Informal document **GRE-68-20**
(68th GRE, 15-18 October 2012,
agenda item 4(b))

# Comments on GRE/2012/27 (Lighting & Signalling WG)

## Headlamp Initial Aiming

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.**

## 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.**

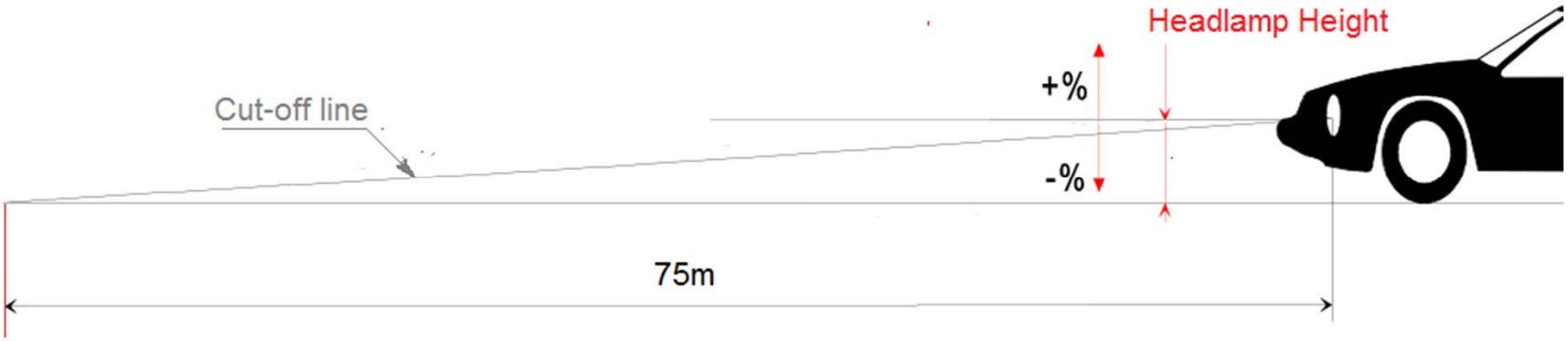
- **To reduce aiming tolerance, and delete the additional aiming tolerance in CoP, aligning it with the approval requirement.**

