SLOVENSKI STANDARD
SIST EN 13201-4:2004

01-september-2004

Cestna razsvetljava – 4. del: Metode za merjenje lastnosti razsvetljave

Road lighting - Part 4: Methods of measuring lighting performance

Straßenbeleuchtung - Teil 4: Methoden zur Messung der Gütemerkmale von Straßenbeleuchtungsanlagen

Eclairage public - Partie 4: Méthodes de mesure des performances photométriques

Ta slovenski standard je istoveten z: **EN 13201-4:2003**

ICS:

93.080.40	Cestna razsvetljava in pripadajoļ a oprema	Street lighting and related equipment

SIST EN 13201-4:2004 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 13201-4

November 2003

ICS 93.080.40

English version

Road lighting - Part 4: Methods of measuring lighting performance

Eclairage public - Partie 4: Méthodes de mesure des performances photométriques

Straßenbeleuchtung - Teil 4: Methoden zur Messung der Gütemerkmale von Straßenbeleuchtungsanlagen

This European Standard was approved by CEN on 1 September 2003.

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Ref. No. EN 13201-4:2003 E

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Foreword

This document (EN 13201-4:2003) has been prepared by Technical Committee CEN/TC 169 “Light and lighting”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by May 2004, and conflicting national standards shall be withdrawn at the latest by May 2004.

This document EN 13201-4 has been worked out by the Joint Working Group of CEN/TC 169 “Light and lighting” and CEN/TC 226 “Road Equipment”, the secretariat of which is held by AFNOR.

Annex A is informative.

This document includes a Bibliography.

This standard, EN 13201 *Road lighting*, consists of three parts. This document is:

Part 4: *Methods of measuring lighting performance*

The other parts of EN 13201 are:

Part 2: *Performance requirements*

Part 3: *Calculation of performance*

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

Introduction

The purpose of this part of this European standard is to establish conventions and procedures for lighting measurements of road lighting installations, and to give advice on the use and selection of luminance meters and illuminance meters.

The conventions for observer position and location of measurement points are those adopted in EN 13201-3. However, relaxation from these is permitted where the measurements are used for monitoring the performance of an installation or other purposes. Conditions which may lead to inaccuracies are identified and precautions are given to minimize these.

A format for the presentation of the measurements is suggested.

1 Scope

This part of this European Standard specifies the procedures for making photometric and related measurements of road lighting installations. Examples are given of the form of the test report.

2 Normative references

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

EN 13201-3, *Road lighting — Part 3: Calculation of performance.*

3 Photometric measurements

The procedures adopted should be suited to the purpose of the measurements. Where the measurements are required for comparison with calculated values then the utmost stringency will be required to ensure that a valid comparison can be made. Where the measurements are required for monitoring the state of an installation then it is possible that a more limited set of measurements at widely spaced locations will suffice. The main essential in this case is that the measurements are carried out in the same way each time monitoring is carried out. In other cases spot checks may be sufficient.

4 Measurement conditions

4.1 Stabilization after switch-on

Discharge lamps require a period of time for their light output to stabilize. Illuminance measurements at the same location or locations shall be taken at regular time intervals to ensure that stability has been reached, before definitive light measurements of the installation are made.

To ensure that stability is maintained during the period of measurement, monitoring readings shall be taken (see A.10).

4.2 Climatic conditions

The climatic conditions should be such as not to affect the measurements significantly, unless this is intended. High or low temperatures may affect the light output of thermally sensitive lamps or the accuracy of the light measuring instruments. Condensation of moisture on light transmitting surfaces of measuring instruments or on their electric circuits may affect their accuracy. High wind speeds may make the luminaires oscillate or make the measuring instruments vibrate. They may also lower the temperature of thermally sensitive lamps thereby affecting their light output. Even a slight dampness of the road surface may significantly affect the luminance of the road surface. The light transmission of the atmosphere will affect the light reaching the surface to be measured, and in the case of luminance measurements the light reaching the luminance meter from the surface to be measured.

4.3 Extraneous light and obstruction of light

When measurements are intended to record the lighting performance of the road lighting installation only, direct or reflected light from the surrounds should be prevented or accounted for. Action taken to do this should be recorded in the report on the measurements (see A.7).

NOTE Light from the surrounds can include light from shop windows, advertising signs, road signals, lights on vehicles, other lighting installations, sky glow, reflections from snow at the road side, etc. This lighting can sometimes be prevented, masked or switched off, or sometimes a correction can be made which is based on separate measurements taken with the road lighting installation switched off. A correction for sky glow depends on the cloudiness not being variable.

When measurements are intended to record the unobstructed light from the installation, measurement areas should be selected which are free of obstructions that may produce shadows. These may include trees, parked cars, or road furniture. The presence of obstructions should be recorded in the report on the measurements (see A.7).

4.4 Measurements taken from a moving vehicle

The light performance of an installation can be measured from a moving vehicle. The main differences between dynamic and static measurements are:

— the number of measurement points is greater in the case of dynamic measurements:

— the requirements in EN 13201-3 for observer position and location of grid points may be more difficult or impossible to meet in the case of dynamic measurements.

To produce useful and reliable results a dynamic measurement system shall:

a) for every measurement point, be able to link the position of the photometric head in terms of height, and transverse and longitudinal distances or coordinates to a datum such as the kerb;

b) minimize any effects, such as vehicle shadow, light reflection, and electronic noise, the vehicle may have on the detector readings;

c) be equipped with photometric heads conforming to the requirements specified in clauses 7 and 8. Measurements from a moving vehicle should include the information listed in A.11.

