



Method description – assessment of road marking materials used in contracts

Version 2:2019
Nordic certification system
for road marking materials

Trond Cato Johansen
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Reg. No., VTI: 2015/0161-8.2
Publication No.: VTI notat 9A-2019
Cover pictures: Trond Cato Johansen och Mostphotos.com
Published by VTI, 2019

Preface

This method description, for the assessment of road marking materials used in contracts in Norway, Sweden and Denmark, is connected to the Nordic certification system for road marking materials.

In these countries, a documented product approval from the mentioned certification system will be required in order to use a road marking material on roads managed by the national road authorities. Product certification will be based on monitored and documented performance measurements of material samples applied on test fields on public roads.

To ensure that the materials used in the contracting are certified and in accordance with the description in the contracts, the road authorities needs to establish a system for control or assessment.

The road authorities in Norway, Denmark and Sweden want to facilitate fair competition and as equal conditions as possible in these countries. To ensure this, it is necessary to have a predictable and uniform assessment system. The system will be based on an independent third party assessment organization, and will be conducted in the same way in all three countries.

In this first stage, the assessment system will be based on collecting samples during application of markings on the road. The sampling will be fully randomized, or, in case of suspicion of irregularities, be targeted. Some of the collected samples will be analysed by an accredited laboratory and compared with the manufacturer's verified declaration of constituents.

Drøbak, May 2019

Trond Cato Johansen
Project leader



Quality review

Internal peer review was performed on 3 June 2019 by Anna Anund. Carina Fors has made alterations to the final manuscript of the report. The research director Anna Anund examined and approved the report for publication on 13 June 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 juni 2019 av Anna Anund. Carina Fors har genomfört justeringar av slutligt rapportmanus. Forskningschef Anna Anund har därefter granskat och godkänt publikationen för publicering 13 juni 2019. De slutsatser och rekommendationer som uttrycks är författarnas egna och speglar inte nödvändigtvis myndigheten VTI:s uppfattning.

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Definitions and abbreviations

Definitions of words and terms used in this document.

Word/term	Description
Assessment organization	The independent third party organization that manages the assessment system.
Contract	The written agreement between the road authority (region or county) and the contracting company which is assigned to install the road markings in the region and/or county.
Contractor	The company assigned by the road authority for installing the road markings.
Contractor's team leader	The person in charge of the contracting team which is actually installing the road markings on site for the contractor.
Inspector	The person, which is part of the assessment organization, that collects the material samples.
Laboratory	The laboratory that carries out the identification analyses.
Manufacturer	The company that is producing and supplying the road marking- and/or drop on materials that are used by the contractor in the respective contracts. The manufacturer may, in some occasions, be the same legal entity as the contractor. In most cases the manufacturer and the contractor will be fully independent legal entities.
National road authority	The national road authorities in Denmark (Vejdirektoratet / The Danish Road Directorate), Iceland (Vegagerðin / The Icelandic Road and Coastal Administration), Norway (Statens vegvesen / The Norwegian Public Roads Administration) and/or Sweden (Trafikverket / The Swedish Transport Administration).
Sample A	One of the two material samples that are taken. The A sample is used for the identification analysis according to EN 12802:2011.
Sample B	One of the two material samples that are taken. The B sample is analysed upon request by the contractor, if the A sample was not approved.

Summary

Method description – assessment of road marking materials used in contracts. Version 2:2019 Nordic certification system for road marking materials.

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

A Nordic certification system for road marking materials was introduced in 2015. In the first stage, the certification system applies to the countries of Denmark, Norway and Sweden. Iceland is joining the certification system in 2019. In these countries, a documented product approval will be required in order to use a road marking material on roads managed by the national road authorities. Product approval will be based on monitored and documented performance measurements of material samples applied on test fields on public roads.

In order to be able to assess whether the (approved) road marking materials that are specified in contracts with a national road authority correspond to the materials that are applied on the roads, an assessment system is introduced. The present report describes this assessment system.

The assessment system prescribes that material samples shall be taken when road marking materials are applied on the roads. Some of the samples will then be sent to an accredited laboratory for analysis. The report describes how the material samples are selected, collected and analysed, and how the result is reported. It also describes the contractor's responsibilities related to sample collection and the required competences of the assessment organization.

Sammanfattning

Metodbeskrivning – kontroll av vägmarkeringsmaterial som används i kontrakt. Version 2:2019 Nordiskt certifieringssystem för vägmarkeringsmaterial

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

Ett nordiskt certifieringssystem för vägmarkeringsmaterial introducerades år 2015 och omfattar i ett första steg Danmark, Norge och Sverige. Island ansluter till systemet under 2019. I dessa länder krävs (eller kommer inom kort att krävas) 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.

