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~~agenda item 3.2.)~~

PROPOSAL FOR DRAFT AMENDMENTS TO DRAFT REGULATION ON ADAPTATIVE FRONT-LIGHTING SYSTEM (AFS)

Transmitted by the Expert from Poland

Note: The text reproduced below was prepared by the expert from Poland, in order to change the co-ordinate system for defining photometric requirements from 25 m screen to road level surface (RS) and surface at the eye-level of the glare exposed drivers (GS) "First step". It refers to document TRANS/WP.29/GRE/2002/18.

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Note: This document is distributed to the Experts on Lighting and Light-Signalling only.

A. PROPOSAL

Annex 3,

Insert new figures 1, 2 and 3 and tables 1, 1a to 1d, to read:

"Figure 1: Position of passing beam photometric requirements on the road surface (RS) for class C, V, W, E.

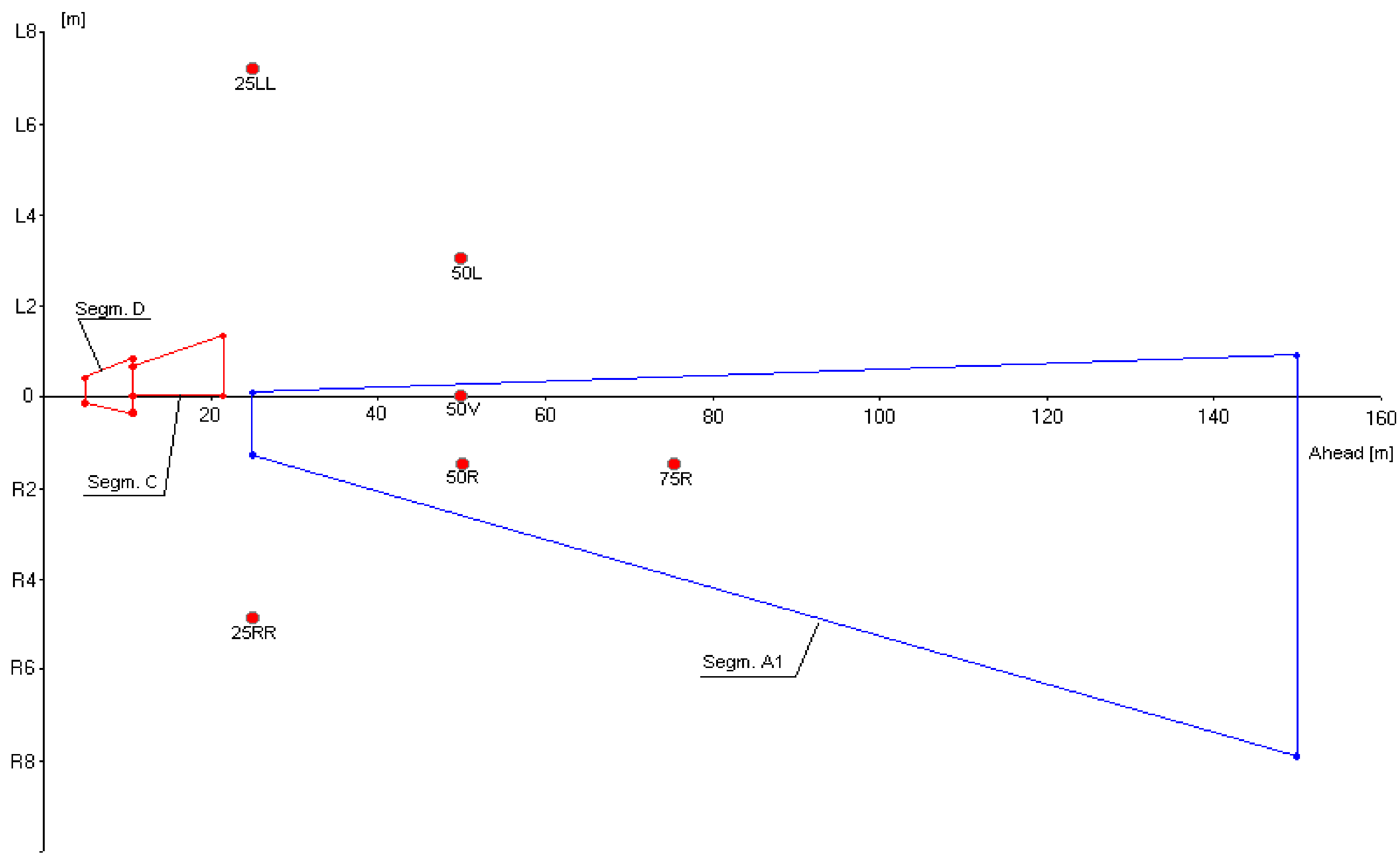

Figure 2: Position of passing beam photometric requirements on the surface at the eye-level of the glare exposed drivers (GS) for Class C,V passing beam.

