OICA-GTB proposal GRE/2015/5

Explanations and justifications

Introductory reminder
Glare is a complex topic

Many possible causes

Introductory reminder
Glare is a complex topic

Introductory reminder: glare is a complex topic – many possible causes

➢ Road geometry/quality (curves, undulations in the road surface, speed bumps, damaged road surface, adverse camber)

➢ Vehicle acceleration and braking (suspension travel)

➢ Reflected light (seen on wet roads, rain situation)

➢ Driving behaviour (inappropriate use of main beam headlamps in traffic)

➢ Oncoming/preceding drivers eye position (in relation to headlamp mounting height)

➢ Headlamp adjustment (loss of factory setting during service)

➢ Headlamp shock (mounting point misaligned due to impact)

→ Headlamp levelling only partially addresses the overall amount of glare on the road network

→ As indicated in terms of reference, VGL should not forget to work beyond questions of levelling, in order to really try to solve glare concerns

Introductory reminder
Glare is a complex topic

Need for costs/benefits

logics & justifications

Introductory reminder: glare is a complex topic – need for costs/benefits logics & justifications

➢ Glare is complex: high amount of contributing parameters

➢ Glare is a real, but highly subjective, phenomenon

➢ « Disability glare » vs. « discomfort glare »
  - An objective impairment of visual performance and a risk to road safety during night time
  - Vs. A subjective impression of discomfort and a lesser risk to road safety during night time. With glare being a subjective phenomena academia has developed a number of rating methods. E.g. The DeBoers scale (1974) which uses the criteria: Noticeable/Acceptable/Just Admissible/Disturbing/Unbearable

➢ Since initial GRE discussions in 2011, no concrete scientific proof has been brought to demonstrate objectively that manual levelling instead of automatic levelling causes « disability glare »

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GRE/2015/5 : justification

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Scientific roots of the
OICA-GTB proposal

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➢ Literature survey by GTB « to improve the understanding of different factors that influence visibility and glare and their respective weighted importance » (notably GRE-71-32, p. 44-77)

➢ Investigations on vehicle use and loading patterns based on available studies (notably GRE-65-16)

➢ Field test in conjunction with the Technical University of Darmstadt (carried out in Klettwitz, DEKRA's facilities)
  - Glare from 25 vehicles (M1/N1) equipped with halogen, HID and LED headlamps rated by 47 observers
  - Cars loaded a 0%, 50% and 100% load conditions
  - Total of 66 tests runs

Scientific roots of the OICA-GTB proposal

➢ Main results from Klettwitz tests:

→ Vehicle pitch contributes to unacceptable glare (rated using the de-Boer scale)

→ Light source technology is not a factor influencing the glare assessment

→ Glare was judged to be acceptable when the horizontal passing beam cut-off remains on or below the H-H line. This correlated with the pitch of test vehicles under the « 50% loading » condition

Explanation of exclusion of heavy trucks at this stage, see presentation from Volvo Trucks

