Nordic certification of road marking materials in Iceland, Norway and Sweden 2018–2020

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Abstract

A Nordic certification system for road marking materials, that applies to 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. 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 Icelandic-Norwegian-Swedish test site in 2020, i.e. one-year follow-up measurements for materials applied in 2019 and two-year follow-up measurements for materials applied in 2018. 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, the chromaticity in daylight, and the chromaticity of retroreflected light (yellow materials, only).

Keywords

Road marking material, certification

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. 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 isländsk-norsk-svenska provfältet 2020, det vill säga ettårsuppföljning av material som lades ut 2019 och tvåårsuppföljning av material som lades ut 2018. Funktionsmätningarna omfattar retroreflexion (R_L) i torrt och vått tillstånd, luminanskoefficient (Qd), friktion, färg i dagsljus och färg i fordonsbelysning (för gula material).

Nyckelord

Vägmarkeringsmaterial, certifiering

Preface

A Nordic certification system for road marking materials was introduced in 2015. The 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 2020 on road marking materials applied for certification at the Norwegian-Swedish test site in 2018–2019.

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

The road trials are administered as a joint project between Ramboll and the Swedish National Road and Transport Research Institute (VTI). Trond Cato Johansen at Ramboll 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, November 2020

Trond Cato Johansen
Project Manager

Quality review

An internal peer review was conducted on 9 November 2020 by Anna Anund. Carina Fors has made adjustments to the final report. Research Director Anna Anund has thereafter reviewed and approved the report for publication on 11 November 2020. The conclusions and recommendations in the report are those of the authors and do not necessarily reflect the views of VTI as a government agency.

Kvalitetsgranskning

Intern peer review har genomförts 9 november 2020 av Anna Anund. Carina Fors har genomfört justeringar av slutligt rapportmanus. Forskningschef Anna Anund har därefter granskat och godkänt publikationen för publicering 11 november 2020. De slutsatser och rekommendationer som uttrycks är författarnas egna och speglar inte nödvändigtvis myndigheten VTI:s uppfattning.

Partners

Contents

Summary

Nordic certification of road marking materials in Iceland, Norway and Sweden 2018–2020

by Trond Cato Johansen (Ramboll) 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. A product approval is based on monitored and documented performance measurements of material samples applied on test fields on public roads. A certification in Iceland, Norway and Sweden is based on the results from a test site in Norway or in Sweden and a certification in Denmark is based on the results from a test site in Denmark. 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).

An Icelandic-Norwegian-Swedish test site was established in 2015, where between 43 and 81 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, the chromaticity in daylight, and the chromaticity of retroreflected light (yellow materials, only) 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 2020, i.e. one-year follow-up measurements for materials applied in 2019 and two-year follow-up measurements for materials applied in 2018.

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 2019, roll-over classes P0, P2 and P4 (inlaid: P2 and P4) were reached in 2020 and for materials applied in 2018, roll-over class P5 was reached in 2020.

Out of the 51 materials applied in 2019, 43 (37 white, 6 yellow) were approved at the initial measurements and did thus qualify for follow-up measurements. Out of the 37 white materials, 13 fulfilled the requirement for roll-over class P4, 24 fulfilled the requirement for roll-over class P2 and 28 fulfilled the requirement for roll-over class P0. Nine white materials did not fulfil the requirement for any roll-over class. Out of the six yellow materials, one fulfilled the requirements for roll-over class P4 and two fulfilled the requirement for roll-over classes P2 and P0. Four yellow materials did not fulfil the requirement for any roll-over class.

Seven materials applied in 2018 fulfilled the requirement for class P4 in 2019. The follow-up measurements carried out in 2020 showed that one of these materials fulfilled the requirement for class P5. Thus, the final result for the 42 materials applied in 2018 is as follows:

- No P-class: 22 white, 3 yellow
- P0: 16 white, 1 yellow
- P1: 9 white, 1 yellow
- P2: 7 white, 1 yellow
- P4: 6 white, 1 yellow
- P5: 1 white, 0 yellow.

Sammanfattning

Nordisk certifiering av vägmarkeringsmaterial i Island, Norge och Sverige 2018–2020

av Trond Cato Johansen (Ramboll) 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. Detta godkännande baseras på funktionsmätningar på vägmarkeringar som har applicerats på provfält på allmän väg. Certifiering i Island, Norge och Sverige baseras på resultat från provfält i Norge eller i Sverige, medan certifiering i Danmark baseras på resultat från provfält i Danmark. 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 isländsk-norsk-svenskt provfält etablerades 2015, där mellan 43 och 81 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, färg i dagsljus och färg i fordonsbelysning (för gula material).

Uppföljande mätningar av ovan nämnda funktionsparametrar görs ett respektive två år efter utläggning. Föreliggande rapport dokumenterar resultaten från de uppföljande mätningar som gjordes 2020, det vill säga ettårsuppföljning av material som lades ut 2019 och tvåårsuppföljning av material som lades ut 2018.

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 2019 uppnåddes klasserna P0, P2 och P4 (nedfrästa: P2 och P4) under 2020 och på provfältet som lades ut 2018 uppnåddes klassen P5 under 2020.

Av de 51 material som lades ut för certifiering 2019 godkändes 43 (37 vita, 6 gula) vid de initiala mätningarna och de kvalificerade sig därmed för uppföljande mätningar. Av de 37 vita materialen uppfyllde 13 kraven för hjulpassageklass P4, 24 för klass P2 och 28 för klass P0. 9 vita material uppfyllde inte kraven i någon hjulpassageklass. Av de 6 gula materialen uppfyllde 1 kraven för hjulpassageklass P4 och 2 för klass P2 och P0. 4 gula material uppfyllde inte kraven i någon hjulpassageklass.

Sju material som lades ut 2018 uppfyllde kraven för klass P4 under 2019. De uppföljande mätningarna som gjordes 2020 visade att ett av dessa material uppfyllde kraven för klass P5. De slutgiltiga resultaten för de 42 material som lades ut 2018 är således:

- Ingen P-klass: 22 vita, 3 gula
- P0: 16 vita, 1 gult
- P1: 9 vita, 1 gult
- P2: 7 vita, 1 gult
- P4: 6 vita, 1 gult
- P5: 1 vitt, 0 gula.

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. Product approval is based on monitored and documented performance measurements of material samples applied on test fields on public roads. Certification in Iceland, Norway and Sweden is based on the results from a test site in Norway or in Sweden and certification in Denmark is based on the results from a test site in Denmark. The results from the Danish test site are presented in a separate report (Johansen and Fors, 2020).

The first round of material tests in Iceland-Norway-Sweden started in May 2015, at a test site located in Sunne, Sweden. In 2017, a new test site for certification in Iceland, Norway and Sweden was established in Haslemoen in Norway. In total, 361 materials, whereof 353 for certification and 8 for manufacturer's internal test, have been applied at the Icelandic-Norwegian-Swedish test sites.

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, chromaticity of retroreflected light (yellow materials only) and friction are carried out one year and two years after application. Thus, in 2020, two-years follow-up measurements for materials applied in 2018 and one-year follow-up measurements for materials applied in 2019 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 Sections 2.2). For materials applied at the Icelandic-Norwegian-Swedish test site in 2018, the P-classes P0, P1, P2 and P4 (inlaid markings: P0, P1 and P4) were reached in 2019 and P-class P5 was reached in 2020. For materials applied at the Icelandic-Norwegian-Swedish test site in 2019, the P-classes P0, P2 and P4 (inlaid: P2 and P4) were reached in 2020.

The certification system is further described in the document *Nordic certification system for road marking materials – Version 7:2020* (Fors and Johansen, 2020) which is a public report available at www.vti.se/en/publications and at www.nordiccert.com.

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 2020 on the materials applied at the Icelandic-Norwegian-Swedish test sites in 2018 and in 2019, i.e. the report presents which materials have been certified for use in Iceland, Norway and Sweden, for the P-classes mentioned above. Results for higher P-classes for materials applied in 2019 will be published after the two-years follow-up measurements in 2021.

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. Result reports for materials applied in 2015–2017 are available at www.nordiccert.com.

2. Test site

The present Icelandic-Norwegian-Swedish test site was established in Haslemoen, Norway in 2017. Materials have been applied in 2017, 2018, 2019 and 2020.

2.1. General

The road used for the test site is a two-lane rural road located in Hedmark, close to Haslemoen in eastern Norway, approximately 180 km northeast of Oslo, Figure 1. The road is straight and relatively flat and without any major junctions. The annual average daily traffic (AADT) is 3 300 vehicles/day (measured in 2019, retrieved from Trafikkdata[1]) and the posted speed limit is 90 km/h. The width of the road is 9 m and each lane is 3.15 m from the edge of milling track in the middle to the edge of milling at the edge line.

