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Strategy to facilitate the integration of Dynamic Lighting into EN 13201 and related regulations

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1. Introduction

According to the Technical Report CEN/TR 13201-1:2014 “Road lighting - Part 1: Guidelines on selection of lighting classes” [1] the normal road lighting class is defined as the class with the maximum value of luminance or illuminance at any period of operation. In the European standard EN 13201-2:2015 “Road lighting - Part 2: Performance requirements” [2] a road lighting class is defined by a set of photometric requirements aiming at the visual needs of certain road users in certain types of road areas under specified environmental conditions.

Adaptive lighting is defined as temporal controlled changes in luminance or illuminance in relation to traffic volume and/or traffic composition, time, or other influencing parameters of the surrounding environment. The application of adaptive / dynamic road lighting is recommended as a possibility to reduce energy consumption, light pollution, and CO_2 emission while keeping road safety and security at an appropriate level. However the current challenge is the missing European legal framework for the application of adaptive / dynamic road lighting.

Such a legal framework could be elaborated on a European level by the experts of a Technical Committee of the European Committee for Standardization (CEN, French: **C**omité **E**uropéen de **N**ormalisation). For the selection of an appropriate lighting class as well as for the application of adaptive lighting, it is desirable to harmonize the selection procedures based on (at the moment) different national regulations. This could be achieved probably by the regularly recurring revision of the European standards on road lighting.

2. European Committee for Standardization

The European Committee for Standardization (CEN), a public standards organization, was founded in 1961 with the aim to promote the economy of the European Union (EU) in global trading, the welfare of European citizens and the environment by providing an efficient infrastructure to interested parties for the development, maintenance and distribution of coherent sets of standards and specifications. Its more than thirty national members, these are the National Standardization Bodies, work together to develop European Standards (ENs) in various sectors to build a European internal market for goods and services and to position Europe in the global economy.

European Standards can be used to enhance safety, security and performance, improve energy efficiency, and protect consumers, workers and the environment. European standards are developed by teams of experts who, nominated by their national standardization organisation, have particular knowledge of the specific sector or topic that is being addressed. Each National Standardization Body that is part of the CEN system is obliged to adopt each European Standard as a national standard and make it available to customers in their country. They also have to withdraw any existing national standard that conflicts with the new European Standard.

The standardization activities of CEN are steered by the CEN Technical Board (BT), who has full responsibility for the execution of CEN's work programme. Standards are prepared by **T**echnical **C**ommittees (TCs). Each Technical Committee has its own field of operation within which a work programme of identified standards is developed and executed. Technical Committees work on the basis of national participation by the CEN Members, where delegates represent their respective national point of view. The real standards development is undertaken by **W**orking **G**roups (WGs) where experts, appointed by the CEN Members but speaking in a personal capacity, come together and develop a draft that will become the future standard.

3. CEN Technical Committee 169 'Light and Lighting'

One of the about 400 CEN Technical Bodies is the Technical Committee CEN/TC 169 'Light and Lighting'. This committee is responsible for standards in the field of vision, photometry and colourimetry, involving natural and man-made optical radiation over the ultra-violet, the visible and the infrared regions of the spectrum, and application subjects covering all usages of light, indoors and outdoors, including environmental, energy and sustainability requirements and aesthetic and non-image forming biological aspects. Altogether there are 14 working groups (WGs) dealing with the elaboration of standards covering the different aspects of light and lighting. These are listed here, together with the published CEN Technical Reports and Standards relevant for road lighting:

