SLOVENSKI STANDARD
SIST ENV 13459-3:2002

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Materiali za označevanje vozišča - Kontrola kakovosti - 3. del: Lastnosti med uporabo

Road marking materials - Quality control - Part 3: Performance in use

Straßenmarkierungsmaterialien - Qualitätskontrolle - Teil 3: Anforderungen in der Praxis

Produits de marquage routier - Contrôle de la qualité - Partie 3: Performances en service

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93.080.20 Materiali za gradnjo cest Road construction materials

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English version

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Produits de marquage routier - Contrôle de la qualité - Partie 3: Performances en service

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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Foreword

This European Prestandard has been prepared by Technical Committee CEN/TC 226 "Road equipment", the secretariat of which is held by AFNOR.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to announce this European Prestandard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

This European Prestandard consists of the following Parts under the general title: Road marking materials – Quality control:

Part 1: Sampling from storage and testing
Part 2: Guidelines for preparing quality plans for materials application
Part 3: Performance in use

Road studs are included in Part 1 and 2 but not in Part 3.

Introduction

Road marking applications include materials in a liquid form (for example paints based on water or solvents, thermoplastics in a molten state, cold plastics in a mixture of reacting components), preformed road markings and road studs.

Drop on materials are often added to the surface of the road markings during the application process to provide night-time visibility and/or to improve the skid resistance.

Each road marking material is applied according to its own technical specifications which may include the preparation of the material and of the road surface, the application method, any particular machinery required, the pattern of application, the quantity to be applied, which drop-on materials to add, in what quantity and by what method.

Once the road marking materials have been applied there are many external, variable and uncontrolled factors - such as road surface (mainly nature and roughness), width and design of the road, amount and type of traffic, winter maintenance, environmental conditions, climatic conditions - which might affect its performance and durability.

Therefore the functional life of road markings (the period during which the road markings fulfil all the requirements) and their assessement criteria specified initially by the responsible road authority, depends on so many factors that, although most of them could be controlled with an appropriate quality plan, from the point of view of traffic safety it has been found essential to verify these performance requirements.

The control can be initiated by a contract for the application of road marking materials and can be carried out shortly after application, at the expiry of a warranty period or at any other relevant point of time.

Furthermore, the control can be part of a systematic and periodic control system according to a contract for the maintenance of road markings, or with the aim of determining when the road markings have come to the end of their functional life.

Evaluating all aspects of the performance of road markings by measurement can be expensive, time-consuming and disruptive to traffic. In this prestandard statistically based methods are described for reducing the number of measurements required. This statistical approach is not always appropriate; the sampling method should then be agreed between the parties involved.

Control usually involves an initial inspection of the road markings to reveal cases where the road marking may be clearly deemed either to comply or not to comply with one or more of the requirements of the specification. The road marking may obviously not comply when it is so worn that measurements are not needed. In almost all situations it is possible to measure parts of the road marking, as selected on the basis of the sampling methods described in this prestandard.

1 Scope

This European Prestandard describes methods for the quality control of road marking performance for road users and for the geometry of road markings. It is intended for acceptance or for maintenance purposes.
This European Prestandard does not relate directly to contracts or to quality control manuals, but does provide some guidance in terms of suitable procedures.

2 Normative references

This European Prestandard incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at appropriate places in the text and the publications are listed hereafter. Subsequent amendments to or revisions of any of these publications apply to this European Prestandard only when incorporated into it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 1436	Road marking materials – Road marking performance for road users.
ISO 3534-1	Statistics -Vocabulary and symbols- Part 1: Probability and general statistical terms.

3 Definitions

For the purposes of this standard the definitions given in ISO 3534-1 apply together with the following :

3.1 set of road marking: all of the road markings subjected to performance control, i.e. lines, symbols, legends, zebra crossings, chevrons, stop-lines, give-way markings.

3.2 subset of road marking: a selected part within the set of road marking, to be subjected to a particular aspect of the whole performance control, normally formed of the same material, with the same age, applied to similar road surfaces, with the same position on the road and subjected to similar traffic.

NOTE: Different types of road markings (i.e. lines, symbols, legends, zebra crossings, chevrons, stop-lines, give-way markings) are subject to different traffic conditions and consequently should not be mixed in a given subset.

3.3 part of road marking: one or more line segments or elements of the road marking within a subset of road marking to be represented by a single value for a characteristic.

NOTE: The single value can be based on one or more measured values being, for example, the average or the minimum value.

3.4 measuring point: a selected point within a part of a road marking, where one or more measurements are made.

4 Methods of quality control

4.1 General

Specifications for road marking performance for road users are expressed using the characteristics defined in EN 1436, which also defines the test methods.

Specifications for the geometry of road markings are expressed in contracts, in national standards, in technical specifications or in regulations. These specifications concern geometric measures and their tolerances, for example location and alignment, width of the lines and length of the lines and gaps. They can prescribe, for example, that road markings shall be clearly present and have sharp outlines.

The geometry of a road marking can be determined using suitable measuring equipment, for example rulers; templates may be useful for symbols and letters. The method for evaluation will in practice depend on the level of the specifications for the geometry. An example of the evaluation of the geometry for longitudinal road markings is given in annex A.

