Lighting of super cycle ways in Norway, Sweden, Finland and Denmark

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Introduction and summary

As a part of the work on road and tunnel lighting within the NMF, it has been decided to compare the lighting levels of the lighting of super cycleways in Norway, Sweden, Finland, and Denmark. As the Netherlands is the No. 1 cyclist country in Europe, the lighting of super cycle ways in the Netherlands is included for reference.

The lighting is expressed by means of the P- and HS-classes for pedestrians and cyclists in EN 13201-2: 2015 "*Road lighting - Part 2: Performance requirements*". These classes are introduced in section 1 together with a table of lighting levels to be introduced in an informative annex of EN 13201 Part 2.

The lighting of cycle ways is briefly accounted for in following sections 2, 3, 4 and 5 for respectively Norway, Sweden, Finland, and Denmark. The accounts include super cycle ways as well as other cycle ways.

The overall results are shown in table 1. It is noted that the highest lighting level for super cycle ways of 10 lx is shared by Norway, Sweden, and Finland. The highest ligting level for Denmark – probably No. 2 cyclist country in Europe – is 25 % lower, while the lighting levels for Holland are about 50 % lower.

Table 1: Lighting levels and classes for cycle ways in the Nordic countries and the Netherlands
(Classes for super cycle ways and other cycleways are indicated by respectively a **fat** and an *italic* font)

Lighting level	Average horizontal illuminance (lx)	Norge	Sverige	Finland	Denmark	Netherlands
11	50					
10	30					
9	20					
8	15					
7	10	**P2**	**P2**	**P2** **C4**		
6	7,50		*P3*	*P3*	**HS1+**	
5	5,00	*P4*	*P4*	*P4*		**P4**
4	4,00				**HS2+** *HS2*	
3	3,00					**P5**
2	2,00					
1	1,50					

1. Introduction to EN 13201 Part 2: 2015 ”*Road lighting - Part 2: Performance requirements*”

EN 13201 Part 2: 2015 ”*Road lighting - Part 2: Performance requirements*” offers P- and HS-classes for pedestrians and cyclists, refer to tables 2 and 3.

Table 2: P-classes based on horizontal illuminance.

Class	Horizontal illuminance		Additional requirement if facial recognition is necessary	
	$\bar{E}$ [a] [minimum maintained] lx	E_{min} [maintained] lx	$E_{v,min}$ [maintained] lx	$E_{sc,min}$ [maintained] lx
P1	15,0	3,00	5,0	5,0
P2	10,0	2,00	3,0	2,0
P3	7,50	1,50	2,5	1,5
P4	5,00	1,00	1,5	1,0
P5	3,00	0,60	1,0	0,6
P6	2,00	0,40	0,6	0,2
P7	performance not determined	performance not determined		

[a] To provide for uniformity, the actual value of the maintained average illuminance shall not exceed 1,5 times the minimum $\bar{E}$ value indicated for the class.

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Table 3: HS-classes based on hemispherical illuminance.

Class	Hemispherical illuminance	
	$\bar{E}_{hs}$ [minimum maintained] lx	U_o [minimum]
HS1	5,00	0,15
HS2	2,50	0,15
HS3	1,00	0,15
HS4	performance not determined	performance not determined

The P-classes are based on horizontal illuminance and have requirements for:

a) Minimum average illuminance varying with the class,
b) Minimum illuminance varying with the class,
c) Maximum average illuminance of 1,5 times the minimum average illuminance.

A current revision of EN 13201 Part 2 is expected to lead to insertion of a minimum requirement for the overall uniformity of 0,20 as an option to the maximum average illuminance.

The HS classes are based hemispherical illuminance and have requirements for:

a) Minimum average illuminance varying with the class,

b) Minimum overall uniformity of 0,15.

The above-mentioned current revision is expected to lead to an alternative minimum overall uniformity of 0,25. When this overall uniformity is applied, a + sign is added to the class designation – for instance HS1+ instead of HS1.

The HS-classes are in practice used in Denmark - and in Sweden in some cases as an alternative to P-classes They allow for longer spacings between luminaires and/or lower mounting heights of the luminaires than the P-classes.

In the current revision,, a table of lighting levels as shown in table 4 will be inserted into an informative annex. It illustrates that:

a) the average horizontal illuminance is approximately 1,5 times the average hemispherical illuminance,
b) HS1 (and HS1+) is of the same lighting level as P3,
c) HS2 (and HS2+) is in between the lighting levels of P4 and P5.

Table 4: Comparison of lighting levels of M, C, P and HS lighting classes.