- WG 1 "Basic terms and criteria" (EN 12665)
- WG 2 "Lighting of work places" (EN 12464-1/2, EN 13032-2)
- WG 3 "Emergency lighting"
- WG 4 "Sports lighting"
- WG 5 "Road lighting" (TR/EN 13201:2003, resolved)
- WG 6 "Tunnel lighting" (CR 14380, EN 16276)
- WG 7 "Photometry" (EN 13032-1, EN 13032-4)
- WG 8 "Photobiology"
- WG 9 "Energy performance of buildings - Energy requirements of lighting)
- WG10 "Performance of optical materials for luminaires" (resolved)
- WG11 "Daylight"
- WG12 "CEN/TC 169/226 Joint Working group road lighting" (TR/EN 13201:2014/15)
- WG13 "Effect of light on human beings"
- WG14 "ErP Lighting Mandate management group"

In the field of road lighting the most important working group is the CEN/TC 169 'Light and lighting' and CEN/TC 226 'Road equipment' joint working group "Road lighting" (CEN/TC 169 WG12). Documents concerning road lighting should not be in contradiction to other reports or standards, in particular to those elaborated by working groups of CEN/TC 169 'Light and lighting'. This means, during the preparation of a document it is necessary either to obey, e.g. definitions, measurement procedures, data presentation or evaluation methods given in other valid standards, or to collaborate with other working groups with the aim to harmonize relevant items by the regularly recurring revision of the different standards.

4. Joint Working Group 'Road Lighting'

It is the scope of CEN/TC 169 Working Group 12 to specify lighting requirements for all classes of roads and road users which meet the needs of visual performance, comfort and safety. It gives lighting values in terms of average luminances, average and minimum illuminances, uniformities, illuminance ratios, glare restrictions and the colour properties of the light sources to design and control road lighting installations and methods to calculate and measure these values. The working group also provides details on how to measure and control the energy efficiency of road lighting installations. It is outside the scope of the

working group to consider or to set lighting specifications for the lighting of tunnels and underpasses on or under roads and for the lighting of pedestrian crossings.

The real standards development has been carried out by five task groups responsible for the different parts of the road lighting standard. In 2014 a revised CEN Technical Report TR 13201-1 “Road lighting - Part 1: Guidelines on selection of lighting classes” [1] has been published, and in 2015 the revised European Standards EN 13201-2 “Road lighting - Part 2: Performance requirements” [2], EN 13201-3 “Road lighting - part 3: Calculation of performance” [3] and EN 13201-4 “Road lighting - Part 4: Methods of measuring lighting performance” [4]. In addition a new standard EN 13201-5 “Road lighting - Part 5: Energy performance indicators” [5] has been issued also in 2015.

A further European Standard has been prepared under a Commission’s request M/485 to support essential requirements of Commission Regulation (EC) No 245/2009, as amended by Regulation (EU) No 347/2010. A sixth task group of CEN/TC 169 Working Group 12 has drafted a European Standard EN 13032-5 “Light and lighting - Measurement and presentation of photometric data of lamps and luminaires - Part 5: Presentation of data for luminaires used for road lighting” [6] which is ready for final vote and is expected to be published early 2018. This document defines the presentation of (accumulated) utilances or utilization factors respectively for luminaires used for road lighting.

5. CEN/TR 13201-1:2014 and the Need for Harmonization

In the European standard EN 13201-2:2015 “Road lighting - Part 2: Performance requirements” [2] a lighting class is defined by a set of photometric requirements aiming at the visual needs of certain road users in certain types of road areas under specified environmental conditions. In this European standard [2] which has to be implemented by the national standards organizations of the participating countries there are basically three different sets of lighting classes described: M classes for areas intended for motorized traffic, C classes for conflict areas, and P classes for pedestrian and low speed areas.

Guidelines on the selection of an appropriate lighting class are given in the Technical Report CEN/TR 13201-1:2014 [1], but national standards organizations are not bound to implement CEN technical reports. Some national standards organizations of countries participating in this INTERREG project have adopted the Technical Report CEN/TR 13201-1:2014 “Road lighting - Part 1: Guidelines on selection of lighting classes” [2] as national recommendation without specifying which of the two methods described in the report has to be applied. In other countries participating in this INTERREG project the national standards organizations have elaborated or are elaborating national standards on the selection of lighting classes.

