020.

7. Summary of materials certified for use in Denmark

Table 17 shows the total number of certified materials per category and P-class. Included in the table are results from the one- and two-years follow-up measurements of materials applied in 2015–2017, and the results from the one-year follow-up measurement of materials applied in 2018.

Table 17. The total number of certified materials for use in Denmark, per category and P-class.

	White								
	Type I			Type II			Antiskid		
P-class	**0.4 mm**	**1.5 mm**	**3 mm**	**0.4 mm**	**3 mm**	**4–5 mm***	**3 mm**	**4 mm**	***Total***
No P-class	2	-	13	-	1	4	-	-	*20*
P0	-	3	44	1	-	7	2	1	*58*
P1	-	3	43	-	-	7	2	1	*56*
P2	-	3	39	-	-	7	2	1	*52*
P3	-	1	32	-	-	7	2	1	*43*
P4	-	1	24	-	-	6	2	1	*34*
P5	-	-	10	-	-	4	2	1	*17*
P5.5	-	-	4	-	-	1	2	1	*8*
P6	-	-	4	-	-	-	2	1	*7*

*) 2016–2017: 4 mm. 2018–: 5 mm.

Lists of certified materials from 2015 onwards are available at www.nordiccert.com.

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Appendix 1 – Results of the performance measurements

Table 18–Table 19 show the results for roll-over classes P5.5 and P6 for materials applied in 2017. Table 20–Table 24 show the results for roll-over classes P0, P2, P3, P4 and P5 for materials applied in 2018.

Regarding materials applied in 2017: due to unfortunate circumstances related to the weather forecast and the time restrictions for road closure, two-years follow-up measurements were carried out only on materials that fulfilled the requirements for roll-over class P5 in 2018. No measurement results are thus available for materials that were not approved in class P5 (*n.m.* in the result tables below).

Explanation of the denotations in the result tables	
Parameters	
$R_{L,dry}$	Mean value of the coefficient of retroreflected luminance for dry road marking, $R_{L,dry}$ [mcd/m^2/lx]
$R_{L,wet}$	Mean value of the coefficient of retroreflected luminance for wet road marking, $R_{L,wet}$ [mcd/m^2/lx]
Qd	Mean value of luminance coefficient under diffuse illumination, *Qd* [mcd/m^2/lx]
Frict.	Mean value of friction [PFT units]
Colour	"OK", when colour coordinates are inside the colour box (daylight colour)
Appr.	Approved (**A**) or Not Approved (**NA**) in the P-class referred to
Comments and annotations	
worn	No measurements could be carried out, because the material was too worn.
n.m.	Not measured (if there was a high degree of wear and the material did not fulfil the requirements for one or more of the other parameters). For materials applied in 2017, see explanation above.
d	Disqualified due to missing documentation.
-	The parameter does not apply to the material.

Values that do not fulfil the performance requirements are indicated in orange.

Rows marked in grey indicate that the material has not fulfilled the requirements in a lower P-class. It can thus not be approved in the present P-class.

Materials applied in 2017

Roll-over class P5.5

Table 18. The performance of materials applied at the Danish test site in 2017 after two years. Roll-over class P5.5. White materials, per type and thickness. Alphabetical order by manufacturer.

Manufacturer *Material*	$R_{L,dry}$	$R_{L,wet}$	*Qd*	*Frict.*	*Colour*	*Appr.*
Type I, 1.5 mm						
Kelly Bros White Spray Briteline Plus	n.m.	-	n.m.	n.m.	n.m.	NA
Type I, 3 mm						
Ennis Flint Preform 1 D2017.6	n.m.	-	n.m.	n.m.	n.m.	NA
Ennis Flint Preform 2 D2017.7	132	-	173	0.67	OK	NA
Ennis Flint Screed/Extr. D2017.1	154	-	153	0.73	OK	A
Ennis Flint Screed/Extr. D2017.2	153	-	153	0.78	OK	A
Ennis Flint Screed/Extr. D2017.3	n.m.	-	n.m.	n.m.	n.m.	NA
Geveko Markings PREMARK DK171	n.m.	-	n.m.	n.m.	n.m.	NA
Geveko Markings PREMARK DK172	n.m.	-	n.m.	n.m.	n.m.	NA
Geveko Markings ViaTherm DK24	n.m.	-	n.m.	n.m.	n.m.	NA
Geveko Markings ViaTherm DK35	n.m.	-	n.m.	n.m.	n.m.	NA
Geveko Markings ViaTherm Viking II	n.m.	-	n.m.	n.m.	n.m.	NA
Hot Mix Hot Mix 3000 kombi white	n.m.	-	n.m.	n.m.	n.m.	NA
Type II, 3 mm						
Ennis Flint Screed/Extr. D2017.4	n.m.	n.m.	n.m.	n.m.	n.m.	NA
Type II, 4 mm						
Geveko Markings ViaTherm DK28 Agglo	n.m.	n.m.	n.m.	n.m.	n.m.	NA
Geveko Markings ViaTherm DK36 Agglo	188	48	155	0.65	OK	A
Kelly Bros Cold White MMA	n.m.	n.m.	n.m.	n.m.	n.m.	NA