5 Non-photometric measurements

5.1 General

The selection of non-photometric measurements should be related to the purpose of the measurements. Where measurements are required for comparison with calculated values, detailed non-photometric measurements will be required. Where the measurements are required for monitoring the state of an installation then it is possible that less detailed non-photometric measurements will suffice.

5.2 Geometric data

On-site measurements should be made of the geometry of the installation. These should include measurements in plan of the installation, the height of the columns, and the length of the outreach. In addition tilt in application of the luminaires, orientation of the luminaires, and rotation of the luminaires should be measured when possible or when these data may be relevant for meeting the objectives of the measurement.

5.3 Electric tension of supply

At the start of a measurement, the electric tension of the supply, at as many lighting columns as is necessary, shall be measured. During the measurement, the electric tension shall be measured continuously at a significant point in the electric installation, and observed. A recording voltmeter is preferable for this purpose.

5.4 Temperature

The temperature shall be measured at a height of 1,0 m above ground level and recorded at intervals of 30 min.

5.5 Instruments

All instruments shall be calibrated.

NOTE There can be requirements for quality assurance of instruments which may be requested as part of a tender or specification.

6 Location of grid points and observer

To assess the agreement between measured and calculated values, the position of the grid points at which measurements are taken and the position of the observer should agree with those used for the calculation. These latter should be in accordance with one of those given in EN 13201-3. This may involve the taking of a large number of observations, which may be impracticable because of time limitations or other considerations. In these circumstances, fewer observations may be taken but there will be a loss of accuracy. Maximum and minimum values may be found by searching rather than by recording numerous values over a closely spaced grid.

7 Measurement of illuminance

7.1 General

Illuminance shall be measured with an illuminance meter which has a performance suitable for the purpose of the measurements. Where the measurements are required for monitoring purposes, absolute calibration of the illuminance meter is not necessary, but consideration should be given to the long term ageing of the illuminance meter.

NOTE 1 Guidance on the performance of illuminance meters is given in CIE Publication 53:1982 and CIE Publication 69:1987.

For the measurement of horizontal and vertical illuminance a photometer head for the measurement of planar illuminance is required. For semicylindrical or hemispherical illuminance a photometer head designed for the purpose is required.

NOTE 2 Hemispherical illuminance at a point can be measured by means of an illuminance meter for measuring planar illuminance by adopting the following procedure. The horizontal illuminance $E_{horizontal}$ from all the luminaires is measured at the point. The component E_1 is measured from each luminaire in turn by directing the surface of the photometer head so that it receives light at right-angles to its surface from the luminaire being measured, and all other light is excluded. The hemispherical illuminance $E_{hemispherical}$ is given by:

$$E_{hemispherical} = \frac{1}{4}[E_{horizontal} + \sum_{k=1}^{n}(E_k]$$

where:

E_k is the contribution from the k^{th} luminaire;

$\sum_{k=1}^{n}$ indicates the summation of the contributions from the 1st to the n^{th} luminaire.

Care should be taken that personnel making the measurements do not obscure light that would otherwise reach the photometer head. For this reason it is recommended that either an illuminance meter with photometer head attached to the meter by means of a cable or an illuminance meter with a remote hold cable be used. Cables should be sufficiently long for observers to position themselves so that they do not obscure any of the light that would otherwise reach the photometer head.

The use of gimbals eases the task of maintaining the photometer head at the correct inclination with respect to the vertical.

NOTE 3 Atmospheric absorption can significantly reduce the luminous intensity of the light reaching the illuminance meter (see 4.2).

7.2 Height and orientation of the photometer head

a) Horizontal and hemispherical illuminance

The plane of the light sensitive surface of the photometer head shall be horizontal. It should be positioned at ground level but where this is not possible the plane of the light sensitive surface shall be within 200 mm of ground level, and recorded in the test report.

b) Semicylindrical and vertical illuminance

The centre of the light sensitive surface of the photometer head shall be positioned 1,5 m above ground level. The light sensitive surface of the photometer head shall be vertical and have the correct orientation, typically facing longitudinally. Guidance is given in EN 13201-3.

7.3 Measurement grid

Unless an alternative grid is agreed between the parties concerned as being satisfactory, the grid of measurement points should be that specified in EN 13201-3. The photometer head shall be positioned precisely over each measurement point.

8 Measurement of luminance

Luminance of the road surface shall be measured with a calibrated luminance meter which has a performance suitable for the purpose of the measurements.

NOTE 1 Average illuminance is calculated by averaging the illuminance at points equally spaced in plan whereas average luminance measured by a single reading gives, in effect, perspective weighting to each point. This should not result in significant discrepancy. Guidance on the performance of luminance meters is given in CIE Publication 69:1987 and CIE Publication 53:1982.

For measurement of the luminance at a grid point, the luminance meter shall be capable of restricting the total angle of the measurement cone to 2 min of arc in the vertical plane and 20 min of arc in the horizontal plane. For the measurement of average luminance by means of a single reading, the meter shall have a masking facility by which only light from the relevant area of the road surface is included in the measurement. The angle of view of the meter shall be at (89 ± 0,5)° to the normal to the road surface.