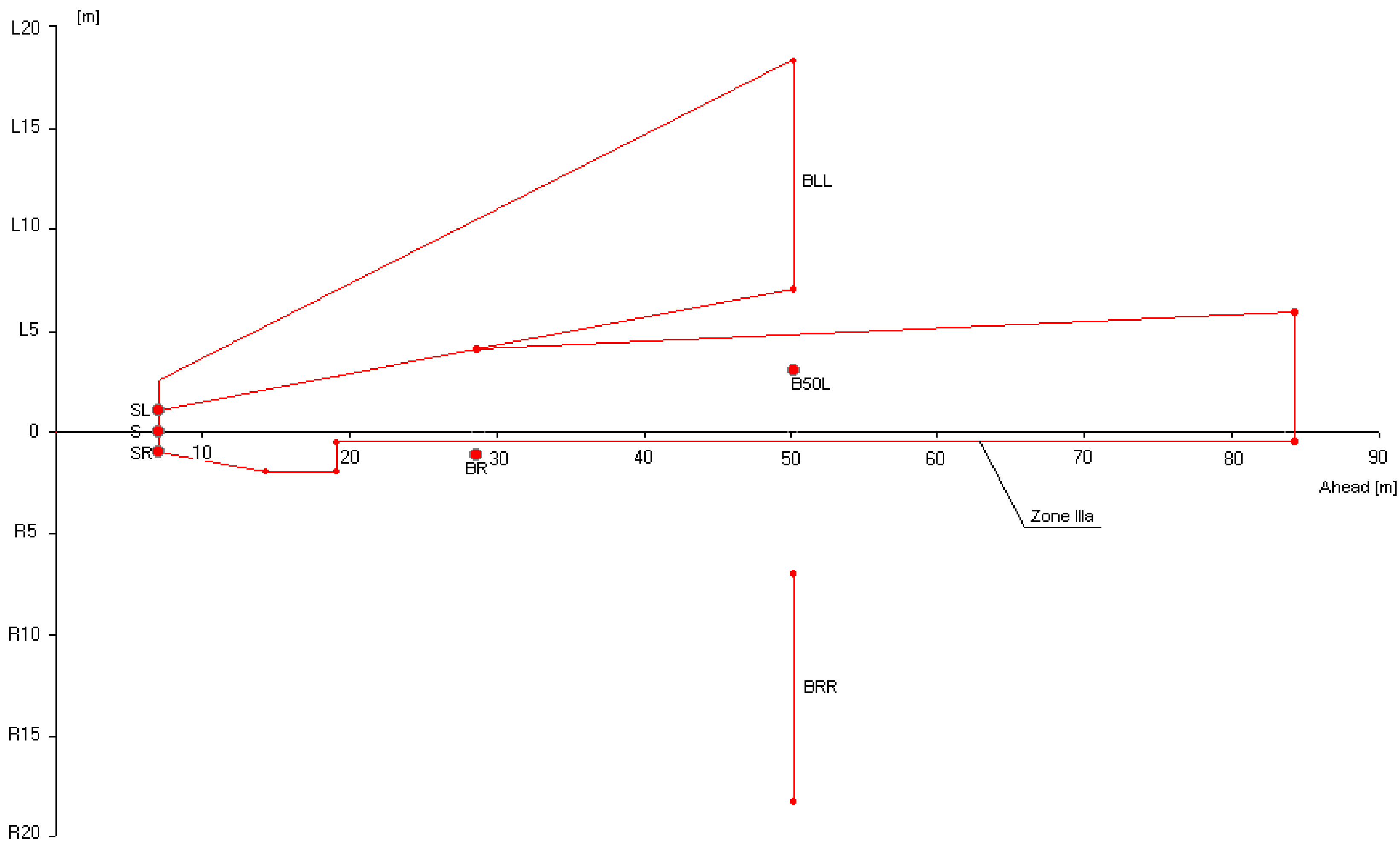

Figure 3: Position of passing beam photometric requirements on the surface at the eye-level of the glare exposed drivers (GS) for Class W,E passing beam.