Manufacturer *Material*	$R_{L,dry}$	$R_{L,wet}$	*Qd*	*Frict.*	*Colour*	*Appr.*
Antiskid, 3 mm						
Ennis Flint Screed/Extr. D2017.5	(33)*	-	148	0.82	OK	**A**
Hot Mix Hot Mix 3000 white_F	(49)*	-	169	0.70	OK	**A**
Antiskid, 4 mm						
Geveko Markings ViaTherm DK65 HF	(38)*	-	152	0.84	OK	**A**

*) No requirement

Roll-over class P6

Table 19. The performance of materials applied at the Danish test site in 2017 after two years. Roll-over class P6. White materials, per type and thickness. Alphabetical order by manufacturer.

Manufacturer *Material*	$R_{L,dry}$	$R_{L,wet}$	*Qd*	*Frict.*	*Colour*	*Appr.*
Type I, 1.5 mm						
Kelly Bros White Spray Briteline Plus	n.m.	-	n.m.	n.m.	n.m.	NA
Type I, 3 mm						
Ennis Flint Preform 1 D2017.6	n.m.	-	n.m.	n.m.	n.m.	NA
Ennis Flint Preform 2 D2017.7	149	-	185	0.66	OK	NA
Ennis Flint Screed/Extr. D2017.1	155	-	170	0.71	OK	A
Ennis Flint Screed/Extr. D2017.2	167	-	175	0.77	OK	A
Ennis Flint Screed/Extr. D2017.3	n.m.	-	n.m.	n.m.	n.m.	NA
Geveko Markings PREMARK DK171	n.m.	-	n.m.	n.m.	n.m.	NA
Geveko Markings PREMARK DK172	n.m.	-	n.m.	n.m.	n.m.	NA
Geveko Markings ViaTherm DK24	n.m.	-	n.m.	n.m.	n.m.	NA
Geveko Markings ViaTherm DK35	n.m.	-	n.m.	n.m.	n.m.	NA
Geveko Markings ViaTherm Viking II	n.m.	-	n.m.	n.m.	n.m.	NA
Hot Mix Hot Mix 3000 kombi white	n.m.	-	n.m.	n.m.	n.m.	NA
Type II, 3 mm						
Ennis Flint Screed/Extr. D2017.4	n.m.	n.m.	n.m.	n.m.	n.m.	NA
Type II, 4 mm						
Geveko Markings ViaTherm DK28 Agglo	n.m.	n.m.	n.m.	n.m.	n.m.	NA
Geveko Markings ViaTherm DK36 Agglo	194	24	159	0.65	OK	NA
Kelly Bros Cold White MMA	n.m.	n.m.	n.m.	n.m.	n.m.	NA
Antiskid, 3 mm						
Ennis Flint Screed/Extr. D2017.5	(38)*	-	171	0.85	OK	A
Hot Mix Hot Mix 3000 white_F	(56)*	-	188	0.73	OK	A

Manufacturer *Material*	$R_{L,dry}$	$R_{L,wet}$	*Qd*	*Frict.*	*Colour*	*Appr.*
Antiskid, 4 mm						
Geveko Markings ViaTherm DK65 HF	(40)*	-	163	0.84	OK	**A**

*) No requirement

Materials applied in 2018

Roll-over class P0

Table 20. The performance of materials applied at the Danish test site in 2018 after one year. Roll-over class P0. White materials, per type and thickness. Alphabetical order by manufacturer.

