

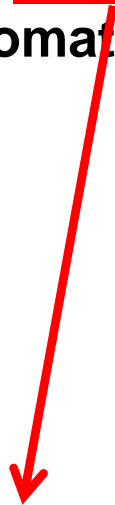
Informal document **GRE-68-31**
(68th GRE, 16-18 October 2012,
agenda item 4(d))

Poland: comments on OICA comments on GRE/2012/27

**Headlamp Initial Aiming and leveling tolerances
influence for road illumination distance**

68 GRE, 17 October 2012

GRE/2012/27 proposes changes to ECE R48 to improve the minimum range of visibility, and to replace the artificial 2000lm limit for automatic levelling with more appropriate glare control.



Road illumination distance understand as cut-off crossing with road surface – clear and simple definition in line with present Reg. 112, 98, 123 and aiming practice

Proposed changes:

- To redefine the initial aim and static load-levelling requirements of dip beam cut-off in terms of theoretical range on the road rather than the current % downward inclination.

How is „practical” range guaranteed by present ECE Regulations or by manufactures?

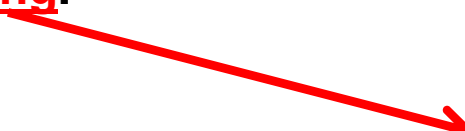
Do drivers know it ?

- To reduce aiming tolerance, and delete the additional aiming tolerance in CoP, aligning it with the approval requirement.
- To add a requirement to measure glare values in loaded conditions as part of both Type Approval and CoP, if the resultant aim falls outside permitted tolerance.

Glare is restricted and controlled by headlamp Regulations (112, 98, 123). Till now it is no any reference on vehicle to this defined glare values. According to present requirements of Reg. 48 “on vehicle” glare can differ from regulated in 112, 98 and 123 in uncontrolled manner. It should be clarified how much more glare is accepted and how to ensure it. Artificial 2000 lm borderline does not work.

Proposed changes:

- To delete the reference to 2000lm as a threshold for automatic levelling.



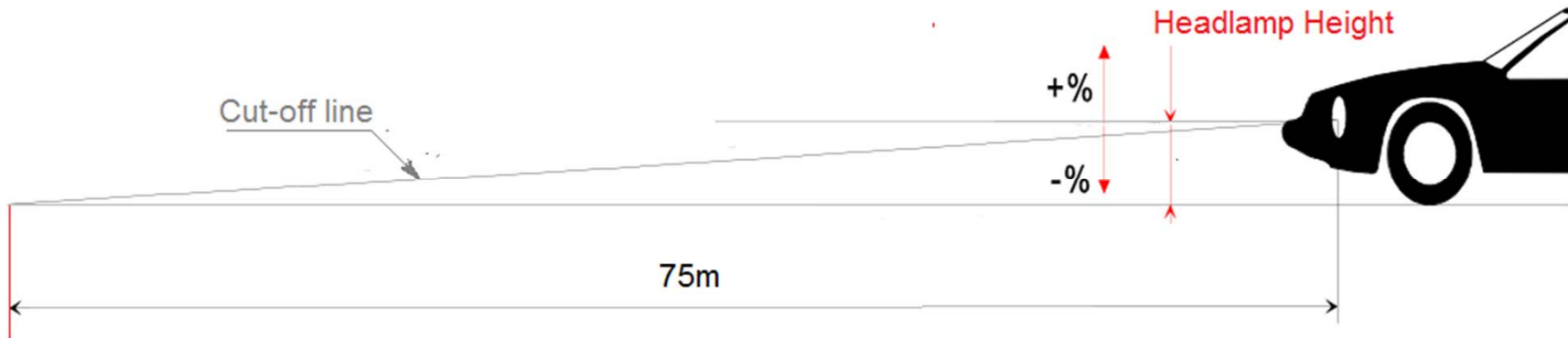
Presently are the same restrictions for manual and automatic levelling (2%-2.5%) but practice for automatic levelling is diverse.

- To add a visible warning to the driver, defining what is the minimum visibility distance, if theoretical range is less than 50m.



„Road illumination distance”

Proposed Initial nominal aim to correspond to 75m theoretical range



- Specified % inclination is (Headlamp height / 75) as a %, rounded to nearest 0.1%.

Proposed Initial nominal aim to correspond to 75m theoretical range

- Currently: initial aim is specified by the manufacturer, within permitted limits dependent on lamp height. Height bands overlap for tolerance.

min height	max height	%down
500	1000	1.0% to 1.5%
800	1200	1.5% to 2.0%

Proposed Initial nominal aim to correspond to 75m theoretical range

- Under proposal,
 - No overlap between height bands
 - Most headlamps would be aimed higher than at present

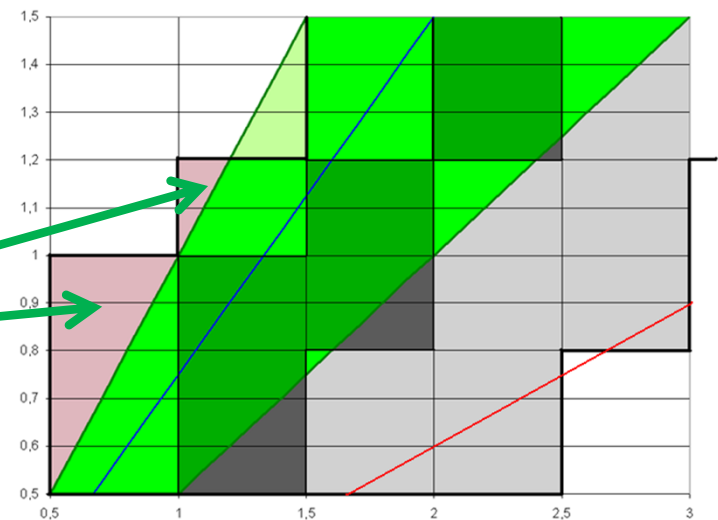
What for are needed overlaps?

It will depend on manufacturers decision and choice of range of amended Reg.48 (30 to 100m or 50 to 100m)

It will be safety oriented advantage and goal of amendment because of longer average road illumination distance.

- Risks increased glare.

Not true. Decreased glare comparing present state.



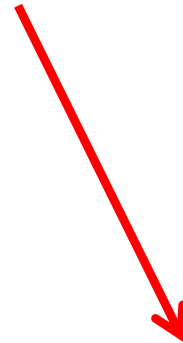
Proposed Initial nominal aim to correspond to 75m theoretical range

min height	max height	%down
488	563	0.7%
563	638	0.8%
638	713	0.9%
713	788	1.0%
788	863	1.1%
863	938	1.2%
938	1013	1.3%
1013	1088	1.4%
1088	1163	1.5%
1163	1238	1.6%

< sports car

< normal family car

< van/SUV



Is it any reference in Reg. 48 to sports car, normal family car, van/SUV?
Should be introduced?
Why?

Theoretical Range vs. real visibility

- Is Theoretical Range a good measure of real visibility range?:
- CIE TC4-45 generated a way to measure visibility range: it is significantly more complicated than simply the cut-off intersection, but correlates well with human perception.
- The following examples are taken from the CIE TC4-45 report
 - Two similar R98 headlamps, with similar mounting heights (715mm, 717mm)
 - Both are aimed at 1.0% down. This is the same value of aim that would apply under the proposal for these headlamp heights.
 - Ranges are calculated according to TC4-45 method.

Abs.: 150 200 250 300 350 400 450 500 550 600 650 700 750 800 850 900 950 1000 1050 1100 cd

Glare intensities plotted on screen located at 50m from Car

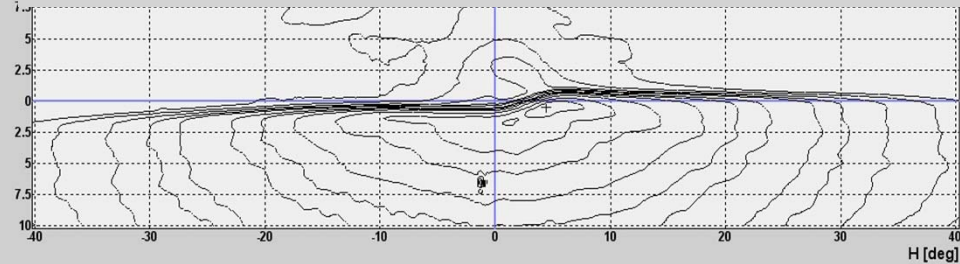
60m
forward
Visibility

75m

Low gradient through the cutoff = less glare sensitivity to initial aiming tolerances

Abs.: 0.1 0.2 0.4 0.7 1 2 3 5 10 20 30 50 lx

Illuminance values plotted on screen at 25m (0,0 is the Headlamp Optical Axis)