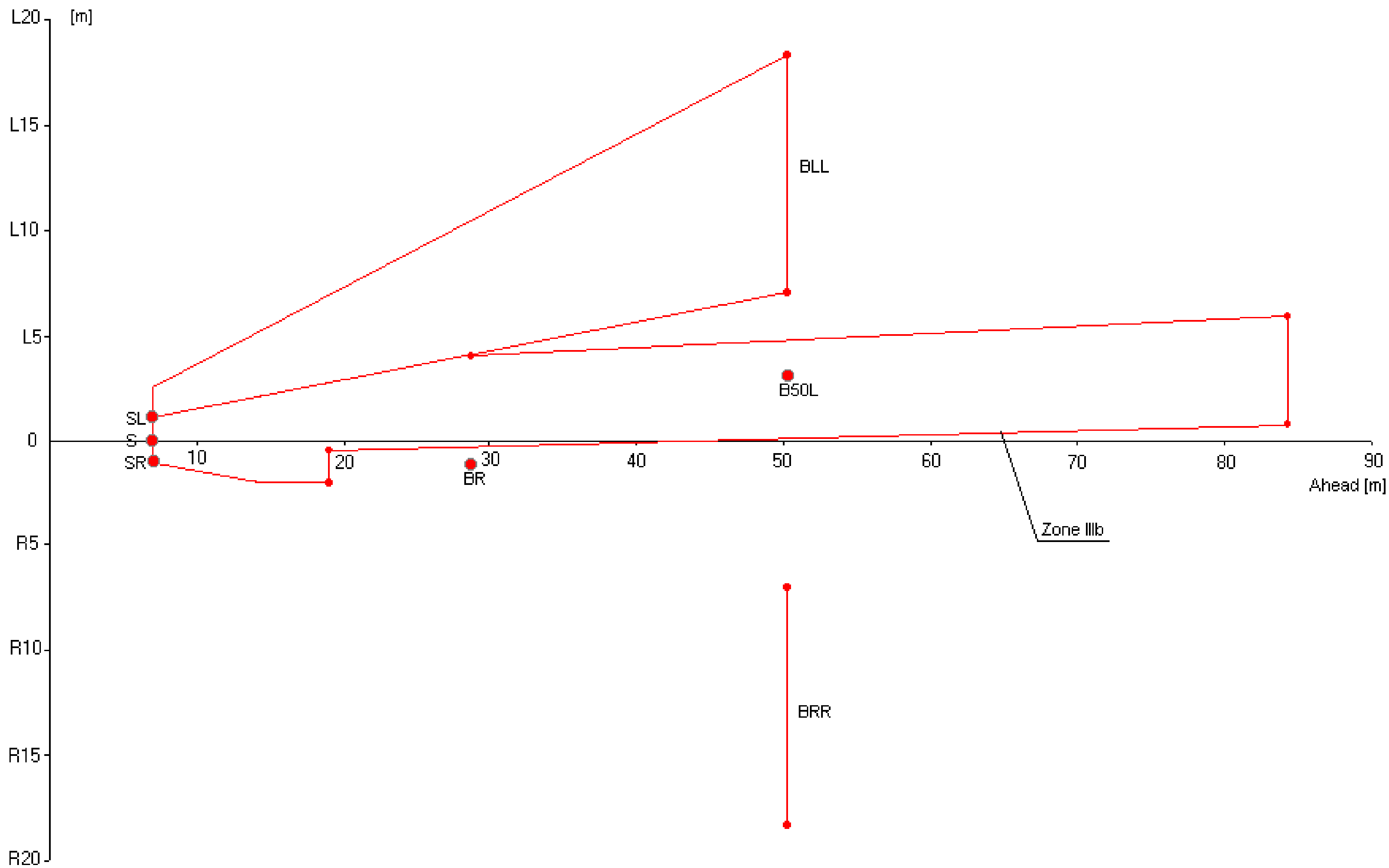

Table 1: Passing beam photometric requirements expressed in lux on RS and GS for system (lighting units energized simultaneously).

tabled requirements expressed in lux on RS, GS				Points position on RS, GS [m] L (left) or R (right)		Ahead	class C (basic) passing beam		class V (town) passing beam		class E (motorway) passing beam		class W (wet road) passing beam	
	No	Element		at/from	to	to	min	max	min	max	min	max	min	max
Part A	1	**B50L**	GS	L 3.0		50.0		0.2		0.2		0.4		0.4
	2	**HV** (as specified by **Table 1a** of this annex)	GS			0.0								
	3	**BR**	GS	R 1.2		29.0	0.3	3.1	0.2	1.5	0.3	3.1	0.3	4.6
	4	Segment **BRR**	GS	R 7.0	R 18.3	50.0		2.0		0.5		2		3.0
	5	Segment **BLL**	GS	L 7.0	L 18.3	50.0		0.4		0.5		0.5		0.5
	6	**P** (as specified by **Table 1a** of this annex)	GS	L 0.0		0.0								
	7	**Zone III** (as specified by **Table 4** and **Table 5** of this annex)	GS											
	8	**S**	GS	V 0.0		7.0	2.4		2.4		2.4		2.4	
	9	**SL**	GS	L 1.0		7.0	1.2				1.2		1.2	
	10	**SR**	GS	R 1.0		7.0	1.2				1.2		1.2	
	11	**50R**	RS	R 1.5		50.0			3.00					
	12	**75R**	RS	R 1.5		75.0	2.6				4.0		5.3	
	13	**50V**	RS	V 0.0		50.0	3.0		1.5		6.0		6.0	
	14	**50L**	RS	L 3.0		50.0	2.1	12.5	1.0	12.5	4.0		4.0	17.5
	15	**25LL**	RS	L 7.1		25.0	2.8		2.0		2.8		8.0	
	16	**25RR**	RS	R 4.8		25.0	2.8		2.0		2.8		8.0	
	17	Segment **C**	RS	L 1.3	V 0.0	21.5								54.2
	18	Segment **D**	RS	L 0.8	R 0.3	11.0		340.0		340.0		340.0		195.6
	19	I_{max} (previous E_{max})	RS				12 500	31 250	6 250	31 250	12 500	56 250	21 875	50 000

Table 1a: Passing beam photometric requirements expressed in lux on GS for system) recalculated for U0,57 deg inclination of system reference axis.

Table requirements expressed in lux on GS			Points position on GS [m]			**class C (basic) passing beam**		**class V (town) passing beam**		**class E (motorway) passing beam**		**class W (wet road) passing beam**	
			L (left) or R (right)		*Ahead*								
	No	**Element**	*at/from*	*to*	*to*	**min**	**max**	**min**	**max**	**min**	**max**	**min**	**max**
A'	2	**HV**	0.0		50.0		0.4		0.4				
	6	**P**	L 6.0		50.0	0.1						0.1	

Table 1b: Bending modes passing beam photometric requirements expressed in lux on GS for system

Table requirements Expressed in lux on GS			Points position on GS [m]			**class C (basic) passing beam**		**class V (town) passing beam**		**class E (motorway) passing beam**		**class W (wet road) passing beam**	
			L (left) or R (right)		*Ahead*								
	No	**Element**	*at/from*	*to*	*to*	**min**	**max**	**min**	**max**	**min**	**max**	**min**	**max**
B	1	**B50L**	L 3.0		50.0		1.2		1.2				
	2	**HV 1/**	0.0		50.6		0.5		0.5				
	7	**Zone III** (as specified by **Table 4 and Table 5** in this annex)											
	14	**50L**	L 3.0		50.0	1.0		0.5		2.0		2.0	
	19	**I max** (previuos E_{max})				7 500	31 250	3 750	31 250	7 500	56 250	15 000	50 000

1/ point HV recalculated for 0,57 inclination

Table 1c: Segment A1 corners position.

	position in meters	Class C (basic) passing beam		Class V (town) passing beam		Class E (motorway) passing beam		Class W (wet road) passing beam	
No	beam part designation and requirement	L, R [m]	Ahead [m]	L, R [m]	Ahead [m]	L, R [m]	Ahead [m]	L, R [m]	Ahead [m]
1c.1	In any place on right and left beside A1 (RS) segment, vertical illumination can not be bigger than any value of tested units in A1 segment at the same distance from vehicle	L 0.9	150	L 0.9	150	L 0.9	150	L 0.9	150
		R 7.9	150	R 7.9	150	R 7.9	150	R 7.9	150
		L 0.1	25	L 0.1	25	L 0.1	25	L 0.1	25
		R 1.3	25	R 1.3	25	R 1.3	25	R 1.3	25

Table 1d: Segment A1 defining values.

Distance from vehicle front		25m÷50m	50m÷75m	75m÷100m	100m÷125m	125m÷150m
Illumination at the road surface (RS) in [lx]	Class V	>10	>3	-	-	-
	Class W, C	>10	>6	>1	>0.5	-
	Class E	>10	>6	>2	>1.5	>0.5

Figure 1. (former), renumber as figure 4 and amend its title to read:

"Figure 4. For information only: Angular position of passing beam photometric requirements"

Table 1: (former), renumber as table 2 and amend its title to read:

"Table 2: For information only: Passing beam photometric requirements"

Table 2: (former), renumber as table 3

Insert new tables 4 and 5, to read:

Table 4: Passing beam Zone III, definig points.

Zone III	Point number:		**1**	**2**	**3**	**4**	**5**	**6**	**7a**	**8a**
Basic points Position on GS	Class C,V	L, R [m]	L 4.0	L 1.0	R 1.0	R 2.0	R 2.0	R 0.5	0.0	R 5.9
		Ahead [m]	28.6	7.2	7.2	14.3	19.1	19.1	84.3	84.3
	Class W,E	L, R [m]	L 4.0	L 1.0	R 1.0	R 2.0	R 2.0	R 0.5	L 0.7	R 5.9
		Ahead [m]	28.6	7.2	7.2	14.3	19.1	19.1	84.3	84.3

Table 5: Photometric requirements for Zone III and segment BLL

Distance from vehicle front	*7m÷14m*	*14m÷19m*	*19m÷28m*	*28m÷50m*	*50m÷75m*	*75m÷84m*
	Class C, V					
Zone III [lx]	*17.1÷4.3*	*4.3÷2.4*	*2.4÷1.1*	*1.1÷0.4*	*0.4÷0.2*	*0.2÷0.1*
BLL [lx]	*<17.1*	*<4.3*	*<2.4*	*<1.1*	*<0.4*	*<0.2*
	Class E, W					
Zone III [lx]	*24.45÷6.1*	*6.1÷3.43*	*3.43÷1.52*	*1.52÷0.5*	*0.5÷0.22*	*0.22÷0.1*
BLL [lx]	*<24.45*	*<6.1*	*<3.34*	*<1.52*	*<0.5*	*<0.8*
Bending modes						
	Class C, V, W, E					
Zone III [lx]	*24.45÷6.1*	*6.1÷3.43*	*3.43÷1.52*	*1.52÷0.5*	*0.5÷0.22*	*0.22÷0.1*
BLL [lx]	*<24.45*	*<6.1*	*<3.34*	*<1.52*	*<0.5*	*<0.8*
4.1.	*In any place on the left side of the BLL segment illumination can not be bigger than in BLL segment at the same distance from vehicle or in zone III respectively.*					

Table 3 (former), renumber as table 6 and amend its title to read:

"Table 6: For information only. Passing beam zones III, defining corner points"

Table 4 (former), renumber as table 7

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B. JUSTIFICATION

The current conception of photometric requirements concerning headlights passing beam (Reg. No. 112 and earlier) are based on the light beam characteristic for a single paraboloidal construction of reflector equipped with filament lamp, which luminous flux was significantly limited. Today many different constructions, of headlamps with other properties than paraboloidal are used. But simplifications used in this conception of formulating requirements lead to difficulties in interpretation of measurement results. In some situations, it may result in giving type approval to devices whose performances are insufficient.

The AFS system is a new quality in headlighting. It is a complicated solution of outstanding significance for standard headlamps. In this situation simplifications used until now in regulations cannot be accepted.

In the new regulation modifications should be introduced on the manner of defining photometric requirements. The measurement devices and methods are still unchanged. Also the checked physical performance of the system is still unchanged. Only the way of expression of requirements is changed to simplify measurement results interpretation, avoid confusions, and prevent giving type approval for devices whose performance is inadequate to tasks and in some situations can be a danger for traffic safety.

The proposed change of the co-ordinate system for defining requirements has a big advantage: it describes the whole system performance independent from the number of lighting modules and their locations.

AFS can consist of some single lighting units placed on different heights and distances from the system reference axis. If each unit is described separately in different places of regulations using screen co-ordinates, there is a need to precise how to interpret requirements: half value for unit, value of left and right part or sum for all units. Of course, the same points for each module are in different places in space so the question arises how to add values: using system reference axis, use units axis and add values which are for different place or in any other way. For example, values in segment D and below are completely separate on the road for the mounting distance of units equal to 100 cm.

When the photometric requirements are recalculated for RS (and GS respectively), this problem does not exist because value is consider only in one point for the whole system.

The basic assumption in the present regulations is the evaluation limits of illumination values for each single headlamp in a few selected points and zones of the measuring screen (Fig. 1.) or in the equivalent angular co-ordinate system. Requirements are based on co-ordinates connected with a vertical screen in a fixed distance. The perception of the projected light beam on this kind of screen cause changes in illuminance values comparing to the road surface and the glare exposed drivers eyes surface.

