**SLR-28-11/Rev.1**

**Polish suggestions in addition to SLR-28-03**

**Compromise between visibility and glare**

**Conclusion / Take-away**

**(from discussion during SLR-27)**

**Conclusion #1**

Compromise between visibility and glare is complicated and always has some limits.

However, it is important to define both sides of “compromise” to have clear limits in requirements e.g.:

- minimum visibility (range) (# 2)

- maximum accepted illuminance at eyes,

- maximum luminance of lamp surface perceived from short distance,

- maximum illuminance during unexpected situation, e.g. directing high intensity to eyes,

Because of “compromise” and limits it should be forwarded clear message to drivers:

- how far they can see using particular (category of ?) headlights (e.g. basic passing beam) and speed equivalent to stopping distance.

... …

**Conclusion #2**

What IS performance oriented**1)** (for a lighting system):

* Visibility (i.e. visibility distance)
* Speed (i.e. stopping distance **\***)
* The width of the illumination (in relation to distance)
* The threshold value of vertical illuminance at road surface (or at given height e.g. 20cm) used for distance and width assessment. Eventually illuminance dependence on distance beyond vehicle.
* Visual appearance of lights at the vehicle for easy distinction the vehicle from other lights in view field and function separation (symmetry of pairs of lamps regarding shape, and distance, separation of function not masking or confusing) **2)**
* Effective method (tool) to verify minimum performance during in-use condition, e.g. precision (repeatability) of aiming to guarantee performance (road illumination and glare protection) during lifetime of vehicle. For instance, restrictions of headlamp size to make possible use headlight tester for aim and intensity checking. **3)**
* The tool to properly aim headlamp horizontally and vertically **4)**.
* … …

***\**** *Stopping distance: recognition, reaction and braking*

What is NOT performance oriented (for a lighting system):

* Light source choice
* Luminous flux of light source
* Maximum speed of the vehicle in case it is higher than the maximum permissible speed (there are different permissible sped in different countries…)
* Design of headlamp (or system or lighting unit). Projection or reflection or light guide etc. are not the performance issue
* Total luminous flux or zones luminous flux emitted from headlamp
* Cut-off line **4)**.

* … …

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1) “Performance” is general term which describe how act given device (system) independently what and which way is acting. May by it is not optimal and sufficiently unambiguous word but it was firstly used also in regard to another vehicle components like emission, brakes etc. May be more adequate term would be “property” and/or “feature”? This document serve to clarify what “performance” does mean and what not. Later this general ideas should be converted to physical measurable values responsible for important aspects of driver perception and recognition. May be it should be described as new definition in regulation.

2) It concern not only headlamps but also signalling lamps. Driver should quickly and correctly recognize given lighting device. From historical and regulatory reasons there were defined and distinguished functions e.g.:

- Headlamps for road illumination. Message: The vehicle is approaching and is in move,

- Position lamps inform regarding presence and shape of vehicle from front and rear,

- Direction indicators show change direction intention,

- Etc.

The shape, size and position of lamps has clear meaning and are coded also clear visual separation between some of them (e.g. RID & DI). Therefore also in the future it should be (more) clear. Decorating vehicle by lighting is somehow against this intention but for today is widely present in uncontrolled manner. Drivers might be able to learn and adapt to such disturbing and sometimes misleading ideas. How much new ideas can differ from clear shape and position (circular, rectangular with rather uniform brightness) is subject of “performance” (“property”). Height symmetry or distance from edge and vehicle axis are examples. Therefore clear definition of apparent surface (what is and what is not) is also "performance" factor and should be instrumentally verifiable.

3) The intention is to guarantee minimum performance during lifetime of lamp. It would be perfect to guarantee it by design. But in reality it is observed unpredictable deterioration of performance which depend on many factors. Differences between lamps come from different manufacturers (e.g. aftermarket). Also maintenance will be necessary. For today the headlamp need initial aim which can change during vehicle use, after bulb change etc. Front lens can be scratched or blurred, dirt can come inside lamp (broken body or lens etc.), incorrect bulb can be placed or bulb can be placed incorrectly. Because of such many and not fully predictable factors the lighting performance might be worsened below acceptable limit in unpredictable time or millage period. Therefore it is needed possibility to verify minimum quality during in-use period in service and in PTI. This is the reason for PTI test which should be reliable. Therefore it is needed appropriate method which should be described at type approval level. E.g. for today headlamps the cut-off line exists which should allow to aim headlamp repeatedly with needed (clearly defined) precision. In addition during PTI should be measured some photometry sufficient to find significant lack in illumination. Today it is done by photo-sensor(s) placed on the tester screed eg. in the middle, 75R and B50L for glare. However for matrix or combined (multisource) systems it might be possible that e.g. some "part of the beam" will not work. Therefore appropriate and more "general performance" test should be proposed. Headlight tester has internal restrictions like tester size and lens size. Therefore to effectively check the headlamp it should have restricted size which allow to measure it with required precision. All flux going out from headlamp and responsible for required illumination should go through tester lens. Therefore size of headlamp should be smaller than lens of tester (required minimum size) or should be possible separate parts of bigger light (eg. two or more lighting units separately activated) and check each part separately to make possible the check of whole beam appropriately.

The “performance” conclusion is that it is needed to define some “design” restrictions to guarantee lifetime “performance” of lighting system.

4) The cut-off line is not the performance item. It is subjective visual phenomenon. It is result of historical decision to have given design of passing and driving beam in one parabolic double filament headlamp. However it was (and is) obligatory tool to aim headlamp. The result are the restrictions in headlamps design and not optimum light distribution - range and glare protection. Sharp cut-off is convenient for set the aim but not always for good road illumination and glare protection. Therefore if will be another “property” possibility to aim the headlamp the cut-off could be irregular or not sharp or not at all.