➢ Validation of the glare observations using the procedure developed by the CIE TC4-45 committee (CIE 188:2010 and CIE S021) – see G. Langhammer's presentation
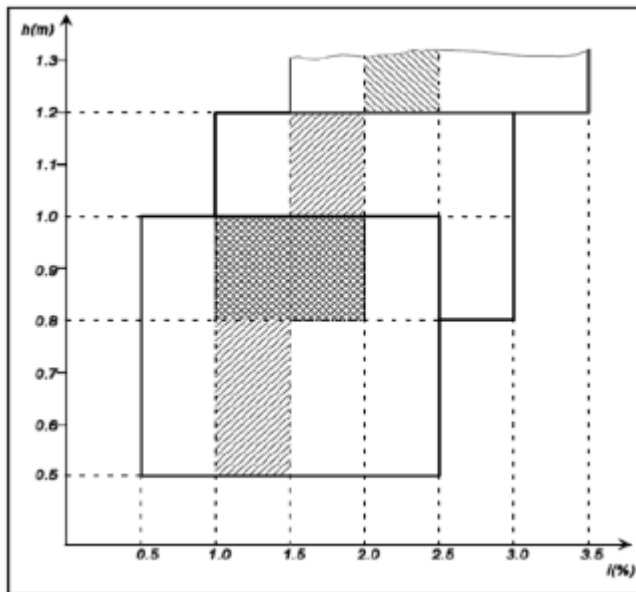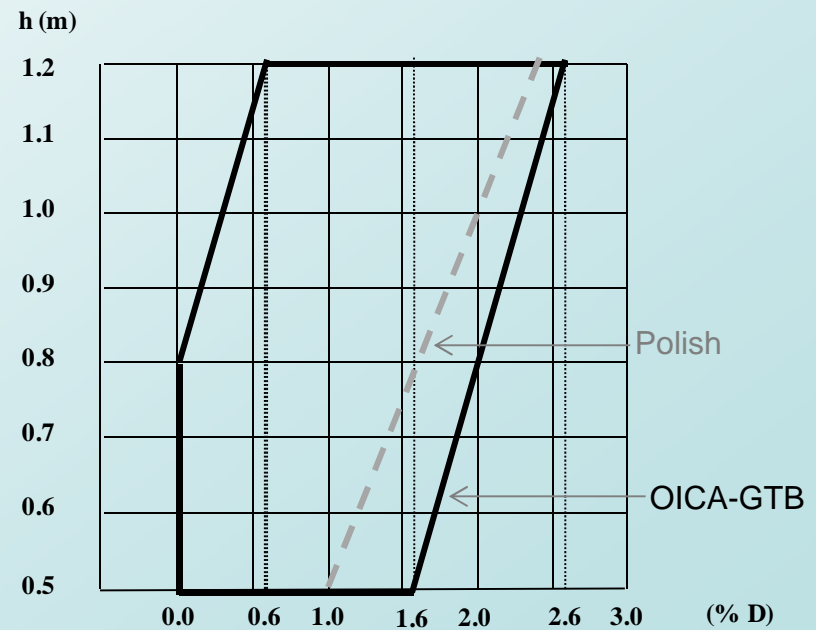
GRE/2015/5 : justification