För att kunna kontrollera och följa upp att de (godkända) vägmarkeringsmaterial som har specificerats i kontrakt med en statlig väghållare stämmer överens med de material som sedan läggs ut på vägen, har ett kontrollsystem utformats. Föreliggande rapport beskriver detta kontrollsystem.

Kontrollsystemet innebär att materialprover tas i samband med att vägmarkeringar utförs på vägen. Ett urval av proverna skickas sedan till ett ackrediterat laboratorium för analys. Rapporten beskriver hur prover väljs ut, samlas in och analyseras, samt hur resultatet rapporteras. Den beskriver också entreprenörens skyldigheter i samband med provtagning och de kompetenser som krävs hos organisationen som utför kontrollen.

1. General

1.1. Nordic certification system for road marking materials

A Nordic certification system for road marking materials was introduced in 2015. In the first stage, the certification system applies to the countries of Denmark, Norway and Sweden. Iceland is joining the certification system in 2019. In these countries, a documented product approval will be required in order to use a road marking material on roads managed by the national road authorities. Product approval will be based on monitored and documented performance measurements of material samples applied on test fields on public roads.

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

The procedures for application and measurements are based on the standards *EN 1824 Road marking materials – Road trials* (CEN, 2011b) and *EN 1436 Road marking materials – Road marking performance for road users* (CEN, 2018), and further described in the document *Nordic certification system for road marking materials – Version 5:2018* (Fors, Johansen, Lundkvist and Nygårdhs, 2018)¹ which is available at www.nordiccert.com and at www.vti.se/en/publications.

1.2. Assessment system

Important reasons for the introduction of the Nordic certification system for road marking material are to promote fair competition and to guarantee that the road authorities get the materials paid for. In order to attain this, a system for assessment of materials used in contracts will be applied.

The aim of the assessment system is to, in a systematic and consistent way, examine whether materials used in contract correspond to the manufacturer's declaration of constituents, and as tested and certified at the test fields.

The assessment system includes selection, collection and analysis of samples, and reporting of the result to the respective national road authority.

The assessment system is managed by an independent third party organization, *the assessment organization*, that is responsible for the assessment in all countries where the system applies. This will maintain a high quality of the system and ensure that the system is applied equally in all Nordic countries and over time.

1.3. Aim and scope

The aim of this document is to describe the methods and procedures related to the Nordic system for assessment of road marking materials used in contracts by national road administrations. This includes descriptions on how to select samples for identification, how to collect samples during contracting and material application, and the analysis of samples done by an accredited laboratory.

Legal consequences of irregularities that may be detected through the assessment system are not included in this document. All legal issues are handled in the respective contract.

¹ A new version of this document, 6:2019, will be published in June 2019.

2. Selection of samples for assessment

A random selection of material samples for assessment is carried out on a yearly basis. The random selection applies to all contracts where certified road marking materials are used. In addition, targeted selections can be applied in case the road authority has reason to believe that the purchased material does not correspond to the product specified in the contract.

The competencies required for the selection of samples are described in Chapter 7.

2.1. Random selection

For each contract and year, a random selection of samples for assessment is made. The recommended number of samples per contract and year is about 5 but can be any number in the range of 1–10. The number of samples will to some extent reflect the size of the contract, i.e. in general, the larger the contract, the more samples will be taken.

Each year, before the road marking installation season begins, the assessment organization makes a suggestion on the number of samples to be taken from each contract. The suggestion is discussed with the respective road authority, which makes the final decision on the number of samples.

When the samples are to be taken is decided by the assessment organization in collaboration with the road authority in the respective region. The selection of sampling occasions is randomized. It should not be possible to know or to guess when and where samples will be taken. All samples must be taken within the season that is specified in each contract.

The selection of samples shall be documented in a report (list) including the following information per sample:

- A unique identification code (year, country, serial number)
- Material name and manufacturer
- Material type
- Contractor
- Contractor's contact person
- Contract
- Length of contract and warranty period
- Responsible road authority

Information related to the selection must not be shared with anyone outside the assessment organization and the road authorities, to avoid the risk that contractors will have knowledge on where and when samples will be taken. Actions should be taken to ensure that the information is handled carefully and securely of all persons involved.

2.2. Targeted selection

In case the road authority has reason to believe that a purchased material does not correspond to the product specification, it can request a targeted selection. The assessment organization will then select extra samples (in addition to the random selection of samples) for that specific contract and product. The recommended number of extra samples is about 3–5. The first extra sample should be collected as soon as possible, and the next ones spread over the rest of the season.