- **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.**

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

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

# 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
  - Risks increased glare.

| 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

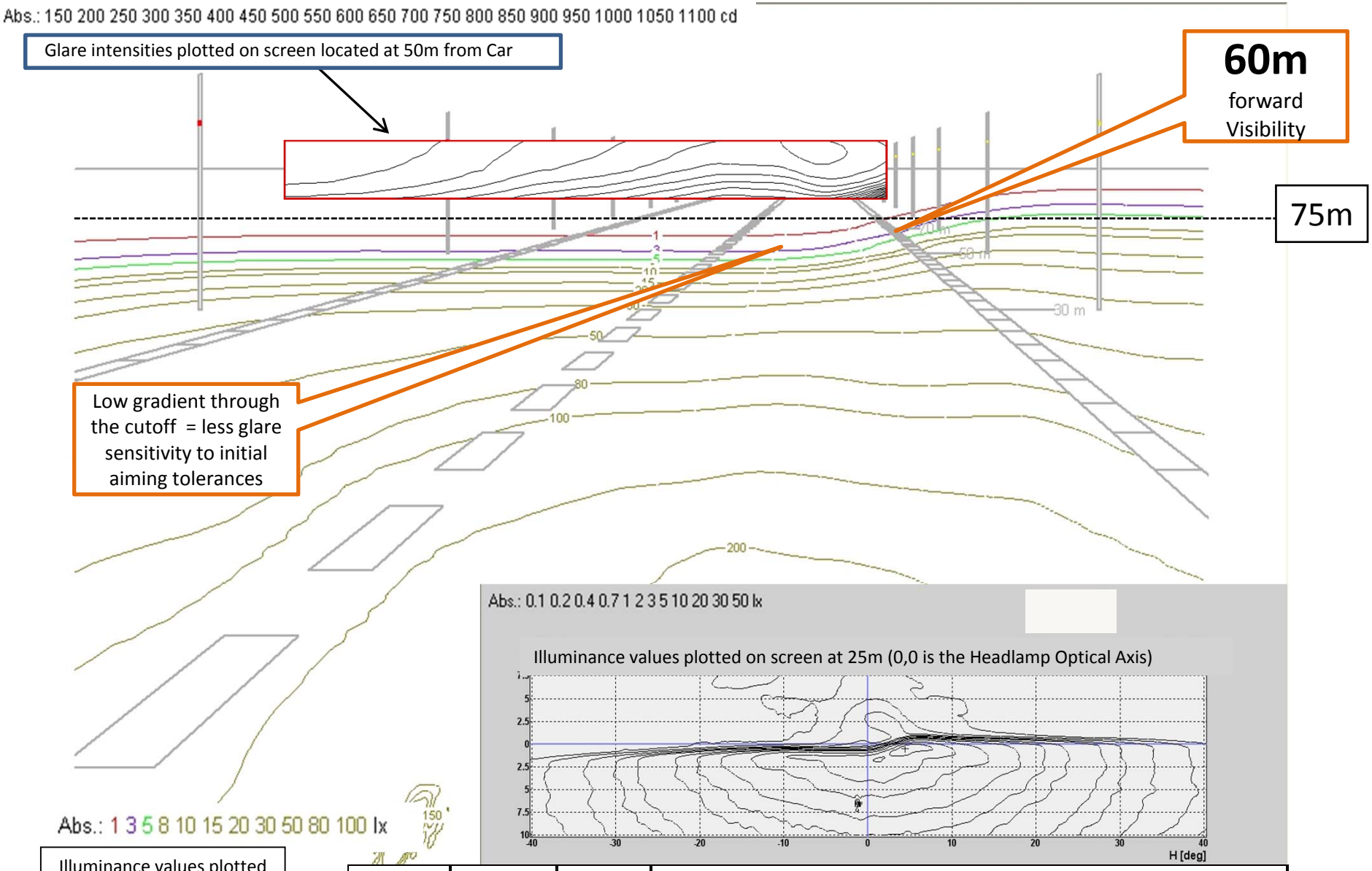
< van/SUV

## Theoretical Range vs. real visibility

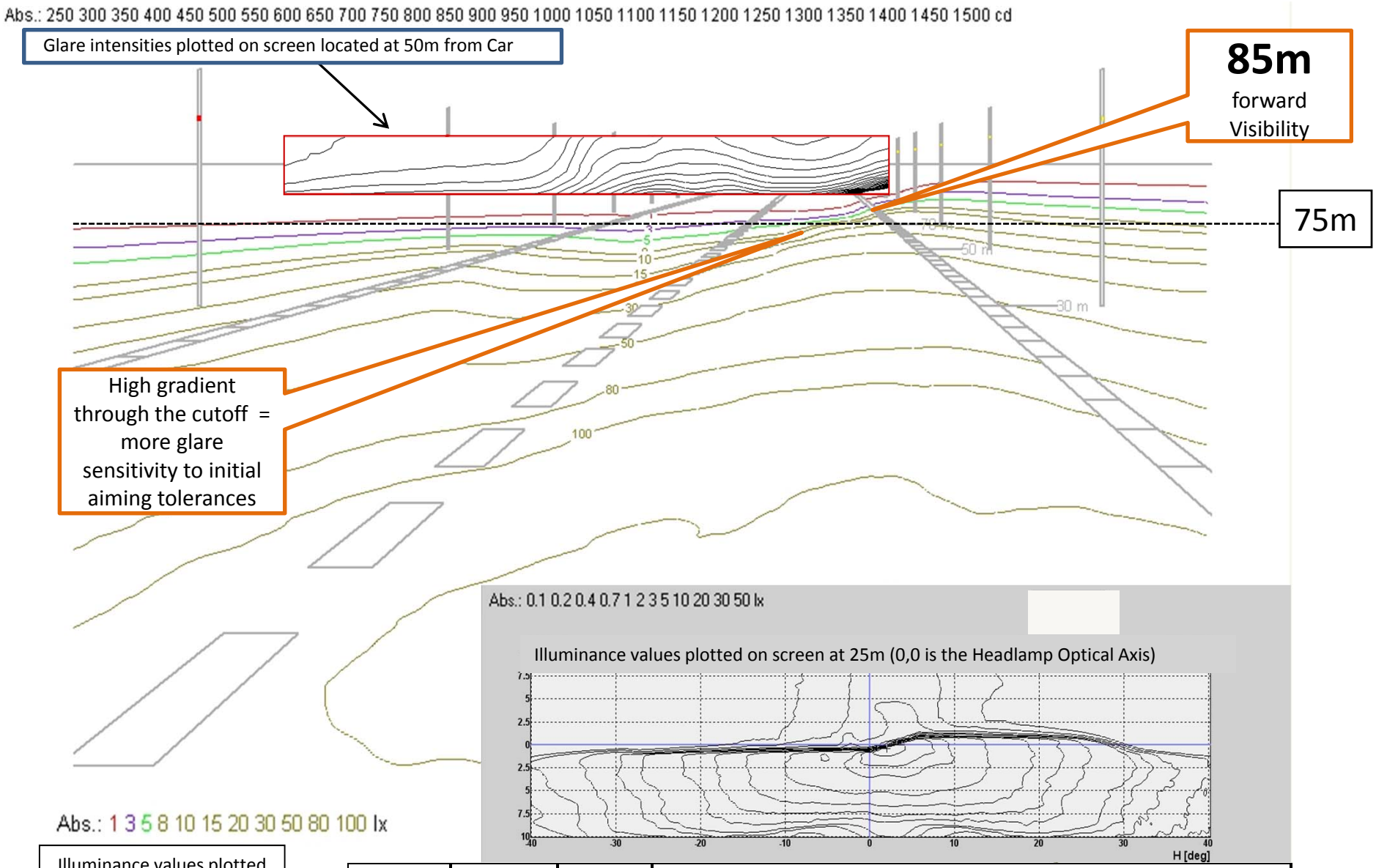
- Is Theoretical Range a good measure of real visibility range?:

- 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.