This description is suitable when the illuminance values change monotonically between points, in a supposed, but not strictly defined way and when distribution of light is homogeneous (simplifications for single paraboloidal headlamp).

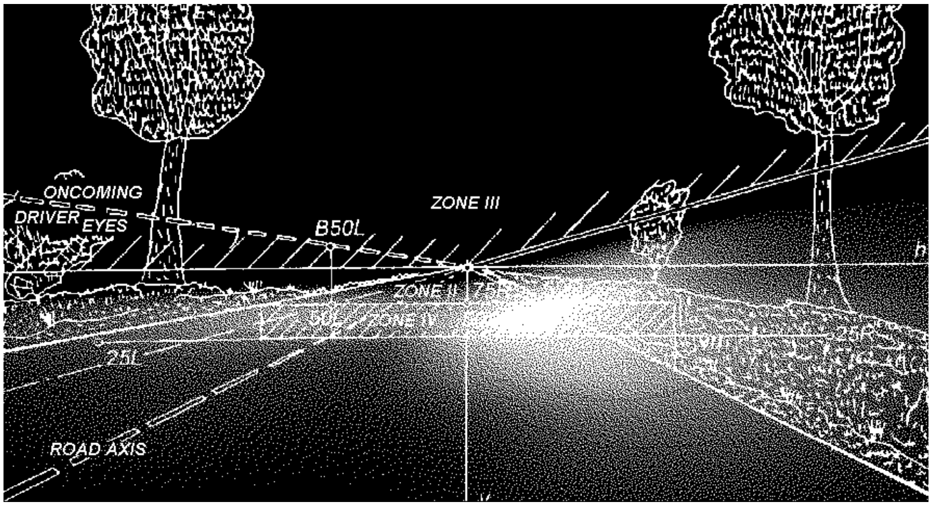

Fig. 1. Example of the light beam from one passing beam on measuring screen surface.

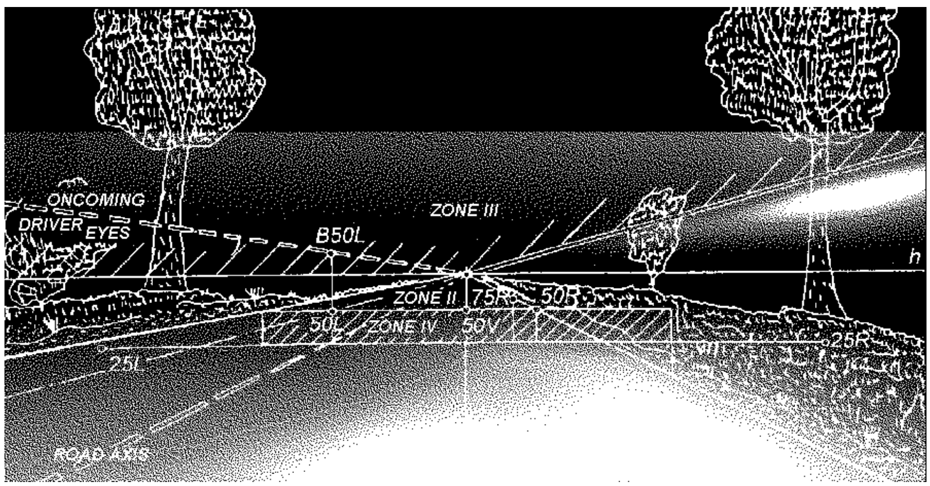

Fig.2. Beam pattern of two headlamps from Fig. 4. recalculated to the road surface with visualisation of glare level on the eyes of oncoming drivers in the space above the horizon.

It is proposed to redefine the co-ordinates system for which the requirements are defined. The new co-ordinates system consist of two surfaces: road level surface (RS) and glare exposed drivers eyes level surface(GS), situated parallel to the road.

The proposed changes may look seemingly revolutionary. In fact this **is only an other way of expression of the same illumination requirements** which are defined for measuring screen surface in TRANS/WP.29/GRE/2002/18.
It is also important that the laboratory measuring equipment and methods are unchanged. The goniophotometer is still the basic tool for measurements. The only need is to **recalculate** the results from an angular coordinate system to RS and GS. There are **relatively simple recalculations** which can easily be done using a computer program like MS Excel. Fig. 3. shows vertical intersection 25 m screen co-ordinates system and proposed co-ordinates system.