The road authority does not need to inform the contractor or to motivate why a targeted selection is made.

3. Collection of samples

The selected samples are collected during installation of road markings, directly from the machine, according to a predetermined procedure. All collected samples are stored by the assessment organization.

3.1. Sample collection

The collection of samples is carried out by one or more *inspectors* that are part of the assessment organization.

The inspector goes to the location where the sample is to be taken, without informing the contractor beforehand. When on place, the inspector contacts the contractor's team leader (squad leader) and informs about the procedure.

The procedure related to sample collection includes the following:

- **Inspection of the labels on material packages:** The inspector takes photos of the labels of the packages for the road marking material and for the drop-on material and checks that the labels are identical on all available packages.
- **Collection of material samples:** The contractor's team leader, under the supervision of the inspector, takes two road marking material samples – sample A and sample B – of approximately 2 kg each directly from the application head of the application machine. The samples must be taken directly after line marking application, as the material may become inhomogeneous after transportation and longer stops. The samples shall not contain any drop on aggregates. Two separate samples are taken – sample A and sample B – of the drop on material of approximately 0.75 kg each. The samples shall be taken from an unopened package of the drop-on material. Labels with the identification code, sample type (road marking material/drop on, A/B), storage temperature, the date and the signatures of the inspector and of the contractor's team leader are affixed to the sample containers (see also Section 3.2). The labels should be placed so that they seal the container.

The sample collection is documented in a report that contains information about the sample (identification code, material name, manufacturer, batch number, temperature etc.), date, location, weather condition, etc. The inspector and the contractor's team leader should ensure that the identification code in the report corresponds to that on the sample container and they should then sign the report. A report template is available in Appendix 1.

The inspector should inform the assessment organization and the national road authority immediately if:

- The labels on the material packages do not correspond to the material specified in the contract
- The contractor is unwilling to let the inspector take a material sample
- The contractor's team leader refuses to sign the report and/or the labels
- The inspector detects and/or suspects any irregularities related to the material

The competencies required for the collection of samples are described in Chapter 7.

3.2. Storage of samples

Collected samples should be stored in containers suitable for the specific type of material – preferably similar to those used for storage of samples that are taken when materials are applied at the test fields.

The containers should have a label with the following information:

- The identification code of the sample (see Section 2.1)
- Sample type (road marking material/drop on, A/B, e.g., road marking material sample A)
- Storage temperature (according to the specifications of the manufacturer)
- Date of sample collection
- Signature of the inspector
- Signature of the contractor's team leader

Collected samples must be stored in temperatures according to the specifications of the manufacturer. They should be sent to the assessment organization for storage as soon as possible.

Collected samples that are not selected for analysis (see Section 4.1) will be stored for a time period that corresponds to the length of the contract + the warranty period.

4. Identification analysis of samples

A selection of the collected and stored samples will be sent to a laboratory for identification, i.e. the content of the material will be analysed and compared to the manufacturer's declaration of constituents of the material, certified in the Nordic system for certification of materials, and as specified in the contract².

4.1. Selection of samples for analysis

A selection of the collected samples will be analysed. The assessment organization and the road authorities will decide on how many samples to send for analysis.

Samples not selected for analysis will be stored and may be sent for analysis later.

The identification is based on analysis of the A samples.

4.2. Analysis method

The analysis of road marking material samples is carried out according to the European standard *EN 12802:2011 Road marking materials – Laboratory methods for identification* (CEN, 2011a).

In short, the content of the material with respect to binder, titanium dioxide and glass beads is determined (in percentage). The binder type, pigment and inorganic substances are identified by infrared spectroscopy.

The analysis of drop on material samples is carried out according to the European standard *EN 1423:2012 Road marking materials – Drop on materials – Glass beads, antiskid aggregates and mixtures of the two* (CEN, 2012).

The competencies required for the analysis of samples are described in Chapter 7.

4.3. Examination of the analysis results

The examination of the analysis results is carried out by the laboratory. The outcome of the analysis is either:

- **Approved:** The content of the analysed material sample is identical (i.e. within the given tolerances, see below) with that of the material specified in the contract.
- **Not approved:** The content of the analysed material sample deviates clearly (i.e. is outside the given tolerances, see below) from that of the material specified in the contract.
- **Uncertain:** It is not possible to determine with certainty whether the material sample is approved or not.

If the outcome of the analysis is *Not approved*, the contractor can request an analysis of the B sample.