Tolerance zone

Tolerance zone

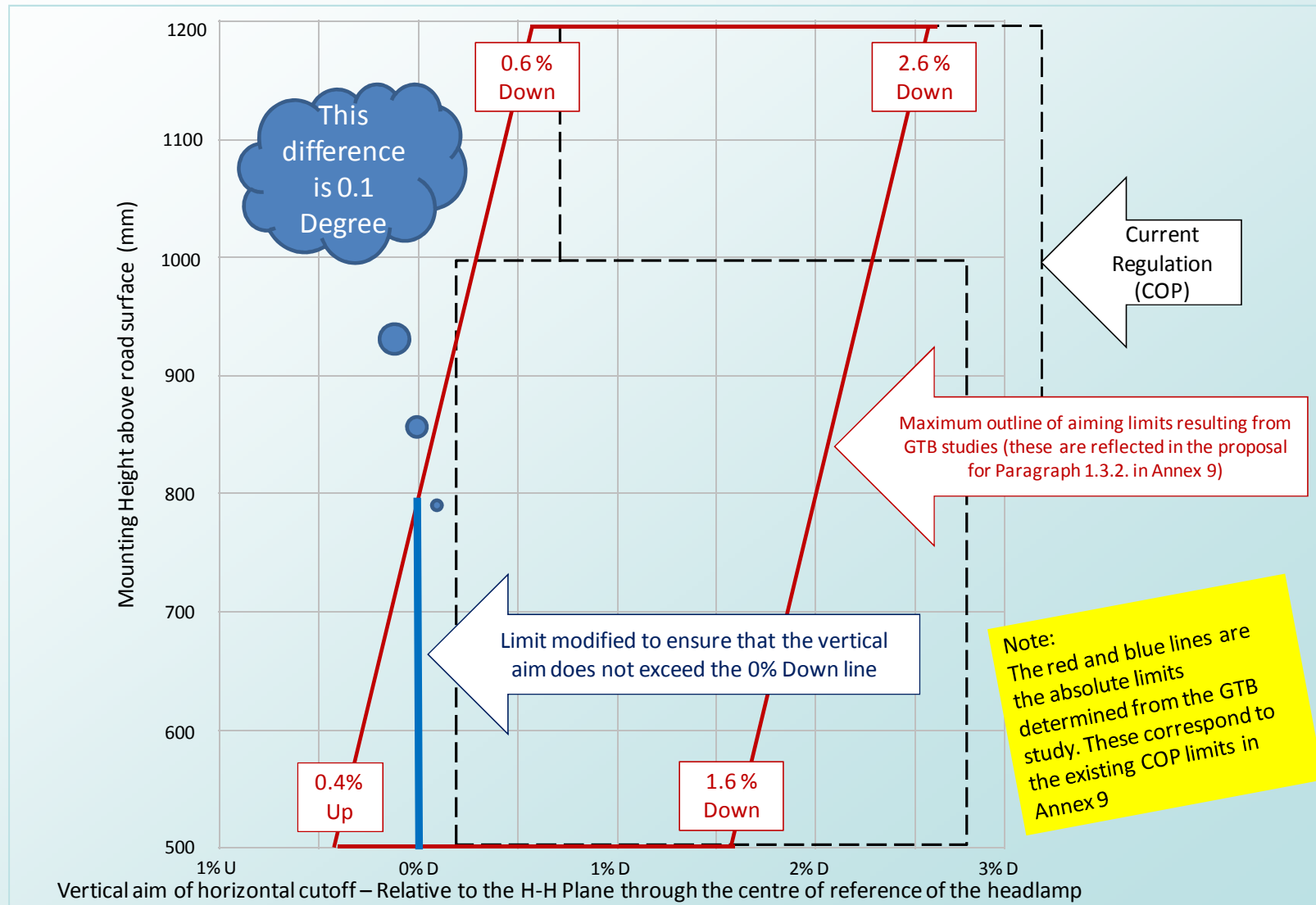## Current ECE R48 (for approval)
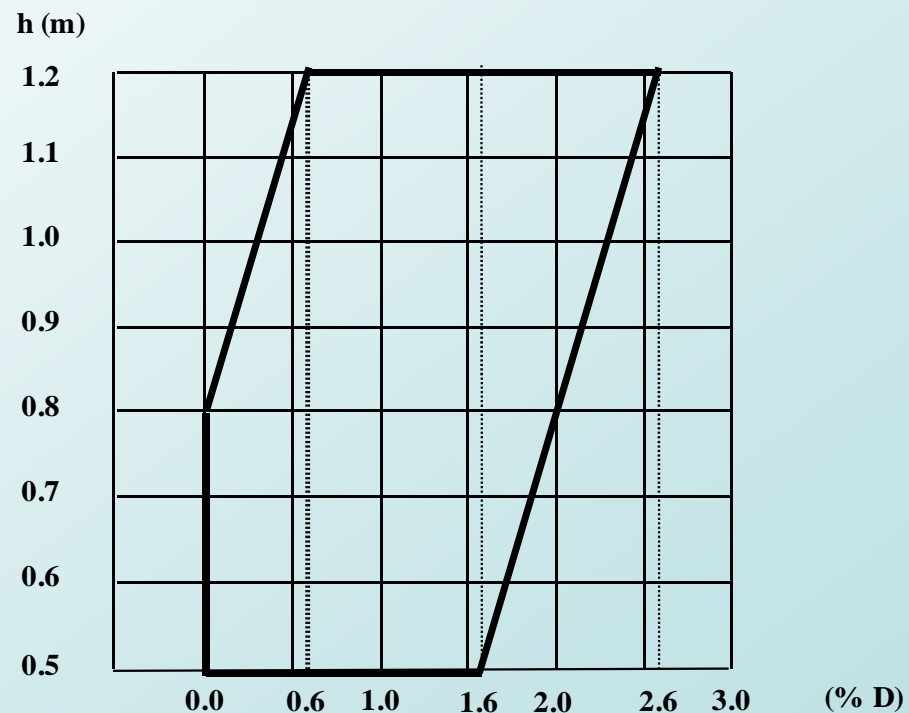