For the selection of an appropriate lighting class as well as for the application of adaptive / dynamic lighting a number of parameters are considered which are generally related to the geometry of the traffic area under consideration, to the traffic use of the area, or to the influence of the surrounding environment. In different national regulations all or only some of the various parameters are regarded as fixed or time dependent. In certain regulations the roads are categorized and some of the parameters are associated intrinsically with the different types of road and not considered further. In cases of given limiting values linked to the selectable options, e.g. for design speed or for average daily or hourly traffic, these values differ from regulation to regulation. Different fixed or (over time) variable parameters which are considered in the various selection processes could lead to deviating lighting classes for in principle the same type of road.

To keep the road safety and security at the same appropriate level for all road users travelling through Europe, there is a need to harmonize the selection procedures across the different national regulations. This could be achieved by the regularly recurring revisions of the European standards in the field of light and lighting, and in particular for the lighting of roads.

6. Strategy for Harmonization - a Proposal

Regarding the structure of the European Commission for Standardization the most important Technical Body in the field of road lighting is the Technical Committee CEN/TC 169 'Light and lighting', and within the CEN/TC 169 the Working Group 12 entitled 'CEN/TC 169/226 Joint Working group road lighting'. The different parts of the documents dealing with road lighting are elaborated by a small number of experts of respective task groups, and are presented to all members of the working group for discussion, circulation, preparation of draft standards for enquiries, and at a later stage for final voting.

The Technical Report CEN/TR 13201-1 "Road lighting - Part 1: Guidelines on selection of lighting classes" [1] has been prepared by some few experts of Task Group 1 of Working Group 12. This Technical Report is obviously not written in a style which would allow national standardization organizations to implement it as a national standard. For that reason a number of national standardization organizations (also of countries not participating in the INTERREG project) have developed national standards, usually numbered differently.

Although identical or very similar parameters are considered on national level for the selection of an appropriate lighting class as well as for the application of adaptive / dynamic lighting, the resulting classes could differ considerably for a given road traffic situation. This depends mainly on the manner of categorizing road situations and on the handling of fixed and/or time-dependent parameters. Recent discussions on a European level within CEN/TC 169 Working Group 12 have led to a request for harmonization in one way or another.

As a first step the selection procedures should be re-considered by experts within the responsible National Standardization Bodies, based on local/regional/national conditions and experiences. National opinions should be made available for discussion in CEN/TC 169 Working Group 12, wherever possible by active participation in the meetings of national delegates. During the preparation of the next revised Technical Report CEN/TR 13201-1 by the respective Task Group 1 of Working Group 12 (second step) delegated (by as many as interested National Standardization Bodies) experts should play an active role in the formulation of a harmonized selection procedure of lighting classes. It should be possible to come to a consensus of opinion regarding road categories and fixed or time dependent parameters to be considered for a particular road situation; expressed in terms of one of the lighting classes M for motorized Traffic, C for conflict areas, or P for pedestrian and low speed areas [2], to be applied for normal and adaptive / dynamic lighting. Where limiting values linked to selectable options, e.g. for design speed, differ from regulation to regulation forced by national legislation, examples could be worked out (as blue-prints) which could be added to a European standard in form of an informative annex.

7. References

[1] CEN/TR 13201-1:2014 "Road lighting - Part 1: Guidelines on selection of lighting classes"

[2] EN 13201-2:2015 "Road lighting - Part 2: Performance requirements"

[3] EN 13201-3:2015 "Road lighting - Part 3: Calculation of performance"

[4] EN 13201-4:2015 "Road lighting - Part 3: Methods for measuring lighting performance"

[5] EN 13201-5:2015 "Road lighting - Part 3: Energy performance indicators"

[6] EN 13032-5:2018 “Light and lighting - Measurement and presentation of photometric data of lamps and luminaires - Part 5: Presentation of data for luminaires used for road lighting”