If the outcome of the analysis is *Uncertain*, the laboratory will ask the contractor to give his explanation. The laboratory will then make a decision on whether the material is *Approved* or *Not approved*. If the outcome is *Not approved*, the contractor can request an analysis of the B sample.

² The manufacturer's declaration of constituents has been submitted for all certified materials. Samples have also been taken from all materials that have been tested for certification. The content of the samples has been analysed and documented in test reports, to verify the declared constituents, which are used for the comparison.

In case the contractor has requested an analysis of the B sample, the final decision on whether the material is *Approved* or *Not approved* is based solely on the outcome of the B sample (i.e. the outcome of the A sample is not considered).

Neither the assessment organization nor the road authorities will be involved in the examination of the analysis results.

Tolerances, expressed in maximum relative deviation or maximum absolute deviation, are specified in EN 12802:2011 (CEN, 2011a).

5. Reporting

A report documenting the assessment carried out should be sent to the respective national road authority in the end of each year. The report should contain information about:

- The selection of samples for identification
- The actual samples taken and deviations from the selection
- The selection of samples for analysis
- The results of the analysis

In case any irregularities are detected and/or suspected, the assessment organization should inform the national road authority immediately.

6. Contractor's responsibilities

Contractors are obliged to:

- Provide the assessment organization with information about their current position(s).
- Provide the inspector with material samples and requested information, according to instructions given by the inspector.
- Bear the costs related to the possible halt in production that might be necessary when material samples are taken.

It is the responsibility of the contractor to reassure that the material samples taken from the application machine are homogeneous and representative for the material in use.

7. Required competencies

All persons involved in the selection, collection and analysis of samples must be independent. i.e. they must not have any interest in the contract, nor any relationship with the contractor or his team, neither directly nor indirectly.

7.1. Sample selection

The following competencies and attributes are required for the persons responsible for the selection of samples:

- Good knowledge in statistics
- Good knowledge about road marking products and application

7.2. Sample collection

The following competencies and attributes are required for the persons responsible the collection of samples:

- Good knowledge of machines/equipment and materials for road marking application
- High integrity

7.3. Sample analysis

The following competencies and attributes are required for the identification analysis of samples:

- Accredited laboratory according to ISO/IEC 17025 for testing methods specified by EN 12802:2011 and EN 1423:2012.

References

CEN (2011a). *Road marking materials – Laboratory methods for identification*. EN 12802:2011, European Committee for Standardization, Brussels, Belgium.

CEN (2011b). *Road marking materials – Road trials*. EN 1824:2011, European Committee for Standardization, Brussels, Belgium.

CEN (2012). *Road marking materials – Drop on materials – Glass beads, antiskid aggregates and mixtures of the two*. EN 1423:2012, European Committee for Standardization, Brussels, Belgium.

CEN (2018). *Road marking materials – Road marking performance for road users*. EN 1436:2018, European Committee for Standardization, Brussels, Belgium.

Fors, C. Johansen, T.C., Lundkvist, S-O and Nygårdhs S (2018). *Nordic certification system for road marking materials – Version 5:2018*. VTI notat 12A-2018, Linköping, Sweden.

Appendix 1 – Report template for sample collection

General			
Identification code:		Date and time:	
Inspector (name and org.):			
Contractor			
Contractor:			
Contractor's team leader:			
Material			
Name of road marking material in contract:			
Name of drop on aggregate in contract:			
Manufacturer of road marking material:			
Location and weather conditions			
Road:		Weather conditions, including air temperature:	
Location: <i>(GPS coordinates, Hp + km)</i>			
Sample			
Road marking material	Material name on label:		
	Batch number:		
	Material temperature in boiler:		
	Material temperature at application head:		
	Photos of the labels of the packages have been taken: <input type="checkbox"/> Yes <input type="checkbox"/> No		
	The labels are identical on all available packages: <input type="checkbox"/> Yes <input type="checkbox"/> No		
	Two material samples (A/B) has been taken: <input type="checkbox"/> Yes <input type="checkbox"/> No		
	Comments:		

Drop on material	Material name on label:
	Batch number:
	Photos of the labels of the packages have been taken: <input type="checkbox"/> Yes <input type="checkbox"/> No
	The labels are identical on all available packages: <input type="checkbox"/> Yes <input type="checkbox"/> No
	Two material samples have been taken: <input type="checkbox"/> Yes <input type="checkbox"/> No
	Comments:
Signatures	
The sample collection has been carried out according to the procedure described in document <i>Method description – assessment of road marking materials used in contracts</i> (VTI notat 9A-2019). The identification code on the labels on the sample containers agrees with the identification code in this report.	
Signature, inspector:	Signature, contractor's team leader:

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