Figure 1. The road used for the Icelandic-Norwegian-Swedish test site. (Photo: Trond Cato Johansen, Ramboll).

The road surface consists of a stone matrix asphalt (SKA) that was installed in 2016. The roughness class is RG2 i.e. the averaged measured texture depth is in the range of 0.60–0.90 mm.

The Köppen classification of the test site is Dfc, close to the boundary of the Dfb climate zone, based on data for the period 1951–2000 (Kottek, Grieser, Beck, Rudolf and Rubel, 2006). The climatic class according to EN 1824 is C3.

Studded tyres are permitted in Norway from 1 November to the first Sunday after Easter. The estimated percentage of cars with studded tyres is 50–55%.

Further details can be found in Fors and Johansen (2020).

[1] http://www.trafikkdata.no

2.2. Material application

Each marking material was applied as a row of ten 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 2 m. The lines are numbered from right to left in the driving direction, i.e. line 1 is the one on the shoulder and line 10 is the one next to the centre line.

Regarding inlaid materials, line 2, 3, 9 and 10 are inlaid. Line 4–8 are applied as non-inlaid lines and they are not included in the evaluation of the material.

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 the testfield established in 2019 are based on wheel passage measurements carried out in September 2019 and in September 2020, which are presented below. The results of the wheel passage measurements carried out in 2018, which apply to the testfield established in 2018, can be found in Johansen and Fors (2019).

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 an empty position (i.e. were no material was applied), in the middle of the test field of 2019. Wheel passages were registered for one week on each measurement occasion.

On average, 84.6% of the registered vehicles were passenger cars, 15.0% were heavy vehicles, and 0.4% were other vehicles (two wheelers, working vehicles). The registered number of vehicles was adjusted so that it corresponded to the annual average daily traffic (AADT) of 3 311 (in 2018–2019) and 3 119 (in 2019–2020) vehicles per lane, by using information from Trafikkdata[2].

Figure 2 shows the distribution of wheel passages for the average week.

[2] http://www.trafikkdata.no, measurement point Haslemosletta, Rv 2, Hp 11, 4175

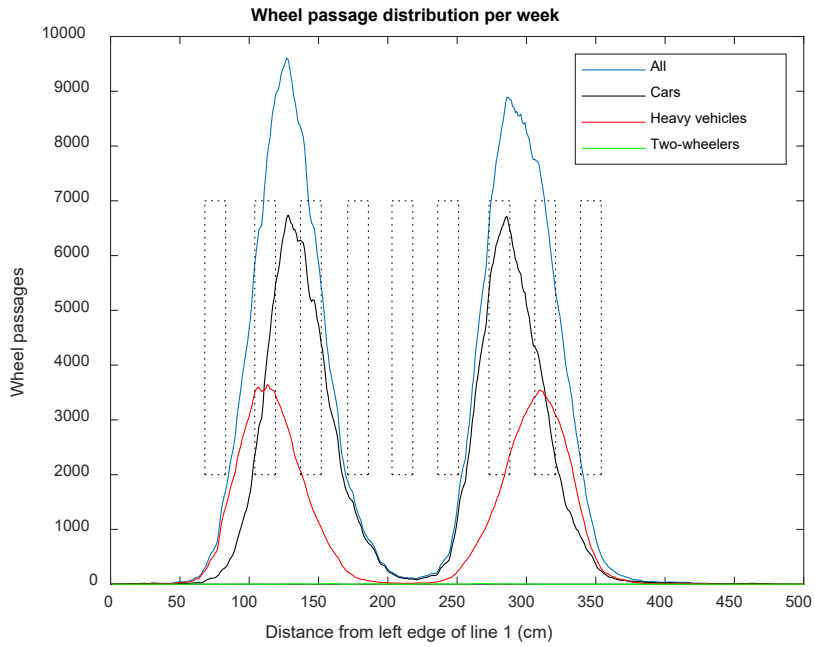

Figure 2. Wheel passages per week at the test field established in Haslemoen in 2019 (measurement in 2020). The dashed areas correspond to the ten lines (line 1 to the left, line 10 to the right). Please note that the shoulder is to the left in the figure. The number of two-wheelers is too few to be visible in the figure.

Table 1 shows the number of wheel passages per line and week for the test field of 2019, as averages for the 15 cm wide lines (corresponding to the measurement area, see Figure 3–Figure 5) and of the two measurements.

Table 1. Number of wheel passages per line and week, at the test field established in Haslemoen in 2019. Line 2 is the one next to the edge line, see also Figure 3.

Line	Line 2	Line 3	Line 4	Line 5	Line 6	Line 7	Line 8	Line 9	Line 10
Number of wheel passages per week	775	8 129	7 056	1 516	150	693	7 753	7 652	1 550

2.4. Weather conditions 2019–2020

The weather conditions from August 2019 to August 2020 are shown in Table 2.

Table 2. Weather conditions at the Icelandic-Norwegian-Swedish test site in Haslemoen, from August 2019 to August 2020.

Weather parameter	**Value**
Annual average temperature	6.3 °C
Average summer temperature (Apr-Sep)	12.0 °C
Average winter temperature (Oct-Mar)	0.6 °C
Highest temperature	30.4 °C
Lowest temperature	-17.9 °C
Annual precipitation	807 mm
Number of sun hours per month	*
Number of weeks with snow	10
Number of times the snow plough has operated	151
Number of times the road has been salted	96

*) No information available

Weather data was retrieved from Yr[3], which is a joint weather service from *the Norwegian Meteorological Institute* and *the Norwegian Broadcasting Corporation*, and from eKlima[4], which is a weather and climate database provided by *the Norwegian Meteorological Institute.* Data on temperature, precipitation and snow are from a weather station located approximately 10 km from the test site.

Information about snow plough operations and salting was obtained from the contractor for winter maintenance.

[3] https://www.yr.no/

[4] http://eklima.met.no/

3. Performance measurements

3.1. General

Measurements of all performance parameters were carried out by operators from Ramboll, 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 September 2020.

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 were poured over the measurement area, and measurements were carried out 60 seconds afterwards.

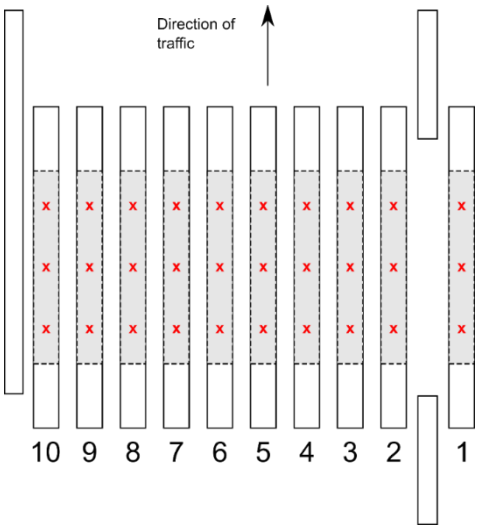

Figure 3. The measurement points (red crosses) for R_L and Qd were placed along the centre line within the measurement area (grey) defined by EN 1824.

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. The chromaticity coordinates of yellow materials in retroreflected light (night-time colour) were measured by an *LTL 2000Y* (Delta, Denmark).

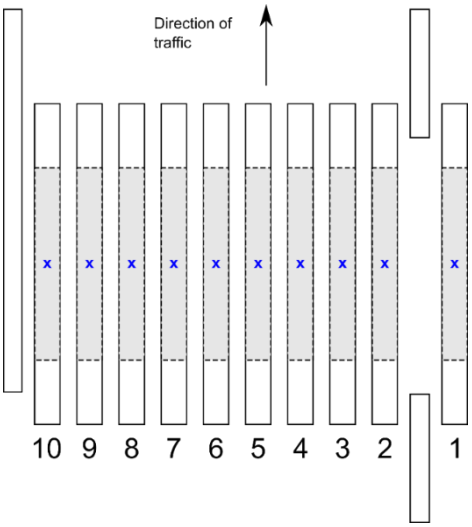

Figure 4. The measurement points (blue crosses) for chromaticity coordinates were placed in the centre of the lines.

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).

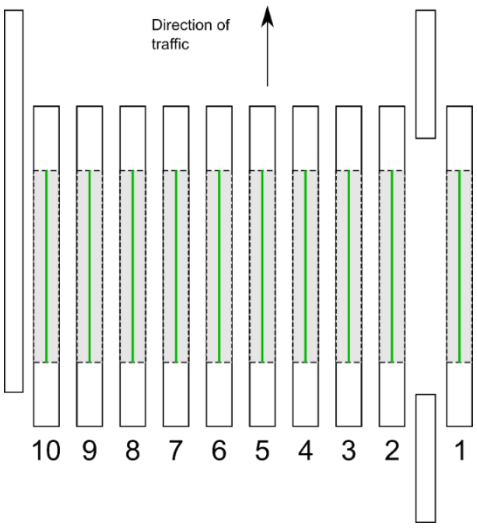

Figure 5. The measurement areas (green lines) for friction.

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 in week 37, it was mostly cloudy, but with some hours of sunshine. The air temperature was approximately 10–18˚ C (day/evening). The road surface temperature was approximately 12–20˚ C. 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[5] and five parameters for type II markings[6] which are given in Table 3. These requirements apply also to inlaid markings. Table 4 shows the requirements for materials for hand applications and Table 5 shows the performance requirements for materials with enhanced durability and for antiskid materials.

Table 3. 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/m^2/lx]	≥ 150	≥ 100	≥ 150	≥ 100
Coefficient of retroreflected luminance, R_L wet [mcd/m^2/lx]	-	-	≥ 35	≥ 35
Luminance coefficient under diffuse illumination, *Qd* [mcd/m^2/lx]	≥ 130	≥ 100	≥ 130	≥ 100
Friction, [PFT units]	≥ 0.52	≥ 0.52	≥ 0.52	≥ 0.52
Chromaticity coordinates, x, y	*	**	*	**

*) According to EN 1436:2018
**) Includes both daytime (class Y1) and night-time colour (class RC1), according to EN 1436:2018

Table 4. 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/m^2/lx]	≥100	≥ 100	-	-
Coefficient of retroreflected luminance, R_L wet [mcd/m^2/lx]	-	-	-	-
Luminance coefficient under diffuse illumination, *Qd* [mcd/m^2/lx]	≥ 130	≥ 100	≥ 130	≥ 100
Friction, [PFT units]	≥ 0.65	≥ 0.65	≥ 0.71	≥ 0.71
Chromaticity coordinates, x, y	*	**	*	**

*) According to EN 1436
**) Includes both daytime (class Y1) and night-time colour (class RC1), according to EN 1436:2018.

[5] Type I refers to flat markings.

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

Table 5. Performance requirements for materials with enhanced durability and antiskid materials.

Performance parameter	Materials with enhanced durability, white	Materials with enhanced durability, yellow	Antiskid materials, white
Coefficient of retroreflected luminance, R_L dry [mcd/m^2/lx]	-	-	-
Coefficient of retroreflected luminance, R_L wet [mcd/m^2/lx]	-	-	-
Luminance coefficient under diffuse illumination, *Qd* [mcd/m^2/lx]	≥ 130	≥ 100	≥ 130
Friction, [PFT units]	≥ 0.52	≥ 0.52	≥ 0.71
Chromaticity coordinates, x, y	*	**	*

*) According to EN 1436
**) Includes both daytime (class Y1) and night-time colour (class RC1), according to EN 1436:2018.
***) Includes both daytime (class Y2) and night-time colour (class RC1), 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 0.65 corresponds to an SRT value of 60 (S4). 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 in the lane, Table 6.

Materials are thus certified for a certain roll-over class (P-class). In order to be certified, all relevant performance requirements (see Section 4.1) must be fulfilled for that particular class.

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 6. 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 Icelandic-Norwegian-Swedish test site 2020

For materials applied at the test site in Haslemoen in 2018, P-classes P0, P1, P2 and P4 were reached in 2019 (inlaid markings: P0, P1 and P4), and P-class P5 was reached in 2020. For materials applied in 2019, P-classes P0, P2 and P4 (inlaid markings: P2 and P4) were reached in 2020 and P5 is expected to be reached in 2021. All P-classes were represented by one line, Table 7–Table 8.

Table 7. P-classes at the test site in Haslemoen, materials applied in 2018.

Roll-over class	Lines, not inlaid	Lines, inlaid	Measured
P0	Line 6	Line 2	August-September 2019
P1	Line 10	Line 10	August-September 2019
P2	Line 7	-	August-September 2019
P3	-	-	-
P4	Line 3	Line 3	August-September 2019
P5	Line 4	Line 3	September 2020

Table 8. P-classes at the test site in Haslemoen, materials applied in 2019.

Roll-over class	**Lines, not inlaid**	**Lines, inlaid**	**Measured**
P0	Line 6	-	September 2020
P1	-	-	-
P2	Line 5	Line 10	September 2020
P3	-	-	-
P4	Line 8	Line 3	September 2020
P5	-	-	Summer 2021 (expected)

5. Certification of materials applied in 2018

Table 7–Table 15 show the certification of road marking materials in P-classes P0, P1, P2, P4 and P5 for materials applied at the test site in Haslemoen 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 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 3 mm

Table 9. Certification of road marking materials for use on Icelandic, Norwegian and Swedish roads, roll-over classes P0–P5. White type I materials, 3 mm, applied in 2018.

Manufacturer *Material*	P0	P1	P2	P4	P5
Ennis Flint Screed Extrusion W2018.1	NA				
Ennis Flint Screed Extrusion W2018.2	NA				
Ennis Flint Screed Extrusion W2018.3	A	A	A	A	NA
Ennis Flint Screed Extrusion W2018.4	A	A	A	A	NA
Hot Mix Hotmix 3000 kombi B	A	A	A	A	NA
Promax Promax prime white typ I 2018	A	A	A	A	NA
Svevia X 1810	A	A	A	A	A
Swarco Vestglas Swarcotherm ERP 18	NA				
Swarco Vestglas Swarcotherm ERP 19	A	A	NA		
Veluvine Thermolit Funen 2018 A	NA				
Veluvine Thermolit Funen 2018 B	NA				

5.1.2. Type II

5.1.2.1. Material thickness 3 mm

Table 10. Certification of road marking materials for use on Icelandic, Norwegian and Swedish roads, roll-over classes P0–P5. White type II materials, 3 mm, applied in 2018.

Manufacturer *Material*	**P0**	**P1**	**P2**	**P4**	**P5**
Swarco Limburger Lackf. Limboplast D492 *Profile/pattern:* Flat	NA				
Swarco Limburger Lackf. Limboplast Reibeplastik Struktur *Profile/pattern:* Flat	NA				
Swarco Limburger Lackf. Limbopl. Reibeplastik Struktur D492 *Profile/pattern:* Flat	NA				

5.1.2.2. Material thickness 5 mm

Table 11. Certification of road marking materials for use on Icelandic, Norwegian and Swedish roads, roll-over classes P0–P5. White type II materials, 5 mm, applied in 2018.

Manufacturer *Material*	**P0**	**P1**	**P2**	**P4**	**P5**
Geveko Markings ViaTherm EXP1850EP W *Profile/pattern:* Chess/Stairs	NA				
Geveko Markings ViaTherm EXP1850EP W *Profile/pattern:* Drops	A	NA			
Geveko Markings ViaTherm EXP1871EP W *Profile/pattern:* Chess/Stairs	NA				
Geveko Markings ViaTherm EXP1871EP W *Profile/pattern:* Drops	A	NA			
Svevia X 1811 *Profile/pattern:* Rolled	A	A	A	NA	
Svevia X 1821 *Profile/pattern:* Rolled	A	NA			

5.1.3. Inlaid type II

5.1.3.1. Material thickness 0.6 mm

Table 12. Certification of road marking materials for use on Icelandic, Norwegian and Swedish roads, roll-over classes P0–P5. White inlaid type II materials, 0.6 mm, applied in 2018.

Manufacturer *Material*	**P0**	**P1**	**P4**	**P5**
Visafo VIT VISA 31 [0.6 mm] *Profile/pattern:* Drop on large beads	NA			

5.1.3.2. Material thickness 5 mm

Table 13. Certification of road marking materials for use on Icelandic, Norwegian and Swedish roads, roll-over classes P0–P5. White inlaid type II materials, 5 mm, applied in 2018.

Manufacturer *Material*	**P0**	**P1**	**P4**	**P5**
Geveko Markings ViaTherm EXP1850EP W *Profile/pattern:* Drops w. bottom line	**A**	**NA**		
Geveko Markings ViaTherm EXP1850EP W *Profile/pattern:* Drops	**A**	**A**	**NA**	
Geveko Markings ViaTherm EXP1871EP W *Profile/pattern:* Drops	**A**	**A**	**A**	**NA**
Kestrel Thermoplastics Eurodot Plus SC White 0018 *Profile/pattern:* Dot'n'line	**A**	**NA**		
Kestrel Thermoplastics Eurodot SC White 0019 *Profile/pattern:* Dots	**NA**			

5.2. Yellow road markings

5.2.1. Type I

5.2.1.1. Material thickness 3 mm

Table 14. Certification of road marking materials for use on Icelandic, Norwegian and Swedish roads, roll-over classes P0–P5. Yellow type I materials, 3 mm, applied in 2018.