The quality control of road marking performance may include one or more of the performance characteristics and/or the geometry.

A comprehensive or a reduced control plan may be applied, depending on the quality control purpose (acceptance or maintenance), the characteristic to be evaluated, the available measuring equipment and other conditions.

4.2 Comprehensive control plan

This control plan is based on an exhaustive number of measurements within a set or subset of road markings.

NOTE: To carry out an exhaustive number of measurements, equipment mounted on a vehicle should be used, so as to proceed more quickly and with less danger and less disturbance to traffic than when measurements are carried out with portable equipment.

4.3 Reduced control plan

4.3.1 General

A reduced control plan can be applied instead of a comprehensive control plan. It is based on the selection of a reduced number of parts of road marking to be measured, using a sampling plan. Therefore the quality level cannot be established with certainty, but a confidence interval can be established on a statistical basis.

4.3.2 Example of procedure

For quality control after application, i.e. acceptance testing, or during the warranty period, or to establish the end of functional life for maintenance purposes, the following procedure can be used.

I. Evaluate whether a set of road marking is homogeneous or not. If the set is not homogeneous divide it into subsets of road marking.

II. Inspection of each identified subset of road marking can be arranged according to the characteristic to be inspected. The inspection may be subjective, visual or otherwise, or can be assisted by measuring instruments.

NOTE 1: The inspection should be carried out from a moving vehicle and with well-trained observers.

NOTE 2: The comprehensive control plan can be an appropriate alternative.

III. The subsets of road marking selected as a result of the inspection are divided into parts of road marking, for example by using the methods described in annex B or in annex C.

NOTE : Parts of road marking within a set of road marking suspected of failing to meet the specifications can be chosen and measured on a selective basis.

IV. The subsets of road marking are subjected to sampling to obtain a reduced number of parts of road marking to be measured.
For this purpose three methods are described in this Prestandard:

a) Periodic systematic sampling plan, see 4.3.3
b) Other sampling plans, see 4.3.4
c) Inspection by attributes, see 4.3.5

NOTE: The decision as to which reduced control plan is chosen will often be influenced by the reasons for undertaking the assessment leading to the control, for instance contractual matters, and by practical matters. It is therefore not possible to provide a specific reduced control plan to be used in all cases. Another matter influencing the choice of a reduced control plan is the information it can provide on a statistical basis.

4.3.3 Periodic systematic sampling plan

With a periodic systematic sampling plan, the quality of a homogeneous set or subset of road marking can be described in terms of statistics, such as the mean value (m) and the standard deviation (s) of the characteristic measured.

An example of a periodic systematic sampling plan is given in annex B.

4.3.4 Other sampling plans

The choice of which sampling plan is used depends on the purpose and the circumstances of the quality control.

The sample size can be determined by different methods, for example as a fixed number or as a proportion of the number of parts of road marking of the set or subset of road marking subjected to control.

An example is given in annex C.

4.3.5 Inspection by attributes

Inspection by attributes means counting values above or below a certain threshold value and drawing conclusions on that basis. The principle requires fewer assumptions about the stochastic distribution of the values than the periodic systematic sampling plan.

Two examples of inspection by attributes are given in annex D, the principles of which are as follows.

Attribute method 1 is based on the principle of deciding beforehand on the required quality level in terms of producer risk, consumer risk and the associated non-conformity levels. Testing can stop when the maximum permitted number of deviations is exceeded.

Attribute method 2 is based on the principle of deciding beforehand on the total number of measurements to execute. After measurement the quality level, in terms of producer risk, consumer risk and the associated non-conformity levels, can be found in statistical tables.

4.4 Test report

A test report shall be made available. A list of content is given in annex E.

Annex A (informative)

Example of evaluation of the geometry of longitudinal road markings

A.1 General

The geometry of longitudinal road markings is specified in national regulations or in tender specifications. The procedure described in this annex can be used to evaluate the fulfilment of these requirements.

> NOTE: Geometrical properties of road markings do not change essentially during their functional life; furthermore, road marking removal is usually more difficult than application, therefore special care should be taken during application.

After the inspection of the set of road marking, if subsets of road marking have been identified, an evaluation of the geometrical properties as described in A.2, A.3 and A.4 should be carried out on the corresponding parts of road marking.

A.2 Location and alignment

A road marking is to be applied at the locations specified. If some deviation is suspected, the relevant parts of marking should be checked by measuring.

For alignment of longitudinal lines any deviation exceeding that specified should be recorded. In the absence of a specified deviation, a deviation of 5 cm in 15 m should be used.

A.3 Width of the line

The deviation with regard to the specified width, W_D, can be expressed in equation A.1.

$$W_D = \frac{W_{av} - W_s}{W_s} \times 100\,\% \qquad \text{(A.1)}$$

where:

W_{av} is the average value of the measurements;
W_s is the specified value

A.4 Module (length of the line and gap)

Evaluation of line and gap lengths can be carried out by measuring the length of the line and of the whole module (line + gap).

The deviation of the length of the line, L_D, and module lengths, M_D, with regard to the specified values can be expressed as in equations A.2 and A.3.: