

## **GRE IWG-VGL - Justification for lines defining the limits for the aiming diagram from VGL-07-04:**

### **Line 2 – [0.0;0.8] to [0.85;1.2]:**

This line results from both the comparison between Kletwitz test and **CIE Standard S021/E:2011** (issued from TC4-45 studies) and a compromise between the members of IWG-VGL.

Comparison of Kletwitz test and **CIE Standard S021/E:2011**:

- During Kletwitz test, it was defined a relationship between the pitch angle and the discomfort glare.  
A passing beam cut-off line above the horizon increases the discomfort glare for oncoming drivers, depending on the headlamp mounting height.  
(Reference: page 149 of **GRE-71-32**)
- Cut-off positions above the horizon lead to weighted luminous flux values in **CIE Standard S021/E:2011** glare zone above 1 lumen.  
(Reference: pages 149 to 152 of **GRE-71-32**)  
→ The correlation between those two elements above allows to use **CIE Standard S021/E:2011** glare calculations for the assessment of glare impact to oncoming drivers in real traffic situations. (Reference: page 152 of **GRE-71-32**)

With the help of scientific calculations based on **CIE Standard S021/E:2011** glare zone method, GTB/OICA defined a graph for mounting heights between 0.5m to 1.2m. (Reference: page 152 of **GRE-71-32**)

On this GTB/OICA graph (see figure 2 below), the top left point is defined as [0.6;1.2]. (This is the initial brown line of the diagram on page 2 of **GRE-77-27**, now so-called Line 6)

However, during the 5<sup>th</sup> session of IWG VGL in Poland (January 2017), Japan asked to keep the real value calculated from **CIE Standard S021/E:2011**: [0.85;1.2] (see figure 1 below).

The group agreed on this proposal and the Line 2 was defined consequently.

In addition, in the 7<sup>th</sup> session of IWG VGL in France (June 2017), the Chairman brought some new elements confirming the robustness of Line 2 (Reference: **VGL-07-06**, explaining so-called Line 7).

This Line 7 is based on the position of the oncoming driver's eyes at 0.94m height and the headlamps at 1.2m height (optical axis). At a distance of 25m, this is equivalent to an initial aiming of 1% down. For all headlamp heights under 1.2m, with same aiming of 1% down, the cut-off line will be always under 0.94m.

As Line 7 is further to the left of Line 2, it consolidates this Line 2. The group decided to keep Line 2, as it is on the “safe side”.

In the 8<sup>th</sup> session of IWG VGL in France (July 2017) it was discovered that the Line 7 crosses a little bit the Line 2 for highest mounting heights. The group concludes that this does not change previous conclusion to keep the Line 2.

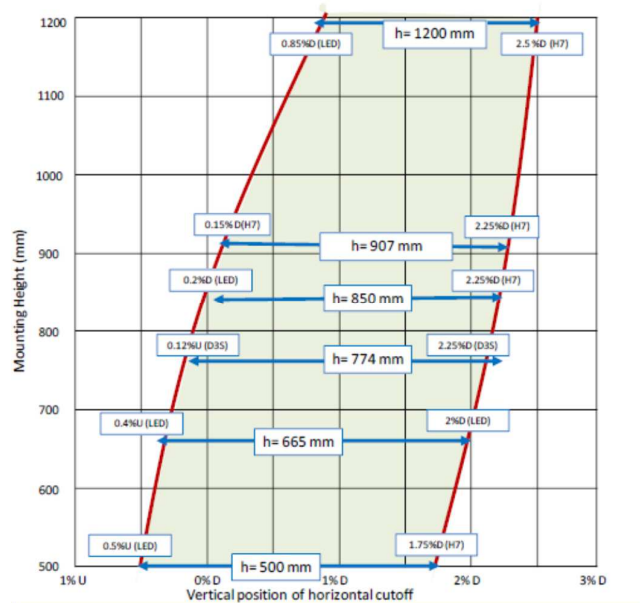


Figure 1 – GTB/OICA - Graph resulting of measurements

(Reference: page 167 of GRE-71-32)