Manufacturer *Material*	**P0**	**P1**	**P2**	**P4**	**P5**
Promax Promax prime yellow typ I 2018	**A**	**A**	**A**	**A**	**NA**

5.3. Summary of the results

Out of the 42 materials applied for certification at the Icelandic-Norwegian-Swedish test site in Haslemoen 2018, 17 have received certification in one or more P-classes. The final results, including materials with one and two years follow-up, per material category and P-class are shown in Table 15–Table 16.

Detailed results for P-classes P0–P4 can be found in the report *Nordic certification of road marking materials in Iceland, Norway and Sweden 2017–2019* (Johansen and Fors, 2019).

5.3.1. White road markings

Table 15. Summary of the results for materials applied at the Icelandic-Norwegian-Swedish test site in 2018. Number of certified materials per material category and P-class. White materials.

Material category	No P-class	P0	P1	P2	P4	P5
Type I, 0.4 mm	2	2	-	-	-	-
Type I, 0.6 mm	1	-	-	-	-	-
Type I, 3 mm	10	6	6	5	5	1
Type II, 3 mm	4	-	-	-	-	-
Type II, 5 mm	2	4	1	1	-	-
Inlaid type II, 0.6 mm	2	-	-	-	-	-
Inlaid type II, 5 mm	1	4	2	1	1	-
Total	*22*	*16*	*9*	*7*	*6*	*1*

5.3.2. Yellow road markings

Table 16. Summary of the results for materials applied at the Icelandic-Norwegian-Swedish test site in 2018. Number of certified materials per material category and P-class. Yellow materials.

Material category	No P-class	P0	P1	P2	P4	P5
Type I, 3 mm	3	1	1	1	1	-
Total	*3*	*1*	*1*	*1*	*1*	-

6. Certification of materials applied in 2019

Table 21–Table 31 show the certification of road marking materials in P-classes P0, P2 and P4 for materials applied at the test site in Haslemoen in 2019. **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

6.1.1.1. Material thickness 0.4 mm

Table 17. Certification of road marking materials for use on Icelandic, Norwegian and Swedish roads, roll-over classes P0–P4. White type I materials, 0.4 mm, applied in 2019.

Manufacturer *Material*	**P0**	**P2**	**P4**
Geveko Markings EXP19 60xx A [0.4 mm]	**NA**		
Geveko Markings EXP19 60xx B [0.4 mm]	**NA**		
Geveko Markings EXP19 60xx C [0.4 mm]	**NA**		
Visafo VIT VISA 36 [0.4 mm]	**NA**		
Visafo VIT VISA 37 [0.4 mm]	**NA**		

6.1.1.2. Material thickness 0.6 mm

Table 18. Certification of road marking materials for use on Icelandic, Norwegian and Swedish roads, roll-over classes P0–P4. White type I materials, 0.6 mm, applied in 2019.

Manufacturer *Material*	**P0**	**P2**	**P4**
Geveko Markings EXP19 60xx A [0.6 mm]	**A**	**NA**	
Geveko Markings EXP19 60xx B [0.6 mm]	**A**	**NA**	
Geveko Markings EXP19 60xx C [0.6 mm]	**NA**		
Visafo VIT VISA 37 [0.6 mm]	**NA**		

6.1.1.3. Material thickness 1.5 mm

Table 19. Certification of road marking materials for use on Icelandic, Norwegian and Swedish roads, roll-over classes P0–P4. White type I materials, 1.5 mm, applied in 2019.

Manufacturer *Material*	**P0**	**P2**	**P4**
Kelly Bros White Spray Briteline (NE)	**A**	**NA**	
Kestrel Thermoplastics Eurolux SC White Spray 0023	**A**	**A**	**A**
Promax SSNI19WI	**A**	**A**	**NA**
Svevia X1950	**A**	**A**	**NA**
Svevia X1951	**A**	**A**	**A**

6.1.1.4. Material thickness 3 mm

Table 20. Certification of road marking materials for use on Icelandic, Norwegian and Swedish roads, roll-over classes P0–P4. White type I materials, 3 mm, applied in 2019.

Manufacturer *Material*	**P0**	**P2**	**P4**
Ennis Flint Crystalex W2019.1	**A**	**A**	**A**
Ennis Flint Crystalex W2019.2	**NA**		
Geveko Markings ViaTherm® EXP 18 71 EP	**A**	**A**	**A**
Kelly Bros White Flexi Cold Plastic (NE)	**NA**		
Kestrel Thermoplastics Eurolux SC White 0021	**A**	**A**	**A**
Kestrel Thermoplastics Eurolux SC White 0022	**A**	**A**	**A**
Promax SNI19WI	**A**	**A**	**A**
Scandinavian Road Paint SRP T19	**A**	**A**	**NA**
Svevia X1910	**A**	**A**	**A**
Svevia X1920	**A**	**A**	**A**
Svevia X1930	**A**	**A**	**A**

6.1.2. Type II

6.1.2.1. Material thickness 5 mm

Table 21. Certification of road marking materials for use on Icelandic, Norwegian and Swedish roads, roll-over classes P0–P4. White type II materials, 5 mm, applied in 2019.

Manufacturer *Material*	**P0**	**P2**	**P4**
Hot Mix Hotmix 3000 Type II *Profile/pattern:* Roll	**A**	**NA**	
Promax SNI19WTII *Profile/pattern:* Rullad	**A**	**A**	**NA**
Svevia X1911 [type II] *Profile/pattern:* Rolled	**A**	**A**	**NA**
Svevia X1921 *Profile/pattern:* Rolled	**A**	**A**	**NA**
Svevia X1931 *Profile/pattern:* Rolled	**A**	**A**	**NA**

6.1.3. Inlaid type II

6.1.3.1. Material thickness 5 mm

Table 22. Certification of road marking materials for use on Icelandic, Norwegian and Swedish roads, roll-over classes P2–P4. White inlaid type II materials, 5 mm, applied in 2019.

Manufacturer *Material*	**P2**	**P4**
Geveko Markings ViaTherm® EXP 19 35 E RW2 *Profile/pattern:* Drops	**A**	**NA**
Kestrel Thermoplastics Eurodot SC White 0026 *Profile/pattern:* Dots	**A**	**NA**
Svevia X1911 [type II inlaid] *Profile/pattern:* Rolled	**A**	**NA**

6.1.4. Materials for hand application, retroreflective

6.1.4.1. Material thickness 3 mm

Table 23. Certification of road marking materials for use on Icelandic, Norwegian and Swedish roads, roll-over classes P0–P4. White materials for hand application, retroreflective, 3 mm, applied in 2019.

Manufacturer *Material*	**P0**	**P2**	**P4**
Geveko Markings ViaTherm® EXP 19 73 H	**A**	**A**	**A**
Svevia X1940	**A**	**A**	**A**

6.1.5. Materials for hand application, non-retroreflective

6.1.5.1. Material thickness 3 mm

Table 24. Certification of road marking materials for use on Icelandic, Norwegian and Swedish roads, roll-over classes P0–P4. White materials for hand application, non-retroreflective, 3 mm, applied in 2019.

Manufacturer *Material*	**P0**	**P2**	**P4**
Geveko Markings ViaTherm® EXP 19 73 HF R2 [non-r]	**A**	**A**	**A**

6.1.6. Materials with enhanced durability

6.1.6.1. Material thickness 3 mm

Table 25. Certification of road marking materials for use on Icelandic, Norwegian and Swedish roads, roll-over classes P0–P4. White materials with enhanced durability, 3 mm, applied in 2019.

Manufacturer *Material*	**P0**	**P2**	**P4**
Geveko Markings ViaTherm® EXP 19 57 R0	**A**	**A**	**NA**

6.2. Yellow Road Markings

6.2.1. Type I

6.2.1.1. Material thickness 1.5 mm

Table 26. Certification of road marking materials for use on Icelandic, Norwegian and Swedish roads, roll-over classes P0–P4. Yellow type I materials, 1.5 mm, applied in 2019.

Manufacturer *Material*	**P0**	**P2**	**P4**
Geveko Markings ViaTherm® EXP 19 NTY 73S A	**NA**		

6.2.1.2. Material thickness 3 mm

Table 27. Certification of road marking materials for use on Icelandic, Norwegian and Swedish roads, roll-over classes P0–P4. Yellow type I materials, 3 mm, applied in 2019.