Manufacturer *Material*	$R_{L,dry}$	$R_{L,wet}$	***Qd***	***Frict.***	***Colour***	***Appr.***
Type I, 3 mm						
Ennis Flint Preform1 D2018.6	205	-	184	0.75	OK	**A**
Ennis Flint Preform2 D2018.7	168	-	183	0.73	OK	**A**
Ennis Flint Screed Extrusion D2018.1	197	-	186	0.59	OK	**A**
Ennis Flint Screed Extrusion D2018.2	191	-	173	0.59	OK	**A**
Ennis Flint Screed Extrusion D2018.3	177	-	179	0.62	OK	**A**
Geveko Markings ViaTherm AW-60E	245	-	155	0.54	OK	**A**
Geveko Markings ViaTherm DK18-69E	245	-	157	0.54	OK	**A**
Type II, 5 mm						
Ennis Flint Multidot D2018.5	301	97	163	0.67	OK	**A**
Ennis Flint Profile1 D2018.8	402	67	156	0.58	OK	**A**
Ennis Flint Screed Extrusion D2018.4	236	71	173	0.68	OK	**A**
Geveko Markings ViaTherm DK18-69 Agglo	227	58	145	0.54	OK	**A**
Geveko Markings ViaTherm DK26-62 Agglo	185	52	143	0.56	OK	**A**
Geveko Markings ViaTherm DK34-65 LongDot	191	31	118	0.60	OK	**NA**

Roll-over class P2

Table 21. The performance of materials applied at the Danish test site in 2018 after one year. Roll-over class P2. White materials, per type and thickness. Alphabetical order by manufacturer.

Manufacturer *Material*	$R_{L,dry}$	$R_{L,wet}$	Qd	Frict.	Colour	Appr.
Type I, 3 mm						
Ennis Flint Preform1 D2018.6	163	-	178	0.64	OK	A
Ennis Flint Preform2 D2018.7	189	-	178	0.63	OK	A
Ennis Flint Screed Extrusion D2018.1	204	-	184	0.55	OK	A
Ennis Flint Screed Extrusion D2018.2	166	-	171	0.58	OK	A
Ennis Flint Screed Extrusion D2018.3	177	-	175	0.59	OK	A
Geveko Markings ViaTherm AW-60E	216	-	154	0.55	OK	A
Geveko Markings ViaTherm DK18-69E	211	-	154	0.52	OK	A
Type II, 5 mm						
Ennis Flint Multidot D2018.5	241	74	164	0.69	OK	A
Ennis Flint Profile1 D2018.8	345	40	159	0.53	OK	A
Ennis Flint Screed Extrusion D2018.4	207	61	165	0.68	OK	A
Geveko Markings ViaTherm DK18-69 Agglo	180	47	138	0.58	OK	A
Geveko Markings ViaTherm DK26-62 Agglo	188	54	146	0.57	OK	A
Geveko Markings ViaTherm DK34-65 LongDot	133	20	127	0.65	OK	NA

Roll-over class P3

Table 22. The performance of materials applied at the Danish test site in 2018 after one year. Roll-over class P3. White materials, per type and thickness. Alphabetical order by manufacturer.

Manufacturer *Material*	$R_{L,dry}$	$R_{L,wet}$	*Qd*	*Frict.*	*Colour*	*Appr.*
Type I, 3 mm						
Ennis Flint Preform1 D2018.6	171	-	177	0.63	OK	A
Ennis Flint Preform2 D2018.7	172	-	173	0.52	OK	A
Ennis Flint Screed Extrusion D2018.1	150	-	167	0.55	OK	A
Ennis Flint Screed Extrusion D2018.2	120	-	150	0.55	OK	NA
Ennis Flint Screed Extrusion D2018.3	124	-	159	0.58	OK	NA
Geveko Markings ViaTherm AW-60E	199	-	162	0.56	OK	A
Geveko Markings ViaTherm DK18-69E	199	-	157	0.52	OK	A
Type II, 5 mm						
Ennis Flint Multidot D2018.5	223	68	168	0.65	OK	A
Ennis Flint Profile1 D2018.8	211	37	159	0.64	OK	A
Ennis Flint Screed Extrusion D2018.4	180	59	167	0.64	OK	A
Geveko Markings ViaTherm DK18-69 Agglo	187	54	154	0.61	OK	A
Geveko Markings ViaTherm DK26-62 Agglo	179	54	157	0.58	OK	A
Geveko Markings ViaTherm DK34-65 LongDot	135	18	130	0.67	OK	NA

Roll-over class P4

Table 23. The performance of materials applied at the Danish test site in 2018 after one year. Roll-over class P4. White materials, per type and thickness. Alphabetical order by manufacturer.