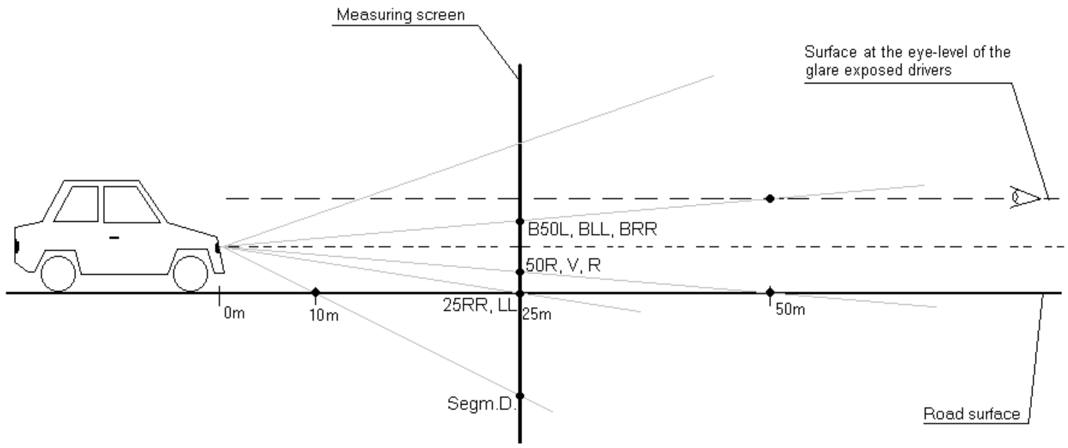

Fig. 3. Present view of vertical intersection of old and proposed co-ordinates system.

Fig. 4. shows bird's - eye view of RS and GS. It is easy to see that each element (Table 1 to 4 of TRANS/WP.29/GRE/2002/18) of measuring screen has its own representation on described surfaces (RS- road surface; GS-glare surface).

Fig. 5. and Fig. 6. shows measuring screen and representation of its contents on RS and GS.

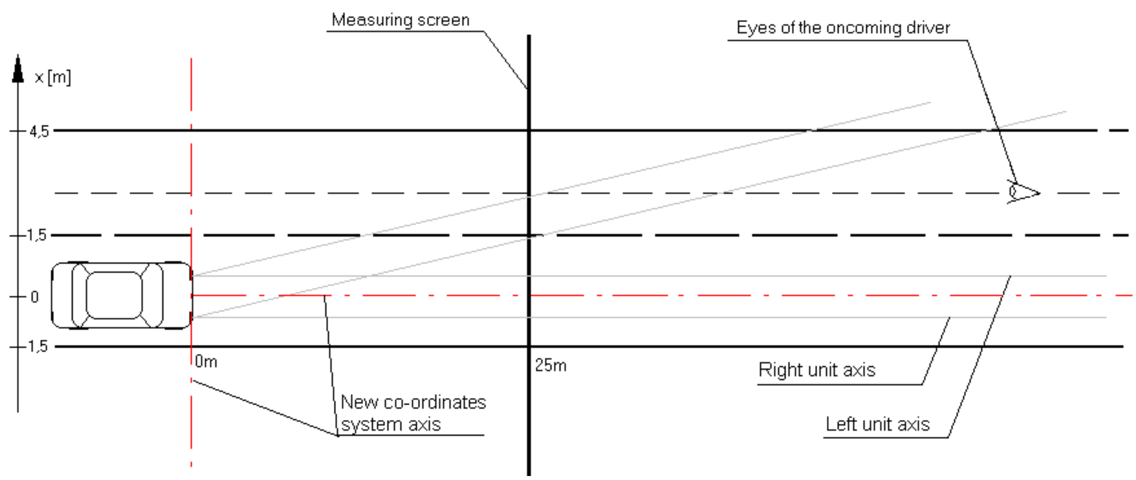

Fig. 4. Bird's - eye view of proposed co-ordinate systems: road surface and oncoming drivers' eyes' surface.