Manufacturer *Material*	**P0**	**P2**	**P4**
Ennis Flint Crystalex Y2019.3	**NA**		
Ennis Flint Crystalex Y2019.4	**NA**		
Geveko Markings ViaTherm® EXP 19 NTY 73E A	**A**	**A**	**A**
Kelly Bros Yellow Extr. / Scr. Briteline (NE)	**NA**		
Promax SNI19YI	**A**	**A**	**NA**

6.3. Summary of the results

Out of the 51 materials – 42 white and 9 yellow – applied for certification at the Icelandic-Norwegian-Swedish test site in Haslemoen 2019, 30 have received certification in one or more P-classes after one year. Out of the 42 white materials, 13 fulfilled the requirement for roll-over class P4, 24 fulfilled the requirement for roll-over class P2 and 28 fulfilled the requirement for roll-over class P0. 14 white materials did not fulfil the requirement for any roll-over class (5 did not fulfil the requirement at the initial measurements and 9 did not fulfil the requirement for class P0). Out of the 9 yellow materials, 1 fulfilled the requirements for roll-over class P4 and 2 fulfilled the requirements for roll-over classes P2 and P0. 7 yellow materials did not fulfil the requirement for any roll-over class (3 did not fulfil the requirement at the initial measurements and 4 did not fulfil the requirement for class P0). The result per material category and P-class is shown in Table 28–Table 29.

The 14 materials that have fulfilled the requirement for roll-over class P4 have the opportunity to receive certification in roll-over class P5, which is expected to be reached in 2021.

6.3.1. White road markings

Table 28. Summary of the results after one year for materials applied at the Icelandic-Norwegian-Swedish test site in 2019. Number of certified materials per material category and P-class. White materials.

Material category	No P-class	P0	P2	P4
Type I, 0.4 mm	5	-	-	-
Type I, 0.6 mm	3	2	-	-
Type I, 1.5 mm	1	5	4	2
Type I, 3 mm	3	9	9	8
Type II, 5 mm	-	5	4	-
Inlaid type II, 5 mm	-	3	3	-
Materials for hand application, retroreflective, 3 mm	2	2	2	2
Materials for hand application, non-retroreflective, 3 mm	-	1	1	1
Materials with enhanced durability, 3 mm	-	1	1	-
Total	*14*	*28*	*24*	*13*

6.3.2. Yellow road markings

Table 29. Summary of the results after one year for materials applied at the Icelandic-Norwegian-Swedish test site in 2019. Number of certified materials per material category and P-class. Yellow materials.

Material category	No P-class	P0	P2	P4
Type I, 1.5 mm	1	-	-	-
Type I, 3 mm	6	2	2	1
Total	*7*	*2*	*2*	*1*

7. Summary of materials certified for use in Iceland, Norway and Sweden

Table 30–Table 31 show 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 2015–2018, and the results from the one-year follow-up measurement of materials applied in 2019.

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

7.1. White road markings

Table 30. The total number of certified materials for use in Iceland, Norway and Sweden, per category and P-class. White materials.

Material category	No P-class	P0	P1	P2	P3	P4	P5
Type I, 0.4 mm	31	2	-	-	-	-	-
Type I, 0.6 mm	7	2	-	-	-	-	-
Type I, 1.5 mm	9	21	19	17	8	5	1
Type I, 3 mm	36	61	60	54	35	26	7
Type II, 0.6 mm	3	-	-	-	-	-	-
Type II, 3 mm	7	-	-	-	-	-	-
Type II, 4–5 mm*	7	19	13	13	-	-	-
Inlaid type II, 0.6 mm	2	-	-	-	-	-	-
Inlaid type II, 5 mm	1	7	5	4	1	1	-
Materials for hand application, retroreflective, 3 mm	2	2	2	2	2	2	-
Materials for hand application, non-retroreflective, 3 mm	-	1	1	1	1	1	-
Materials with enhanced durability, 3 mm	-	1	1	1	-	-	-
Antiskid materials, 4 mm	-	2	2	2	2	2	2
Total	*105*	*118*	*103*	*94*	*49*	*37*	*10*

*) 2016–2017: 4 mm. 2018–: 5 mm.

7.2. Yellow road markings

Table 31. The total number of certified materials for use in Iceland, Norway and Sweden, per category and P-class. Yellow materials.

Material category	No P-class	P0	P1	P2	P3	P4	P5
Type I, 0.4 mm	3	-	-	-	-	-	-
Type I, 0.6 mm	1	-	-	-	-	-	-
Type I, 1.5 mm	15	4	3	3	2	-	-
Type I, 3 mm	39	17	16	12	4	2	-
Type II, 3 mm	2	-	-	-	-	-	-
Type II, 4–5 mm*	2	1	-	-	-	-	-
Total	*62*	*22*	*19*	*15*	*6*	*2*	-

*) 2016–2017: 4 mm. 2018–: 5 mm.

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Appendix 1 – Results of the performance measurements

Table 33–Table 38 show the results for roll-over class P5 for materials applied in 2018.Table 39–Table 70 show the results for roll-over classes P0, P2 and P4 for materials applied in 2019.

Two-years follow-up measurements were carried out only on materials that fulfilled the requirements for roll-over class P4 in year one.

Table 32 explains the denotations in the result tables.

Table 32. Explanation of the denotations in the result tables.

$R_{L,dry}$	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)
NTY	"OK", when colour coordinates are inside the colour box (night-time colour)
Appr.	Approved (**A**) or Not Approved (**NA**) in the P-class referred to
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 or, for two-years follow-up measurements, the material did not fulfil the requirements for the highest roll-over in the one-year follow-up measurement).
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 2018

Roll-over class P5

Table 33. The performance of materials applied at the Icelandic-Norwegian-Swedish test site in 2018 after two years. Roll-over class P5. White materials, type I, 3 mm. Alphabetical order by manufacturer.

Type I, 3 mm ***Manufacturer*** *Material*	***$R_{L,dry}$***	***$R_{L,wet}$***	***Qd***	***Frict.***	***Colour***	***Appr.***
Ennis Flint Screed Extrusion W2018.1	n.m.	-	n.m.	n.m.	n.m.	**NA**
Ennis Flint Screed Extrusion W2018.2	n.m.	-	n.m.	n.m.	n.m.	**NA**
Ennis Flint Screed Extrusion W2018.3	134	-	221	0.84	OK	**NA**
Ennis Flint Screed Extrusion W2018.4	143	-	234	0.79	OK	**NA**
Hot Mix Hotmix 3000 kombi B	126	-	183	0.82	OK	**NA**
Promax Promax prime white typ I 2018	worn	-	worn	worn	worn	**NA**
Svevia X 1810	156	-	211	0.75	OK	**A**
Swarco Vestglas Swarcotherm ERP 18	n.m.	-	n.m.	n.m.	n.m.	**NA**
Swarco Vestglas Swarcotherm ERP 19	n.m.	-	n.m.	n.m.	n.m.	**NA**
Veluvine Thermolit Funen 2018 A	n.m.	-	n.m.	n.m.	n.m.	**NA**
Veluvine Thermolit Funen 2018 B	n.m.	-	n.m.	n.m.	n.m.	**NA**

Table 34. The performance of materials applied at the Icelandic-Norwegian-Swedish test site in 2018 after two years. Roll-over class P5. White materials, type II, 3 mm. Alphabetical order by manufacturer.

Type II, 3 mm ***Manufacturer*** *Material*	***$R_{L,dry}$***	***$R_{L,wet}$***	***Qd***	***Frict.***	***Colour***	***Appr.***
Swarco Limburger Lackf. Limboplast D492	n.m.	n.m.	n.m.	n.m.	n.m.	**NA**
Swarco Limburger Lackf. Limboplast Reibeplastik Struktur	n.m.	n.m.	n.m.	n.m.	n.m.	**NA**
Swarco Limburger Lackf. Limbopl. Reibeplastik Struktur D492	n.m.	n.m.	n.m.	n.m.	n.m.	**NA**

Table 35. The performance of materials applied at the Icelandic-Norwegian-Swedish test site in 2018 after two years. Roll-over class P5. White materials, type II, 5 mm. Alphabetical order by manufacturer.

Type II, 5 mm ***Manufacturer*** *Material*	$R_{L,dry}$	$R_{L,wet}$	*Qd*	*Frict.*	*Colour*	*Appr.*
Geveko Markings ViaTherm EXP1850EP W [Ch./st.]	n.m.	n.m.	n.m.	n.m.	n.m.	**NA**
Geveko Markings ViaTherm EXP1850EP W [Drops]	n.m.	n.m.	n.m.	n.m.	n.m.	**NA**
Geveko Markings ViaTherm EXP1871EP W [Ch./st.]	n.m.	n.m.	n.m.	n.m.	n.m.	**NA**
Geveko Markings ViaTherm EXP1871EP W [Drops]	n.m.	n.m.	n.m.	n.m.	n.m.	**NA**
Svevia X 1811	n.m.	n.m.	n.m.	n.m.	n.m.	**NA**
Svevia X 1821	n.m.	n.m.	n.m.	n.m.	n.m.	**NA**

Table 36. The performance of materials applied at the Icelandic-Norwegian-Swedish test site in 2018 after two years. Roll-over class P5. White materials, inlaid type II, 0.6 mm. Alphabetical order by manufacturer.

