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Cestna razsvetljava - 1. del: Smernice za izbor razredov za razsvetljavo

Road lighting - Part 1: Guidelines on selection of lighting classes

Straßenbeleuchtung - Teil 1: Leitfaden zur Auswahl der Beleuchtungsklassen

Éclairage public - Partie 1: Sélection des classes d'éclairage

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93.080.40	Cestna razsvetljava in pripadajoča oprema	Street lighting and related equipment

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TECHNICAL REPORT

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English Version

Road lighting - Part 1: Guidelines on selection of lighting classes

Éclairage public - Partie 1: Sélection des classes d'éclairage

Straßenbeleuchtung - Teil 1: Leitfaden zur Auswahl der Beleuchtungsklassen

This draft Technical Report is submitted to CEN members for Technical Committee Approval. It has been drawn up by the Technical Committee CEN/TC 169.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

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Foreword

This document (FprCEN/TR 13201-1:2013) has been prepared by Technical Committee CEN/TC 169 “Light and lighting”, the secretariat of which is held by DIN.

This document is currently submitted to the Technical Committee Approval.

This document will supersede CEN/TR 13201-1:2004.

This revised publication includes a simplified system of guidelines for selection of the lighting classes. The most important parameters are listed for the different lighting situations - motorised traffic areas, conflict areas, and pedestrian/low speed areas. The parameters include the design speed, the traffic volume and traffic composition, the function of the overall layout of the road, and the environmental conditions.

Road lighting is dealt with by CEN as follows:

- CEN/TR 13201-1: *Road lighting – Part 1: Guidelines on selection of lighting classes.*
- EN 13201-2: *Road lighting – Part 2: Performance requirements.*
- EN 13201-3: *Road lighting – Part 3: Calculation of performance.*
- EN 13201-4: *Road lighting – Part 4: Methods of measuring lighting performance.*
- EN 13201-5: *Road lighting – Part 5: Energy performance indicators*

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Introduction

This document offers guidance on the selection of lighting classes and related aspects. It is applicable to fixed lighting installations intended to provide good visibility to users of outdoor public traffic areas during the hours of darkness to support traffic safety, traffic flow and public security.

The document offers two alternative examples of selection of lighting classes, one based on simple lighting class and the other giving a more refined result within the lighting class. Both methods provide comparable lighting classes and are interchangeable. Any adaptation of either of these methods or any other method can be used instead, on the national level.

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1 Scope

The decision on whether a road should be lit is defined in the national road lighting policy. This varies by country or municipality. Specific guidelines are usually available at national level for each country. This Technical Report does not give the criteria on which a decision to light an area can be made, nor on how a lighting installation should be used. Further guidance is given in CIE 115:2010 (Paragraph 1.2 and Annex A).

This Technical Report specifies the lighting classes set out in EN 13201-2 and gives guidelines on the selection of the most appropriate class for a given situation. To do this, it includes a system to define appropriate lighting classes for different outdoor public areas in terms of parameters relevant to guarantee the aims presented in introductions.

The methods presented in Clauses 5, 6 and 7 have to be considered as the starting points of a comprehensive approach for the normal road lighting. In that sense, the models cannot cover all the different road cases; they introduce general parameters and the impact on lighting requirements. Only the real situation and its unique characteristics (geometry of the road, marking, visual environment, difficulty of the navigation task, lack of visibility, risks of glares due to existing elements, local weather, specific users such as high rate of elderly or visually impaired people, etc.) can lead to a final determination of the appropriate lighting class applying risk evaluation techniques.

The visual needs of road users under reduced traffic volumes during certain periods of night or under varying weather conditions, and the positive benefits of reduced energy consumption and potential environmental improvements, are some of the considerations which justify the installation of adaptive road lighting. There are a variety of suitable instruments, devices and methods which can be used for the intelligent control of a road lighting installation. The control systems range from very simple to the most sophisticated applications. Annex B is of assistance in choosing the correct lighting level when adaptive lighting is used as it provides a more refined evaluation of the luminance or illuminance levels within the specific lighting class. Whilst the luminance or illuminance levels may be varied to suit reduced traffic volumes, weather conditions or other parameters the quality parameters of the applicable lighting class specified in EN 13201-2 should be maintained at all times.