Lighting level	Average horizontal illuminance (lx)	C classes	M classes	P classes	HS classes
11	50	C0			
10	30	C1	M1		
9	20,0	C2	M2		
8	15,0	C3	M3	P1	
7	10,0	C4	M4	P2	
6	7,50	C5	M5	P3	HS1
5	5,00			P4	
4	4,00		M6		HS2
3	3,00			P5	
2	2,00			P6	
1	1,50				HS3
0	-			P7	HS4

2. Lighting of pedestrian and/or bicycle paths in Norway

The Norwegian requirements are given in *"Teknisk planlegging av veg- og tunnelbelysning, Håndbok V124* (Technical planning of road and tunnellighting, Handbook V124 - in Norwegian). https://fileserver.motocross.io/trafikksiden/HB_V124_Planlegging_veg_tunnelbelysning_2021.pdf

The requirements are simple and found in a clause 3.7 "*Illumination for pedestrian and cycle ways*". This is a translation:

Pedestrian and/or bicycle paths must be illuminated in accordance with the following requirements when the lighting level is lower than two lighting classes below the main road:

- For small and medium pedestrian and/or bicycle traffic, lighting class P4 is used,
- For heavy pedestrian and/or bicycle traffic, lighting class P2 is used,

The lighting levels of classes P4 and P2 are respectively 5 lx and 10 lx.

3. Lighting of cycle ways in Sweden

The Swedish requirements are found in "*VGU krav*" (VGU requirements - in Swedish). VGU Krav (Trafikverkets publikationsdatabas)

The requirements concern "*GCM lanes/roads*" meaning lanes/roads for pedestrians, cyclists, and mopeds.

In urban areas, GCM lanes/roads must be illuminated according to lighting class P3. For areas with heavy traffic or with a lot of ambient light, lighting class P2 must be used. This applies also for level crossings with railways and trams on special railway embankments.

GCM lanes/roads outside urban areas that are equipped with lighting must be illuminated according to lighting class P4.

The lighting levels of classes P2, P3 and P4 are respectively 10 lx, 7,5 lx and 5 lx.

4. Lighting of cycle ways in Finland

An "*Extract of the Finnish national code of practice for lighting of road and railway areas*": 2015 (in English) has been provided by Aleksanteri Ekrias.

This extract recommends in a table 11 classes P4 and P6 for separate pedestrian and cycle paths of depending on the traffic volume. A table 11 with "*Selection parameters for lighting class P*" can result in higher or lower P-classes. However, Aleksanteri Ekrias has later informed that class P3 is used for main cycleways and that class P4 is used for minor cycleways.

The lighting levels of classes P3 and P4 are respectively 7,5 lx and 5 lx.

Aleksanteri Ekrias points out that the Finnish code of practice is old, and that class C4 is used for super cycleways with high traffic in cities, when not separated from a carriageway by a curb or a reserve. If separated, class P2 is used.

The lighting levels of classes P2 and C4 are both 10 lx, but the minimum overall uniformities are respectively 0,2 and 0,4.

Note: Refer to table 4 and EN 13201-2 regarding the C-classes.

Aleksanteri Ekrias also informs that the selection of lighting classes depends on the owner of the cycleway (municipality or Finnish Transport Infrastructure Agency):

Municipality:

Super cycleways (straight cycleways with highest quality, high maintenance): C4 or P2
C4 if cycleway is in connection with the carriageway of motorized traffic (not separated by curb for example)
P2 if cycleway is separated (see Figure below)

P3: regional cycleways
P4: local cycleways

Finnish Transport Infrastructure Agency:

P3: regionally important cycleways, as part of the municipality's super cycleways or regional cycleways, important work routes to the city
P4: footways and cycleways, high traffic volume, pedestrians and cyclists
P6: footways and cycleways, low traffic volume, pedestrians and cyclists, outside urban area

5. Lighting of cycle ways in Denmark

The Danish requirements are provided in ”Håndbog for vejbelysning: oktober 2020” (Handbook for road lighting - in Danish).

http://leverandorportal.vejdirektoratet.dk/Lists/TenderDocuments/Indk%C3%B8b%20af%20armaturer%20til%20vejbelysning/Udbudsdokumenter/HB%20Vejbelysning%20-%20IND-VB-DK-2020.PDF

The requirements are:

- HS2+ for super cycle ways, can be raised to HS1+ super cycle ways with heavy traffic*),
- HS2 for pedestrian and/or bicycle paths in a traffic system, else no requirement.

*) When illuminating super cycle ways, the side areas should be adequately illuminated. It is recommended to include a minimum 1,5 m side area on both sides of the cycle way itself.

The lighting level of HS2 and HS2+ is 4 lx, and the lighting level of HS1 and HS1+ is 7,5 lx.

Note: In the Danish handbook for road lighting, the HS classes HS1, HS2, HS3 and HS4 are labelled respectively E1, E2, E3 and E4. The plus (+) classes are labelled E1+, E2+ etc.