Inlaid type II, 0.6 mm ***Manufacturer*** *Material*	$R_{L,dry}$	$R_{L,wet}$	*Qd*	*Frict.*	*Colour*	*Appr.*
Visafo VIT VISA 31 [0.6 mm]	n.m.	n.m.	n.m.	n.m.	n.m.	**NA**

Table 37. The performance of materials applied at the Icelandic-Norwegian-Swedish test site in 2018 after two years. Roll-over class P5. White materials, inlaid type II, 5 mm. Alphabetical order by manufacturer.

Inlaid type II, 5 mm ***Manufacturer*** *Material*	$R_{L,dry}$	$R_{L,wet}$	*Qd*	*Frict.*	*Colour*	*Appr.*
Geveko Markings ViaTherm EXP1850EP W [Drops b. l.]	n.m.	n.m.	n.m.	n.m.	n.m.	**NA**
Geveko Markings ViaTherm EXP1850EP W [Drops]	n.m.	n.m.	n.m.	n.m.	n.m.	**NA**
Geveko Markings ViaTherm EXP1871EP W	109	5	117	0.81	OK	**NA**
Kestrel Thermoplastics Eurodot Plus SC White 0018	n.m.	n.m.	n.m.	n.m.	n.m.	**NA**
Kestrel Thermoplastics Eurodot SC White 0019	n.m.	n.m.	n.m.	n.m.	n.m.	**NA**

Table 38. The performance of materials applied at the Icelandic-Norwegian-Swedish test site in 2018 after two years. Roll-over class P5. Yellow materials, type I, 3 mm. Alphabetical order by manufacturer.

Type I, 3 mm ***Manufacturer*** *Material*	$R_{L,dry}$	$R_{L,wet}$	*Qd*	*Frict.*	*Colour*	*NTY*	*Appr.*
Promax Promax prime yellow typ I 2018	worn	-	worn	worn	worn	worn	**NA**

Materials applied in 2019

Roll-over class P0

Table 39. The performance of materials applied at the Icelandic-Norwegian-Swedish test site in 2019 after one year. Roll-over class P0. White materials, type I, 0.4 mm. Alphabetical order by manufacturer.

Type I, 0.4 mm ***Manufacturer*** *Material*	$R_{L,dry}$	$R_{L,wet}$	*Qd*	*Frict.*	*Colour*	*Appr.*
Geveko Markings EXP19 60xx A [0.4 mm]	102	-	127	0.77	OK	**NA**
Geveko Markings EXP19 60xx B [0.4 mm]	98	-	123	0.78	OK	**NA**
Geveko Markings EXP19 60xx C [0.4 mm]	75	-	131	0.81	OK	**NA**
Visafo VIT VISA 36 [0.4 mm]	164	-	120	0.77	OK	**NA**
Visafo VIT VISA 37 [0.4 mm]	160	-	126	0.77	OK	**NA**

Table 40. The performance of materials applied at the Icelandic-Norwegian-Swedish test site in 2019 after one year. Roll-over class P0. White materials, type I, 0.6 mm. Alphabetical order by manufacturer.

Type I, 0.6 mm ***Manufacturer*** *Material*	$R_{L,dry}$	$R_{L,wet}$	*Qd*	*Frict.*	*Colour*	*Appr.*
Geveko Markings EXP19 60xx A [0.6 mm]	154	-	145	0.79	OK	**A**
Geveko Markings EXP19 60xx B [0.6 mm]	158	-	136	0.79	OK	**A**
Geveko Markings EXP19 60xx C [0.6 mm]	97	-	158	0.82	OK	**NA**
Visafo VIT VISA 37 [0.6 mm]	87	-	143	0.86	OK	**NA**

Table 41. The performance of materials applied at the Icelandic-Norwegian-Swedish test site in 2019 after one year. Roll-over class P0. White materials, type I, 1.5 mm. Alphabetical order by manufacturer.

Type I, 1.5 mm ***Manufacturer*** *Material*	$R_{L,dry}$	$R_{L,wet}$	*Qd*	*Frict.*	*Colour*	*Appr.*
Kelly Bros White Spray Briteline (NE)	175	-	213	0.74	OK	**A**
Kestrel Thermoplastics Eurolux SC White Spray 0023	290	-	214	0.63	OK	**A**
Promax SSNI19WI	272	-	214	0.59	OK	**A**
Svevia X1950	232	-	222	0.66	OK	**A**
Svevia X1951	210	-	217	0.68	OK	**A**

Table 42. The performance of materials applied at the Icelandic-Norwegian-Swedish test site in 2019 after one year. Roll-over class P0. White materials, type I, 3 mm. Alphabetical order by manufacturer.

Type I, 3 mm ***Manufacturer*** *Material*	$R_{L,dry}$	$R_{L,wet}$	*Qd*	*Frict.*	*Colour*	*Appr.*
Ennis Flint Crystalex W2019.1	235	-	198	0.75	OK	**A**
Ennis Flint Crystalex W2019.2	102	-	198	0.72	OK	**NA**
Geveko Markings ViaTherm® EXP 18 71 EP	425	-	190	0.58	OK	**A**
Kelly Bros White Flexi Cold Plastic (NE)	81	-	196	0.71	OK	**NA**
Kestrel Thermoplastics Eurolux SC White 0021	303	-	209	0.56	OK	**A**
Kestrel Thermoplastics Eurolux SC White 0022	265	-	197	0.67	OK	**A**
Promax SNI19WI	275	-	209	0.54	OK	**A**
Scandinavian Road Paint SRP T19	237	-	190	0.65	OK	**A**
Svevia X1910	216	-	219	0.74	OK	**A**
Svevia X1920	209	-	213	0.77	OK	**A**
Svevia X1930	224	-	207	0.80	OK	**A**

Table 43. The performance of materials applied at the Icelandic-Norwegian-Swedish test site in 2019 after one year. Roll-over class P0. White materials, type II, 5 mm. Alphabetical order by manufacturer.

Type II, 5 mm ***Manufacturer*** *Material*	$R_{L,dry}$	$R_{L,wet}$	Qd	Frict.	Colour	Appr.
Hot Mix Hotmix 3000 Type II	238	51	187	0.73	OK	**A**
Promax SNI19WTII	219	55	191	0.73	OK	**A**
Svevia X1911 [type II]	193	61	192	0.86	OK	**A**
Svevia X1921	181	63	186	0.87	OK	**A**
Svevia X1931	188	53	195	0.83	OK	**A**

Table 44. The performance of materials applied at the Icelandic-Norwegian-Swedish test site in 2019 after one year. Roll-over class P0. White materials for hand application, retroreflective, 3 mm. Alphabetical order by manufacturer.

Materials for hand application, retroreflective, 3 mm ***Manufacturer*** *Material*	$R_{L,dry}$	$R_{L,wet}$	Qd	Frict.	Colour	Appr.
Geveko Markings ViaTherm® EXP 19 73 H	201	-	188	0.70	OK	**A**
Svevia X1940	200	-	200	0.73	OK	**A**

Table 45. The performance of materials applied at the Icelandic-Norwegian-Swedish test site in 2019 after one year. Roll-over class P0. White materials for hand application, non-retroreflective, 3 mm. Alphabetical order by manufacturer.

Materials for hand application, non-retroreflective, 3 mm ***Manufacturer*** *Material*	$R_{L,dry}$	$R_{L,wet}$	Qd	Frict.	Colour	Appr.
Geveko Markings ViaTherm® EXP 19 73 HF R2 [non-r]	(179)*	-	190	0.73	OK	**A**

*) No requirement

Table 46. The performance of materials applied at the Icelandic-Norwegian-Swedish test site in 2019 after one year. Roll-over class P0. White materials with enhanced durability, 3 mm. Alphabetical order by manufacturer.

Materials with enhanced durability, 3 mm ***Manufacturer*** *Material*	$R_{L,dry}$	$R_{L,wet}$	Qd	Frict.	Colour	Appr.
Geveko Markings ViaTherm® EXP 19 57 R0	(204)*	-	185	0.67	OK	**A**

*) No requirement

Table 47. The performance of materials applied at the Icelandic-Norwegian-Swedish test site in 2019 after one year. Roll-over class P0. Yellow materials, type I, 1.5 mm. Alphabetical order by manufacturer.

Type I, 1.5 mm ***Manufacturer*** *Material*	$R_{L,dry}$	$R_{L,wet}$	Qd	Frict.	Colour	NTY	Appr.
Geveko Markings ViaTherm® EXP 19 NTY 73S A	127	-	158	0.73	OK	outside	**NA**

Table 48. The performance of materials applied at the Icelandic-Norwegian-Swedish test site in 2019 after one year. Roll-over class P0. Yellow materials, type I, 3 mm. Alphabetical order by manufacturer.

Type I, 3 mm ***Manufacturer*** *Material*	$R_{L,dry}$	$R_{L,wet}$	Qd	Frict.	Colour	NTY	Appr.
Ennis Flint Crystalex Y2019.3	119	-	152	0.68	OK	outside	**NA**
Ennis Flint Crystalex Y2019.4	92	-	165	0.72	OK	outside	**NA**
Geveko Markings ViaTherm® EXP 19 NTY 73E A	139	-	157	0.74	OK	OK	**A**
Kelly Bros Yellow Extr. / Scr. Briteline (NE)	61	-	177	0.81	OK	outside	**NA**
Promax SNI19YI	145	-	145	0.66	OK	OK	**A**

Roll-over class P2

Table 49. The performance of materials applied at the Icelandic-Norwegian-Swedish test site in 2019 after one year. Roll-over class P2. White materials, type I, 0.4 mm. Alphabetical order by manufacturer.

Type I, 0.4 mm ***Manufacturer*** *Material*	***$R_{L,dry}$***	***$R_{L,wet}$***	***Qd***	***Frict.***	***Colour***	***Appr.***
Geveko Markings EXP19 60xx A [0.4 mm]	21	-	95	0.84	OK	**NA**
Geveko Markings EXP19 60xx B [0.4 mm]	21	-	96	0.85	OK	**NA**
Geveko Markings EXP19 60xx C [0.4 mm]	23	-	100	0.87	OK	**NA**
Visafo VIT VISA 36 [0.4 mm]	21	-	95	0.77	OK	**NA**
Visafo VIT VISA 37 [0.4 mm]	23	-	97	0.77	OK	**NA**

Table 50. The performance of materials applied at the Icelandic-Norwegian-Swedish test site in 2019 after one year. Roll-over class P2. White materials, type I, 0.6 mm. Alphabetical order by manufacturer.

Type I, 0.6 mm ***Manufacturer*** *Material*	***$R_{L,dry}$***	***$R_{L,wet}$***	***Qd***	***Frict.***	***Colour***	***Appr.***
Geveko Markings EXP19 60xx A [0.6 mm]	22	-	105	0.83	OK	**NA**
Geveko Markings EXP19 60xx B [0.6 mm]	22	-	100	0.87	OK	**NA**
Geveko Markings EXP19 60xx C [0.6 mm]	25	-	126	0.86	OK	**NA**
Visafo VIT VISA 37 [0.6 mm]	24	-	98	0.86	OK	**NA**

Table 51. The performance of materials applied at the Icelandic-Norwegian-Swedish test site in 2019 after one year. Roll-over class P2. White materials, type I, 1.5 mm. Alphabetical order by manufacturer.

Type I, 1.5 mm ***Manufacturer*** *Material*	$R_{L,dry}$	$R_{L,wet}$	*Qd*	*Frict.*	*Colour*	*Appr.*
Kelly Bros White Spray Briteline (NE)	132	-	219	0.83	OK	**NA**
Kestrel Thermoplastics Eurolux SC White Spray 0023	230	-	213	0.70	OK	**A**
Promax SSNI19WI	213	-	210	0.62	OK	**A**
Svevia X1950	194	-	227	0.71	OK	**A**
Svevia X1951	192	-	229	0.71	OK	**A**

Table 52. The performance of materials applied at the Icelandic-Norwegian-Swedish test site in 2019 after one year. Roll-over class P2. White materials, type I, 3 mm. Alphabetical order by manufacturer.

Type I, 3 mm ***Manufacturer*** *Material*	$R_{L,dry}$	$R_{L,wet}$	*Qd*	*Frict.*	*Colour*	*Appr.*
Ennis Flint Crystalex W2019.1	208	-	211	0.72	OK	**A**
Ennis Flint Crystalex W2019.2	194	-	207	0.79	OK	**NA**
Geveko Markings ViaTherm® EXP 18 71 EP	378	-	200	0.58	OK	**A**
Kelly Bros White Flexi Cold Plastic (NE)	35	-	214	0.76	OK	**NA**
Kestrel Thermoplastics Eurolux SC White 0021	269	-	219	0.59	OK	**A**
Kestrel Thermoplastics Eurolux SC White 0022	197	-	213	0.76	OK	**A**
Promax SNI19WI	222	-	218	0.59	OK	**A**
Scandinavian Road Paint SRP T19	217	-	180	0.64	OK	**A**
Svevia X1910	191	-	224	0.70	OK	**A**
Svevia X1920	181	-	222	0.75	OK	**A**
Svevia X1930	195	-	224	0.69	OK	**A**

Table 53. The performance of materials applied at the Icelandic-Norwegian-Swedish test site in 2019 after one year. Roll-over class P2. White materials, type II, 5 mm. Alphabetical order by manufacturer.

Type II, 5 mm ***Manufacturer*** *Material*	$R_{L,dry}$	$R_{L,wet}$	*Qd*	*Frict.*	*Colour*	*Appr.*
Hot Mix Hotmix 3000 Type II	219	27	203	0.71	OK	**NA**
Promax SNI19WTII	190	36	206	0.70	OK	**A**
Svevia X1911 [type II]	168	35	206	0.79	OK	**A**
Svevia X1921	162	41	194	0.82	OK	**A**
Svevia X1931	164	43	199	0.74	OK	**A**

Table 54. The performance of materials applied at the Icelandic-Norwegian-Swedish test site in 2019 after one year. Roll-over class P2. White materials, inlaid type II, 5 mm. Alphabetical order by manufacturer.

Inlaid type II, 5 mm ***Manufacturer*** *Material*	$R_{L,dry}$	$R_{L,wet}$	*Qd*	*Frict.*	*Colour*	*Appr.*
Geveko Markings ViaTherm® EXP 19 35 E RW2	206	40	175	0.74	OK	**A**
Kestrel Thermoplastics Eurodot SC White 0026	171	37	162	0.80	OK	**A**
Svevia X1911 [type II inlaid]	184	54	200	0.84	OK	**A**

Table 55. The performance of materials applied at the Icelandic-Norwegian-Swedish test site in 2019 after one year. Roll-over class P2. White materials for hand application, retroreflective, 3 mm. Alphabetical order by manufacturer.

Materials for hand application, retroreflective, 3 mm ***Manufacturer*** *Material*	$R_{L,dry}$	$R_{L,wet}$	*Qd*	*Frict.*	*Colour*	*Appr.*
Geveko Markings ViaTherm® EXP 19 73 H	145	-	193	0.76	OK	**A**
Svevia X1940	162	-	206	0.72	OK	**A**

Table 56. The performance of materials applied at the Icelandic-Norwegian-Swedish test site in 2019 after one year. Roll-over class P2. White materials for hand application, non-retroreflective, 3 mm. Alphabetical order by manufacturer.

Materials for hand application, non-retroreflective, 3 mm ***Manufacturer*** *Material*	$R_{L,dry}$	$R_{L,wet}$	*Qd*	*Frict.*	*Colour*	*Appr.*
Geveko Markings ViaTherm® EXP 19 73 HF R2 [non-r]	(144)*	-	201	0.77	OK	**A**

*) No requirement

Table 57. The performance of materials applied at the Icelandic-Norwegian-Swedish test site in 2019 after one year. Roll-over class P2. White materials with enhanced durability, 3 mm. Alphabetical order by manufacturer.

Materials with enhanced durability, 3 mm ***Manufacturer*** *Material*	$R_{L,dry}$	$R_{L,wet}$	*Qd*	*Frict.*	*Colour*	*Appr.*
Geveko Markings ViaTherm® EXP 19 57 R0	(143)*	-	178	0.75	OK	**A**

*) No requirement

Table 58. The performance of materials applied at the Icelandic-Norwegian-Swedish test site in 2019 after one year. Roll-over class P2. Yellow materials, type I, 1.5 mm. Alphabetical order by manufacturer.

Type I, 1.5 mm ***Manufacturer*** *Material*	$R_{L,dry}$	$R_{L,wet}$	*Qd*	*Frict.*	*Colour*	*NTY*	*Appr.*
Geveko Markings ViaTherm® EXP 19 NTY 73S A	102	-	173	0.77	OK	OK	**NA**

Table 59. The performance of materials applied at the Icelandic-Norwegian-Swedish test site in 2019 after one year. Roll-over class P2. Yellow materials, type I, 3mm. Alphabetical order by manufacturer.