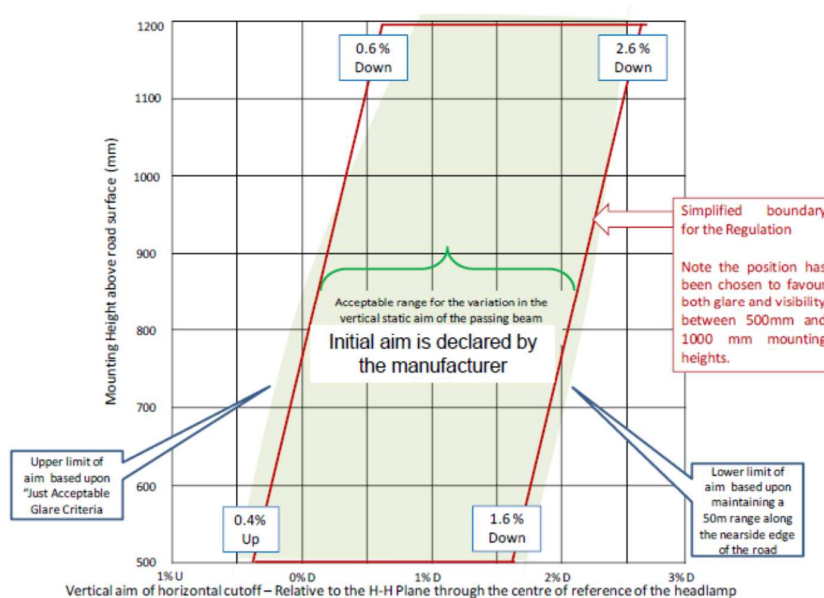


Figure 2 – GTB/OICA - Graph with straight lines

(Reference: page 168 of GRE-71-32)

**Line 1 – [0.0;0.5] to [0.0;0.8]:**

This line results also from both the comparison between Kletwitz test and **CIE Standard S021/E:2011** (issued from TC4-45 studies) and a compromise between the members of IWG-VGL.

A basic straight line was drawn on the left side [0.4U;0.5] to [0.6D;1.2]; following same work done for so-called Line 6 (Reference: page 168 of GRE-71-32).

To avoid to create any confusion for the Contracting Parties and to limit glare risks further, it was decided as a compromise to cut the area above 0 on X axis (aiming). →The result is the Line 1: [0.0;0.5] to [0.0;0.8] (0.8 is a round value, resulting from Line 1 crossing Line 2).

**Line 4 – [1.6;0.8] to [2.4;1.2]:**

The angle of Line 4 is defined scientifically by the requirement of 50m minimum road illumination distance independently from mounting height. Starting point ids [0.0;0.0]. This is an important prerequisite from Poland. The group agreed on the merit of a performance-based line.

The value of 50m has been discussed during the 5<sup>th</sup> session of IWG VGL in Poland. Japan expressed its interest to keep it as minimum safety value.

OICA expressed concerns about the fact that such a line does not take into account the necessary tolerances for design, production and life of vehicles in reality.

**Line 3 – [1.6;0.5] to [1.6;0.8]:**

Carmakers presented some studies about the range needed for the aiming, independently from the levelling device type or system, both in 5<sup>th</sup> or 7<sup>th</sup> sessions.

The conclusion during the 5<sup>th</sup> session was that Industry needs a minimum range of 1.6%.

So Japan proposed to draw a line parallel to the Line 1 with an interval of 1.6. It is the start of this vertical Line 3. The end point of it is defined by its intersection with the Line 4.

**Additional information:** Absolute limits (including CoP) / compare the new box with old box including CoP tolerances

→ To have a cleaned up version of the new diagram.

The compromise of combination of Line 3 and Line 4 is not totally satisfactory for Poland, who insisted on having a line with a [0.0;0.0] starting point.

As a result, Poland drew some other alternatives lines (5, 8 & 9) after the 5<sup>th</sup> session, issued from the same scientific calculation as for the angle of (green) Line 4.

**Line 5 - starting from [0;0] crossing the point [1.6;0.5]:**

Poland made, during the 6<sup>th</sup> session of IWG VGL, a proposal to have 2 Classes for minimum road illumination distance: 50m (Class50), spirit of green Line 4, and alternative 30m (Class 30), so-called Line5.

This could allow for instance 'city cars' to have bigger range due to their typical road uses and would cover the needs for the range explained by Industry.

However, some Contracting Parties expressed the need to improve the minimum visibility distances compared to today and 30m would be too low to improve significantly the road safety.

Therefore, Line 8 (37.5m) and Line 9 (40m) have been defined as possible compromise during the 7<sup>th</sup> session, with homework for Industry to analyze consequences (vis-à-vis needed range).

**Line 8 - starting from [0;0] crossing the point [1.6;0.6]:**

This line defines minimum road illumination distance of 37.5m.

It reduces the range below 1.6 for lowest mounting heights. Industry has to study consequences on vehicles.

**Line 9 - starting from [0;0] crossing the point [1.6;0.65]:**

This line defines minimum road illumination distance of 40m.

It reduces the range significantly below 1.6 for lowest mounting heights. Industry has to study consequences on vehicles.

**Remarks:**

→ To add in appendix at the end of the document, the latest version of the diagram and even other needed slides.

→ Explanations under development (target according to VGL-08-13 original version: 13<sup>th</sup> of September 2017):

- 1 lumen: to be updated (by beginning of September)
- Range of 1.6