Abs.: 1 3 5 8 10 15 20 30 50 80 100 lx

Illuminance values plotted on road surface

Sample Number	Halogen		HID		Vehicle Data							
	REF	PROJ	REF	PROJ	Initial Aim	Voltage		Driving Beam operated with passing Beam?	Mounting Height mm		Separation	
					%	Passing	Driving		Passing	Driving	Passing	Driving
11				X	1%	13.1	13.1	Yes	717	639.3	1285	1285

Abs.: 250 300 350 400 450 500 550 600 650 700 750 800 850 900 950 1000 1050 1100 1150 1200 1250 1300 1350 1400 1450 1500 cd

Glare intensities plotted on screen located at 50m from Car

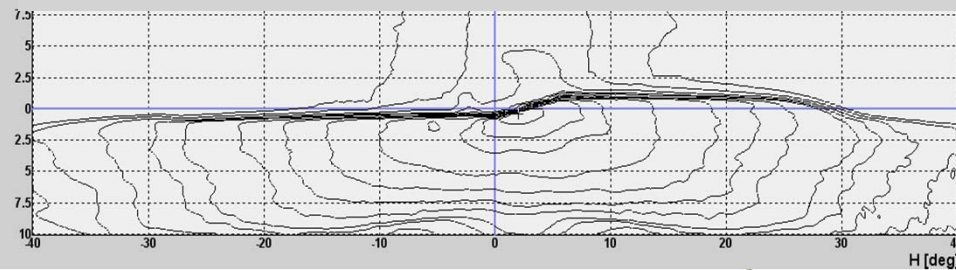
85m
forward
Visibility

75m

High gradient
through the cutoff =
more glare
sensitivity to initial
aiming tolerances

Abs.: 0.1 0.2 0.4 0.7 1 2 3 5 10 20 30 50 lx

Illuminance values plotted on screen at 25m (0,0 is the Headlamp Optical Axis)



Abs.: 1 3 5 8 10 15 20 30 50 80 100 lx

Illuminance values plotted
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					%	Passing	Driving		Passing	Driving	Passing	Driving
5				X	1%	13, 2	13, 2	Yes	715	695	1265	1035

5.06

Theoretical Range vs. real visibility

- Both lamps have a theoretical range of 75m
 - Sample 11 has TC4-45 visibility range of 60m
 - Sample 5 has TC4-45 visibility range of 85m
- **Conclusion: theoretical range is a poor measure of real-world visibility**



Theoretical Range vs. real visibility

- **Conclusion: theoretical range is a poor measure of real-world visibility**



To objectively assess aiming/leveling results of GRE/2012/27 appropriate are calculations for **lowest allowed** leveling according present requirements **2.5% down aiming**. How big will be differences between both headlamps and where will be 3lx position on left side?

Have in mind **inverted square law**. **1% aiming is inappropriate** for this situation.

By **2.5% aiming** results should be very closed **to 28 m**

In GRE/2012/27 is proposed : "It is also possible on the same way to declare **a longer** than minimum required road illumination distance according applicant knowledge"

Could be modified „It is also possible on the same way to declare a **longer or shorter** than minimum required road illumination distance according applicant knowledge"

Tolerance with load levelling to be 50m to 100m theoretical range (6.2.6.1.2) for both approval and CoP

- Currently total load levelling tolerance is 2.0% approval, 2.6% CoP
- Manufacturer may define initial aim to optimise levelling results

Current Approval		
min height	max height	%down
500	1000	0.5% to 2.5%
800	1200	1.0% to 3.0%

Current CoP		
min height	max height	%down
500	1000	0.2% to 2.8%
800	1200	0.7% to 3.3%

Tolerance with load levelling to be 50m to 100m theoretical range (6.2.6.1.2) for both approval and CoP

- Proposal is shown expressed as %.
 - Initial aim is defined by regulation
 - Highest permitted aim with levelling unchanged at -0.5%
 - Corresponds to a reduction in load levelling tolerance for most cars of 60-75%

Proposal				
	min angle	set	max angle	
H(mm)	100m	"75m"	50m	total tol
500	-0.5%	-0.7%	-1.0%	0.5%
550	-0.6%	-0.7%	-1.1%	0.6%
600	-0.6%	-0.8%	-1.2%	0.6%
650	-0.7%	-0.9%	-1.3%	0.7%
700	-0.7%	-0.9%	-1.4%	0.7%
800	-0.8%	-1.1%	-1.6%	0.8%
900	-0.9%	-1.2%	-1.8%	0.9%
1000	-1.0%	-1.3%	-2.0%	1.0%
1200	-1.2%	-1.6%	-2.4%	1.2%

It is alternative in GRE/2012/27:

„The crossing distance could be lower but not less than [25 m or 30m] under the condition that there will be information for driver

It should be carefully verified. But... What is the problem?

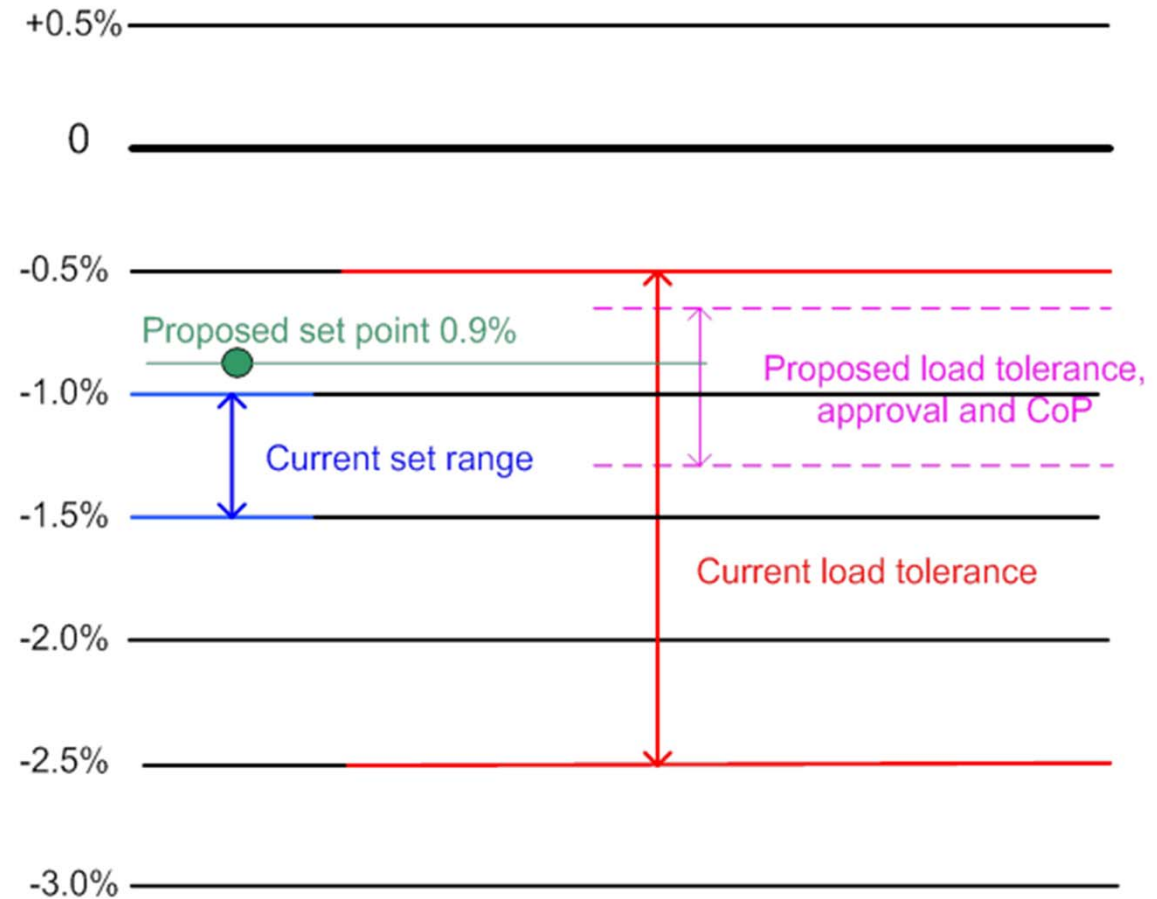
Manufacturers convenience (because not technical possibility)

or ...

SAFETY OF MILIONS DRIVERS AND PEDESTRIANS

Tolerance with load levelling

Example for
650mm high
passenger car
headlamp



- To consistently meet CoP requirements, initial aim and levelling system need to be repeatable with a standard deviation of better than 0.1%.
Repeatability of suspension system alone is not this good.