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Renewal or refurbishment of obsolete and uneconomic installations is important. It may be possible to obtain more adapted lighting levels with lower energy consumption using new designs and new technology. The upgrading of lighting and control systems will often give good cost-benefit ratios and short amortisation periods.

This document does not give guidelines on the selection of lighting classes for toll stations, tunnels or canals and locks.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 13201-2, *Road lighting – Part 2: Performance requirements.*

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

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3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 13201-2 and EN 13201-3 the following apply.

3.1
normal lighting class
class with the maximum value of average luminance or illuminance at any period of operation

3.2
adaptive lighting
temporal controlled changes in luminance or illuminance in relation to traffic volume (e.g. veh/5 min), time, weather or other parameters

3.3
motorised traffic (M)
motor powered vehicles

3.4
conflict area (C)
relevant area where motorised traffic streams intersect each other or overlap areas frequented by other user types

3.5
pedestrians and low speed area (P)
relevant area reserved for use by people on foot or using bicycle, and drivers of motorised vehicles at low speed (≤ 40 km/h)

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3.6
design speed
speed selected for purposes of design and correlation of the geometric features of a road and is a measure of the quality of design offered by the road. It is the highest continuous speed at which individual vehicles can travel with safety on a road when weather conditions are favourable and traffic density is so low that the safe speed is determined by the geometric features of the road

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3.7
traffic volume
the number of vehicles passing a given point in a stated time period in both directions

Note 1 to entry: E.g. average daily traffic is measured as number of vehicles per day

3.8
maximum capacity
maximum rate of flow at which vehicles can be reasonably expected to traverse a point or uniform segment of a lane or carriageway during a specified time period under prevailing road, traffic and control conditions; usually expressed as veh/h or veh/d

3.9
traffic density
number of vehicles occupying a given length of lane or carriageway averaged over time; usually expressed as vehicles/kilometre or vehicles/kilometre/lane

3.10
traffic composition
distribution of vehicle types in the traffic stream, directional distribution of traffic, lane use distribution of traffic, and type of driver population on a given facility. In this report simplified: mixed and motorised only

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3.11
junction
place where several traffic routes meet, join, or cross each other, and a location where traffic can change between different routes

3.12
intersection
general area where two or more roads join or cross at the same level, within which are included the carriageway and roadside facilities for traffic movements

3.13
interchange
grade-separated junction with one or more turning ramps for travel between the through roads

3.14
ambient luminosity
assessed luminance levels of the surroundings

3.15
visual guidance / traffic control
means that ensure that motorists are given adequate information on the course of the road

3.16
facial recognition
visual task of pedestrians consisting of a recognition of a face at certain distances that allows to take evasive or defensive action if thought necessary

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Note 1 to entry: Generally, facial recognition requires an overall minimum lighting value at a distance where the recognition of a face is possible.

Note 2 to entry: An ideal facial recognition distance is 10 m – the point of transition between “close” and “not-close” phases.

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3.17
relevant area
part of the public traffic area under consideration

3.18
non-motorised
pedestrians and pedal cyclists

3.19
separation of carriageways
central reserve and/or guardrail

3.20
difficulty of navigational task
degree of effort necessary by the road user, as a result of the information presented, to select route and lane, and to maintain or change speed and position on the carriageway

Note 1 to entry: Visual guidance provided by the road is part of this information

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4 Outline of selection procedure

In this Technical Report, a number of the most important parameters are listed for the different lighting situations - motorised traffic areas, conflict areas, and pedestrian and low speed areas. These parameters include the design speed, the traffic volume and traffic composition, the function and the overall layout of the road, and the environmental conditions.

Selection procedures, parameters and weighting values presented in the main text of this document are based on ones defined in CIE 115:2010, Lighting of roads for motor and pedestrian traffic. Annex B is an alternative method of selection of lighting classes which allows refined evaluation of the luminance or illuminance levels given for each class in EN 13201-2.