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




| Sample Number | Halogen | | HID | | Vehicle Data | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | REF | PROJ | REF | PROJ | Initial Aim % | Voltage Passing | Voltage Driving | Driving Beam operated with passing Beam? | Mounting Height mm Passing | Mounting Height mm Driving | Separation Passing | Separation Driving |
| 5 | | | | X | 1% | 13, 2 | 13, 2 | Yes | 715 | 695 | 1265 | 1035 |

## 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**

# 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% to3.0% |

| Current CoP | | |
|---|---|---|
| min height | max height | %down |
| 500 | 1000 | 0.2% to 2.8% |
| 800 | 1200 | 0.7% to3.3% |

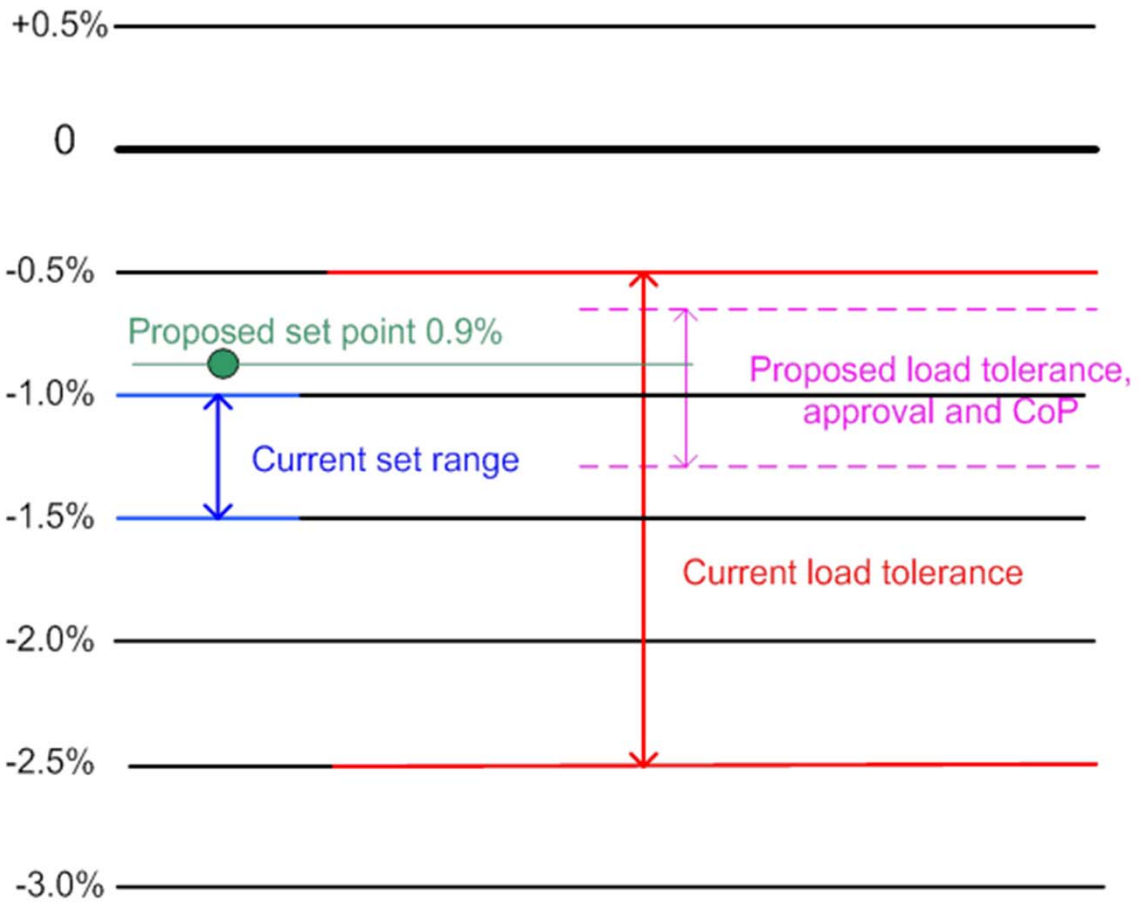
# Tolerance with load levelling to be 50m to 100m theoretical range (6.2.6.1.2) for both approval and CoP

- 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% |

# 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.

## 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.

# 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.

## 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).

## 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.

# Thank You