Manufacturer *Material*	$R_{L,dry}$	$R_{L,wet}$	Qd	Frict.	Colour	Appr.
Type I, 3 mm						
Ennis Flint Preform1 D2018.6	192	-	175	0.53	OK	A
Ennis Flint Preform2 D2018.7	188	-	168	0.57	OK	A
Ennis Flint Screed Extrusion D2018.1	181	-	174	0.55	OK	A
Ennis Flint Screed Extrusion D2018.2	135	-	160	0.55	OK	NA
Ennis Flint Screed Extrusion D2018.3	164	-	164	0.57	OK	NA
Geveko Markings ViaTherm AW-60E	205	-	158	0.55	OK	A
Geveko Markings ViaTherm DK18-69E	183	-	159	0.57	OK	A
Type II, 5 mm						
Ennis Flint Multidot D2018.5	232	72	156	0.68	OK	A
Ennis Flint Profile1 D2018.8	216	49	174	0.63	OK	A
Ennis Flint Screed Extrusion D2018.4	174	62	156	0.66	OK	A
Geveko Markings ViaTherm DK18-69 Agglo	151	55	142	0.69	OK	A
Geveko Markings ViaTherm DK26-62 Agglo	146	53	146	0.66	OK	NA
Geveko Markings ViaTherm DK34-65 LongDot	113	17	127	0.66	OK	NA

Roll-over class P5

Table 24. The performance of materials applied at the Danish test site in 2018 after one year. Roll-over class P5. White materials, per type and thickness. Alphabetical order by manufacturer.

Manufacturer *Material*	$R_{L,dry}$	$R_{L,wet}$	Qd	Frict.	Colour	Appr.
Type I, 3 mm						
Ennis Flint Preform1 D2018.6	178	-	172	0.54	OK	A
Ennis Flint Preform2 D2018.7	173	-	167	0.58	OK	A
Ennis Flint Screed Extrusion D2018.1	181	-	168	0.61	OK	A
Ennis Flint Screed Extrusion D2018.2	136	-	156	0.59	OK	NA
Ennis Flint Screed Extrusion D2018.3	145	-	161	0.60	OK	NA
Geveko Markings ViaTherm AW-60E	166	-	164	0.59	OK	A
Geveko Markings ViaTherm DK18-69E	142	-	157	0.58	OK	NA
Type II, 5 mm						
Ennis Flint Multidot D2018.5	211	55	155	0.66	OK	A
Ennis Flint Profile1 D2018.8	160	35	170	0.67	OK	A
Ennis Flint Screed Extrusion D2018.4	165	45	149	0.66	OK	A
Geveko Markings ViaTherm DK18-69 Agglo	136	50	145	0.68	OK	NA
Geveko Markings ViaTherm DK26-62 Agglo	153	34	150	0.66	OK	NA
Geveko Markings ViaTherm DK34-65 LongDot	102	17	127	0.65	OK	NA

VTI, Statens väg- och transportforskningsinstitut, är ett oberoende och internationellt framstående forskningsinstitut inom transportsektorn. Huvuduppgiften är att bedriva forskning och utveckling kring infrastruktur, trafik och transporter. Kvalitetssystemet och miljöledningssystemet är ISO-certifierat enligt ISO 9001 respektive 14001. Vissa provningsmetoder är dessutom ackrediterade av Swedac. VTI har omkring 200 medarbetare och finns i Linköping (huvudkontor), Stockholm, Göteborg, Borlänge och Lund.

The Swedish National Road and Transport Research Institute (VTI), is an independent and internationally prominent research institute in the transport sector. Its principal task is to conduct research and development related to infrastructure, traffic and transport. The institute holds the quality management systems certificate ISO 9001 and the environmental management systems certificate ISO 14001. Some of its test methods are also certified by Swedac. VTI has about 200 employees and is located in Linköping (head office), Stockholm, Gothenburg, Borlänge and Lund.

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