In many cases public areas consist of more than just one traffic area, e.g. often there is a carriageway with adjacent footway or cycle path. As users of the different traffic areas have different visual demands, the respective relevant parameters have to be considered during the selection process.

In selecting the normal (design) lighting class the maximum value of the selection parameters likely to occur at any period of operation should be considered, e.g. for traffic volume consider peak hourly value. For simplicity, in this document only the main parameters are summarised for ordinary motorised traffic, for conflict areas and for pedestrian and low speed areas. The descriptions of the parameters and the associated options are broad so that they can be interpreted to suit the individual requirements of national recommendations. In some cases risk analysis or other consideration (environmental for example) could lead to the consideration of other parameters.

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As indicated above, the normal (design) lighting class is selected using the most onerous parameter values, however, the application of this class may not be justified throughout the hours of darkness due to changing conditions e.g. weekends, different weather conditions, different traffic volumes, etc. Temporal changes in the parameters under consideration when selecting the normal (design) lighting class could allow, or may require, an adaptation of the normal level of average luminance or illuminance, usually by reducing the level. The most important parameters in this respect are likely to be traffic volume, traffic composition, real time reflection properties of pavement and current state of road surface (dark, light, dry, wet, salty, snowy), but ambient luminosity can also have an influence.

The adaptive lighting level or levels should be the average luminance or illuminance selected from a class or classes in the same table from which the normal lighting class has been selected. Tables 1, 3 and 4 can be used to select the appropriate adaptive lighting class or classes for different periods of the hours of darkness when the value of the selection parameters is significantly different.

When using adaptive lighting it is important that the changes in the average lighting level do not affect the other quality criteria outside the limits given in the system of M, C or P lighting classes. Reducing the light output from every light source by the same amount using dimming techniques will not affect luminance or illuminance uniformity, or the object contrast, but the threshold contrast increases. Reducing the average level by switching off some luminaires will not generally fulfill the quality requirements and is not recommended.

The use of adaptive lighting can provide significant reduction in energy consumption, compared with operating the normal lighting class throughout the night. It can also be used to reduce energy consumption by reducing the light output of the light source to the maintained value when the installation is clean and the light sources are new.

Where the pattern of variation in parameter values is well known, such as from a record of traffic monitoring stations (TMS) and weather stations (AWS) on traffic routes, or can be reasonably assumed, as in many residential areas, a simple time based control system may be appropriate.

In other situations, an interactive control system linked to real-time data may be preferred. This approach will permit the normal lighting class to be activated in the case of road works, serious accidents, bad weather or poor visibility.

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The following Clauses 5, 6 and 7 describe the method of selecting lighting classes as defined in CIE 115:2010. Alternatively, Annex B provides supplementary guidance about the level of requirement in each class:

- maximum average maintained luminance or illuminance;
- refined average maintained luminance or illuminance within the range between minimum and maximum values.

Both methods are suitable for all cases.

5 Lighting classes for motorised traffic

The lighting classes M are intended for drivers of motorised vehicles on traffic routes, and in some countries also on residential roads, allowing moderate to high driving speeds. The application of these classes depends on the geometry of the relevant area and on the traffic and time dependant circumstances. The appropriate lighting class has to be selected according to the function of the road, the design speed, the overall layout, the traffic volume, traffic composition, and the environmental conditions.

At the final engineering stage of a new road the predicted traffic volume 10 years after opening of the road can be used. For existing roads information from traffic monitoring systems can be used.

Table 1 incorporates the considered principles and values. At national level further developed code of practice for road lighting is recommended based on the administrative or functional classification of roads. Close cooperation with road lighting, traffic planning, highway engineering and traffic safety experts is required. Maximum capacity values shall be obtained from traffic planning expert because figures vary according to road and street classes.

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For the determination of the lighting class M to be applied to a given situation the appropriate weighting values (VW) have to be selected and added to find the sum of the weighting values (VWS). The number of the lighting class M is then calculated as:

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Number of lighting class M = 6 - VWS

Careful selection of appropriate weighting values in Table 1 will yield class numbers between 1 and 6. If the sum of the weighting values (VWS) is < 0 the value 0 shall be applied. If the result M is ≤ 0 the lighting class M1 shall be applied.