Tolerance with load levelling

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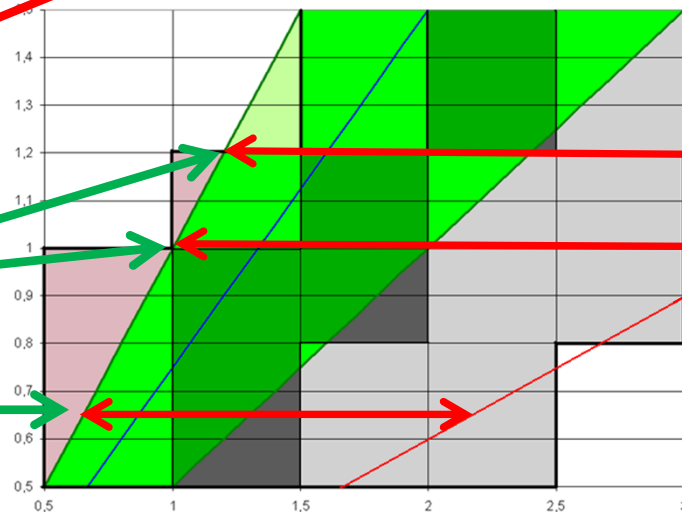
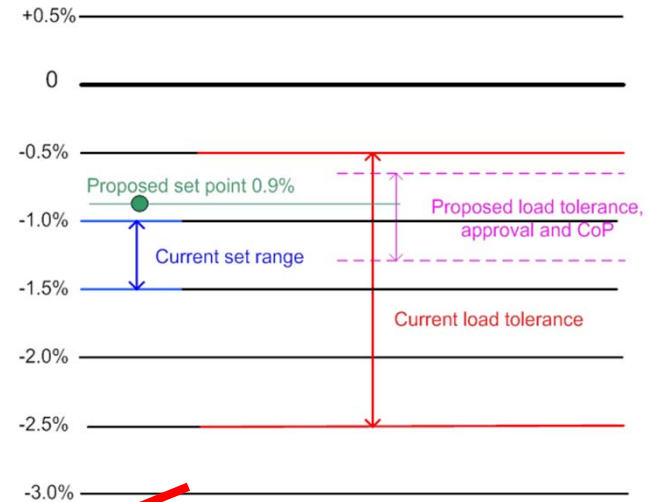
Repeatability of suspension system alone is not this good.

Repeatability (tested in Motor Transport Institute including performance of suspension) for automatic leveling for many cars was much better than 0.1%

For same (van/SUV/delivery trucks) tolerances are bigger

For some cars (sport cars) are lower

Example for 650mm high passenger car headlamp



6.2.6.1.3 requires that if, under loading conditions of Annex 5, aim falls above the 100m range, glare must be measured

- This is assessing the glare with the headlamp aimed as it would be under Annex 5 load conditions. Measurement to take place during headlamp type approval.
 - But at time of headlamp Type Approval, R48 inspection has not taken place, so the aim of the headlamp under Annex 5 conditions is not known.



**At time of headlamp Type Approval, could be very easy measured and additionally reported:
- what are the highest possible aiming/ mounting height values**

Deletion of 2000lm requirement

Current regulation para 6.2.9 prohibits the use of para 6.2.2.2 manual levelling option with LED or >2000lm light sources

- Proposal deletes this prohibition
 - Provided that 50-100m theoretical range can be achieved by manual levelling, manual levelling would be permissible for any headlamp.
- **GTB working group is currently reviewing visibility and glare: it would be better to await their outcome.**



GTB working group reviewed GLARE ONLY (Klettwitz tests) in respect to obligatory automatic leveling.

Results are as was easy to theoretically predict: significant influence of pitch angle. No significant influence of light source flux.

No visibility range research were done till now.

It is easy to predict that cut-off position at 20m before vehicle (or less for CoP reasons) cannot guarantee visibility for speed of 100 km/h

Warning message

- If theoretical range under Annex 5 loading conditions falls below 50m but above 25m, a warning notice is to be placed in the car, declaring the minimum theoretical range as a minimum "visibility distance"
- Visibility distance does not correlate directly with theoretical range (see above).



**For short distances correlates very well
Please verify before reporting**

GRE/2012/21 proposed changes to ECE R48 (1 of 3):

To redefine the initial aim and static load-levelling requirements of dip beam headlamps in terms of theoretical range on the road rather than the current % downward inclination.

Conclusion:

- Redefining the aim point will raise the aim for most passenger cars
This may not give the desired visibility range
- To prevent this causing increased glare, aiming and levelling tolerances must be tightened
 - Industry needs aiming and levelling capability data to identify if this tolerance tightening is practicable.

Conclusion:

- Redefining the aim point will raise the aim for most passenger cars
This may not give the desired visibility range



Not proved. Illegitimate statement.

- To prevent this causing increased glare, aiming and leveling tolerances must be tightened
 - Industry needs aiming and levelling capability data to identify if this tolerance tightening is practicable.



It is not a problem to identify.

It is possible easy measure values for vehicles offered on market.

It is simple and it was done.



**THANK YOU FOR YOUR
ATTENTION**