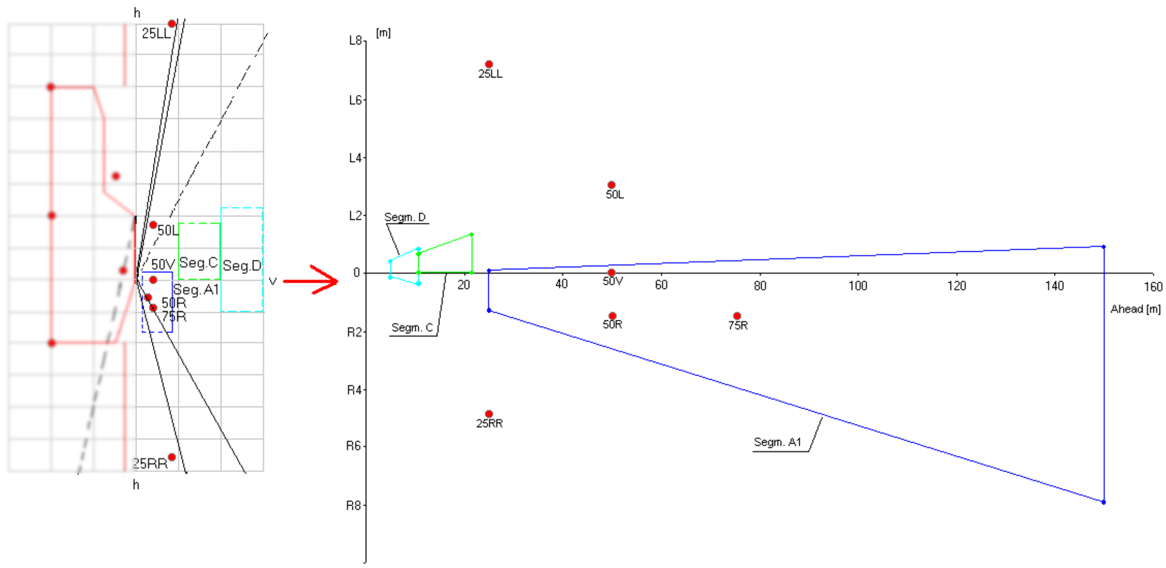

Fig. 5. Measuring screen and its representations on RS.

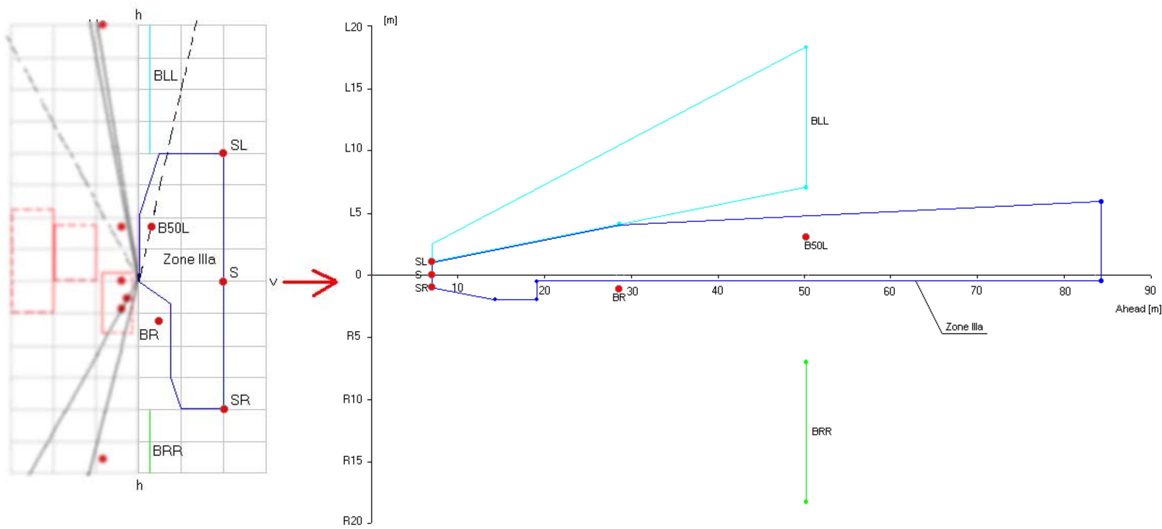

Fig. 6. Measuring screen and its representations on GS.

A visible double edge is the result of calculations for two units in distance of 100 cm. Subscripts $_{L}$, $_{R}$ and $_{L+R}$ means areas for left, right and both headlamps. E.g. $B50L_{L}$; $B50L_{R}$.

In TRANS/WP.29/GRE/2002/18 there are significant areas for which requirements are not defined. e.g. place for E_{max} is between 25 m and 140 m from front of vehicle for class C ("basic") and for 25 m do 340 m for class E ("motorway"). It means that road illumination can be done relatively freely.
Above a "First Step" is proposed. It is a change of co-ordinate system for defining photometric requirements from 25 m screen to road level surface (RS) and the surface at the eye-level of the glare exposed drivers (GS) without any changes in photometric values. It allows in future to introduce zones on RS and GS in place of points to more precise defined requirements.

For more justification and explanation, please compare the contribution:
T. Targosiński. "Analysis of the Properties of the ECE Requirements Concerning Headlights" PAL 2001 Darmstadt.

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