Type I, 3 mm ***Manufacturer*** *Material*	$R_{L,dry}$	$R_{L,wet}$	*Qd*	*Frict.*	*Colour*	*NTY*	*Appr.*
Ennis Flint Crystalex Y2019.3	107	-	163	0.70	OK	outside	**NA**
Ennis Flint Crystalex Y2019.4	72	-	165	0.80	OK	outside	**NA**
Geveko Markings ViaTherm® EXP 19 NTY 73E A	120	-	177	0.76	OK	OK	**A**
Kelly Bros Yellow Extr. / Scr. Briteline (NE)	49	-	167	0.90	OK	OK	**NA**
Promax SNI19YI	111	-	158	0.70	OK	OK	**A**

Roll-over class P4

Table 60. The performance of materials applied at the Icelandic-Norwegian-Swedish test site in 2019 after one year. Roll-over class P4. White materials, type I, 0.4 mm. Alphabetical order by manufacturer.

Type I, 0.4 mm ***Manufacturer*** *Material*	***$R_{L,dry}$***	***$R_{L,wet}$***	***Qd***	***Frict.***	***Colour***	***Appr.***
Geveko Markings EXP19 60xx A [0.4 mm]	worn	-	worn	worn	worn	**NA**
Geveko Markings EXP19 60xx B [0.4 mm]	worn	-	worn	worn	worn	**NA**
Geveko Markings EXP19 60xx C [0.4 mm]	worn	-	worn	worn	worn	**NA**
Visafo VIT VISA 36 [0.4 mm]	worn	-	worn	worn	worn	**NA**
Visafo VIT VISA 37 [0.4 mm]	worn	-	worn	worn	worn	**NA**

Table 61. The performance of materials applied at the Icelandic-Norwegian-Swedish test site in 2019 after one year. Roll-over class P4. White materials, type I, 0.6 mm. Alphabetical order by manufacturer.

Type I, 0.6 mm ***Manufacturer*** *Material*	***$R_{L,dry}$***	***$R_{L,wet}$***	***Qd***	***Frict.***	***Colour***	***Appr.***
Geveko Markings EXP19 60xx A [0.6 mm]	worn	-	worn	worn	worn	**NA**
Geveko Markings EXP19 60xx B [0.6 mm]	worn	-	worn	worn	worn	**NA**
Geveko Markings EXP19 60xx C [0.6 mm]	worn	-	worn	worn	worn	**NA**
Visafo VIT VISA 37 [0.6 mm]	worn	-	worn	worn	worn	**NA**

Table 62. The performance of materials applied at the Icelandic-Norwegian-Swedish test site in 2019 after one year. Roll-over class P4. White materials, type I, 1.5 mm. Alphabetical order by manufacturer.

Type I, 1.5 mm ***Manufacturer*** *Material*	$R_{L,dry}$	$R_{L,wet}$	*Qd*	*Frict.*	*Colour*	*Appr.*
Kelly Bros White Spray Briteline (NE)	104	-	201	0.81	OK	NA
Kestrel Thermoplastics Eurolux SC White Spray 0023	188	-	224	0.69	OK	A
Promax SSNI19WI	123	-	174	0.72	OK	NA
Svevia X1950	146	-	204	0.76	OK	NA
Svevia X1951	150	-	209	0.75	OK	A

Table 63. The performance of materials applied at the Icelandic-Norwegian-Swedish test site in 2019 after one year. Roll-over class P4. White materials, type I, 3 mm. Alphabetical order by manufacturer.

Type I, 3 mm ***Manufacturer*** *Material*	$R_{L,dry}$	$R_{L,wet}$	*Qd*	*Frict.*	*Colour*	*Appr.*
Ennis Flint Crystalex W2019.1	179	-	221	0.71	OK	A
Ennis Flint Crystalex W2019.2	155	-	224	0.78	OK	NA
Geveko Markings ViaTherm® EXP 18 71 EP	264	-	197	0.61	OK	A
Kelly Bros White Flexi Cold Plastic (NE)	22	-	242	0.73	OK	NA
Kestrel Thermoplastics Eurolux SC White 0021	226	-	223	0.72	OK	A
Kestrel Thermoplastics Eurolux SC White 0022	155	-	210	0.78	OK	A
Promax SNI19WI	186	-	217	0.62	OK	A
Scandinavian Road Paint SRP T19	worn	-	worn	worn	worn	NA
Svevia X1910	163	-	229	0.70	OK	A
Svevia X1920	150	-	224	0.72	OK	A
Svevia X1930	161	-	225	0.68	OK	A

Table 64. The performance of materials applied at the Icelandic-Norwegian-Swedish test site in 2019 after one year. Roll-over class P4. White materials, type II, 5 mm. Alphabetical order by manufacturer.

Type II, 5 mm ***Manufacturer*** *Material*	$R_{L,dry}$	$R_{L,wet}$	*Qd*	*Frict.*	*Colour*	*Appr.*
Hot Mix Hotmix 3000 Type II	188	17	199	0.67	OK	**NA**
Promax SNI19WTII	166	15	201	0.68	OK	**NA**
Svevia X1911 [type II]	149	29	206	0.75	OK	**NA**
Svevia X1921	139	27	202	0.77	OK	**NA**
Svevia X1931	148	16	200	0.74	OK	**NA**

Table 65. The performance of materials applied at the Icelandic-Norwegian-Swedish test site in 2019 after one year. Roll-over class P4. White materials, inlaid type II, 5 mm. Alphabetical order by manufacturer.

Inlaid type II, 5 mm ***Manufacturer*** *Material*	$R_{L,dry}$	$R_{L,wet}$	*Qd*	*Frict.*	*Colour*	*Appr.*
Geveko Markings ViaTherm® EXP 19 35 E RW2	75	3	119	0.86	OK	**NA**
Kestrel Thermoplastics Eurodot SC White 0026	48	2	99	0.90	OK	**NA**
Svevia X1911 [type II inlaid]	146	34	198	0.79	OK	**NA**

Table 66. The performance of materials applied at the Icelandic-Norwegian-Swedish test site in 2019 after one year. Roll-over class P4. White materials for hand application, retroreflective, 3 mm. Alphabetical order by manufacturer.

Materials for hand application, retroreflective, 3 mm ***Manufacturer*** *Material*	$R_{L,dry}$	$R_{L,wet}$	*Qd*	*Frict.*	*Colour*	*Appr.*
Geveko Markings ViaTherm® EXP 19 73 H	124	-	192	0.75	OK	**A**
Svevia X1940	135	-	215	0.72	OK	**A**

Table 67. The performance of materials applied at the Icelandic-Norwegian-Swedish test site in 2019 after one year. Roll-over class P4. White materials for hand application, non-retroreflective, 3 mm. Alphabetical order by manufacturer.

Materials for hand application, non-retroreflective, 3 mm ***Manufacturer*** *Material*	$R_{L,dry}$	$R_{L,wet}$	*Qd*	*Frict.*	*Colour*	*Appr.*
Geveko Markings ViaTherm® EXP 19 73 HF R2 [non-r]	(108)*	-	196	0.81	OK	**A**

*) No requirement

Table 68. The performance of materials applied at the Icelandic-Norwegian-Swedish test site in 2019 after one year. Roll-over class P4. White materials with enhanced durability, 3 mm. Alphabetical order by manufacturer.

Materials with enhanced durability, 3 mm ***Manufacturer*** *Material*	$R_{L,dry}$	$R_{L,wet}$	*Qd*	*Frict.*	*Colour*	*Appr.*
Geveko Markings ViaTherm® EXP 19 57 R0	(worn)*	-	worn	worn	worn	**NA**

*) No requirement

Table 69. The performance of materials applied at the Icelandic-Norwegian-Swedish test site in 2019 after one year. Roll-over class P4. Yellow materials, type I, 1.5 mm. Alphabetical order by manufacturer.

Type I, 1.5 mm ***Manufacturer*** *Material*	$R_{L,dry}$	$R_{L,wet}$	*Qd*	*Frict.*	*Colour*	*NTY*	*Appr.*
Geveko Markings ViaTherm® EXP 19 NTY 73S A	101	-	178	0.71	OK	OK	**NA**

Table 70. The performance of materials applied at the Icelandic-Norwegian-Swedish test site in 2019 after one year. Roll-over class P4. Yellow materials, type I, 3 mm. Alphabetical order by manufacturer.

Type I, 3 mm ***Manufacturer*** *Material*	$R_{L,dry}$	$R_{L,wet}$	*Qd*	*Frict.*	*Colour*	*NTY*	*Appr.*
Ennis Flint Crystalex Y2019.3	83	-	171	0.79	OK	OK	**NA**
Ennis Flint Crystalex Y2019.4	72	-	176	0.75	OK	outside	**NA**
Geveko Markings ViaTherm® EXP 19 NTY 73E A	104	-	176	0.72	OK	OK	**A**
Kelly Bros Yellow Extr. / Scr. Briteline (NE)	41	-	182	0.83	OK	OK	**NA**
Promax SNI19YI	96	-	167	0.68	OK	OK	**NA**

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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.

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