OICA-GTB &. Poland « tolerance zones »

Tolerance zone

« Tolerance zone » OICA-GTB vs. Poland

➢ Left limit (regarding risk of glare):

🌐 Agreement between Poland (GRE-73-18) & OICA-GTB (GRE/2015/05 & 73-06) – based on Klettwitz tests

🌐 Glare remains acceptable providing the horizontal cutoff remains below the H-H line as defined in the headlamp regulations


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« Tolerance zone » OICA-GTB vs. Poland

➢ Right limit (regarding minimum visibility):

🌐 Both proposals improve minimum visibility, compared to current regulation levels

🌐 Both proposals use a 50 meters criterion

❖ Polish proposal based on lowest possible performing headlamps meeting the minimum type approval requirements / independently from considerations of current levels of performance on the roads

❖ OICA-GTB proposal – based on Klettwitz tests and CIE TC4-45 (calculation) – see Gerd Langhammer's presentation – lower limit of aim based upon maintaining 50m range along the nearside edge of the road / based upon headlamp systems typical of the standard of performance currently achieved in popular Western European and Japanese type-approved vehicles
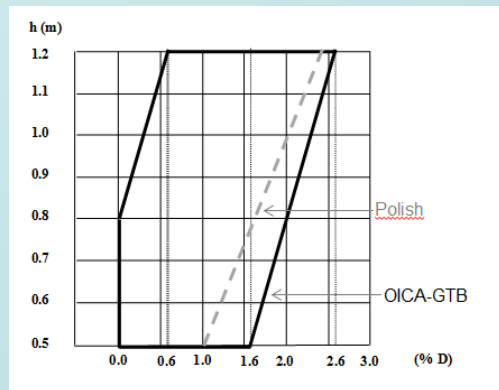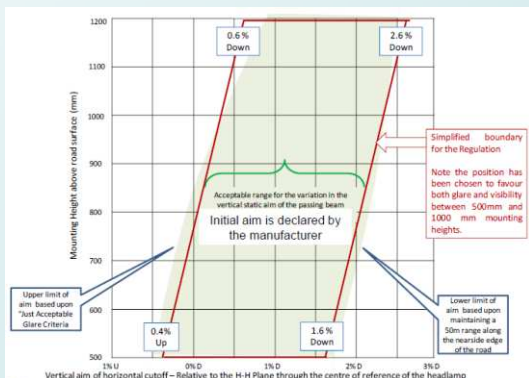
« Tolerance zone » OICA-GTB vs. Poland

« Headlamp systems typical of the standard of performance currently achieved in popular Western European and Japanese type-approved vehicles » vs. « lowest possible performing headlamps meeting the minimum type approval requirements »:

- Regulation cannot ignore reality.
    - « Standard of performance » of current approved vehicles needs to be considered in order to avoid overregulation
    - We regulate for future cars

- Minimum level is necessary for safety reasons, in order to ensure minimum visibility distance

OICA-GTB takes into account the request for improvement compared to today: proposal guarantees a minimum 50m range along the nearside edge of the road, for all dipped-beam headlamps – including the « lowest possible performing headlamps meeting the minimum type approval requirements ».

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GRE/2015/5 : justification

Loading cases & decision criterion

GRE/2015/5 : justification

Loading cases & decision criterion

Variation of pitch angle according to the load as a decisive aspect

Variation of pitch angle according to the load as a decisive aspect

➢ Today:
  - 2,000 lm criterion to decide whether manual levelling is authorized, or not
  - Then, all cases of current annex 5

➢ OICA-GTB proposal in 2 steps (1st for decision – 2nd for performance of the levelling device)
  - 50% load case (new)

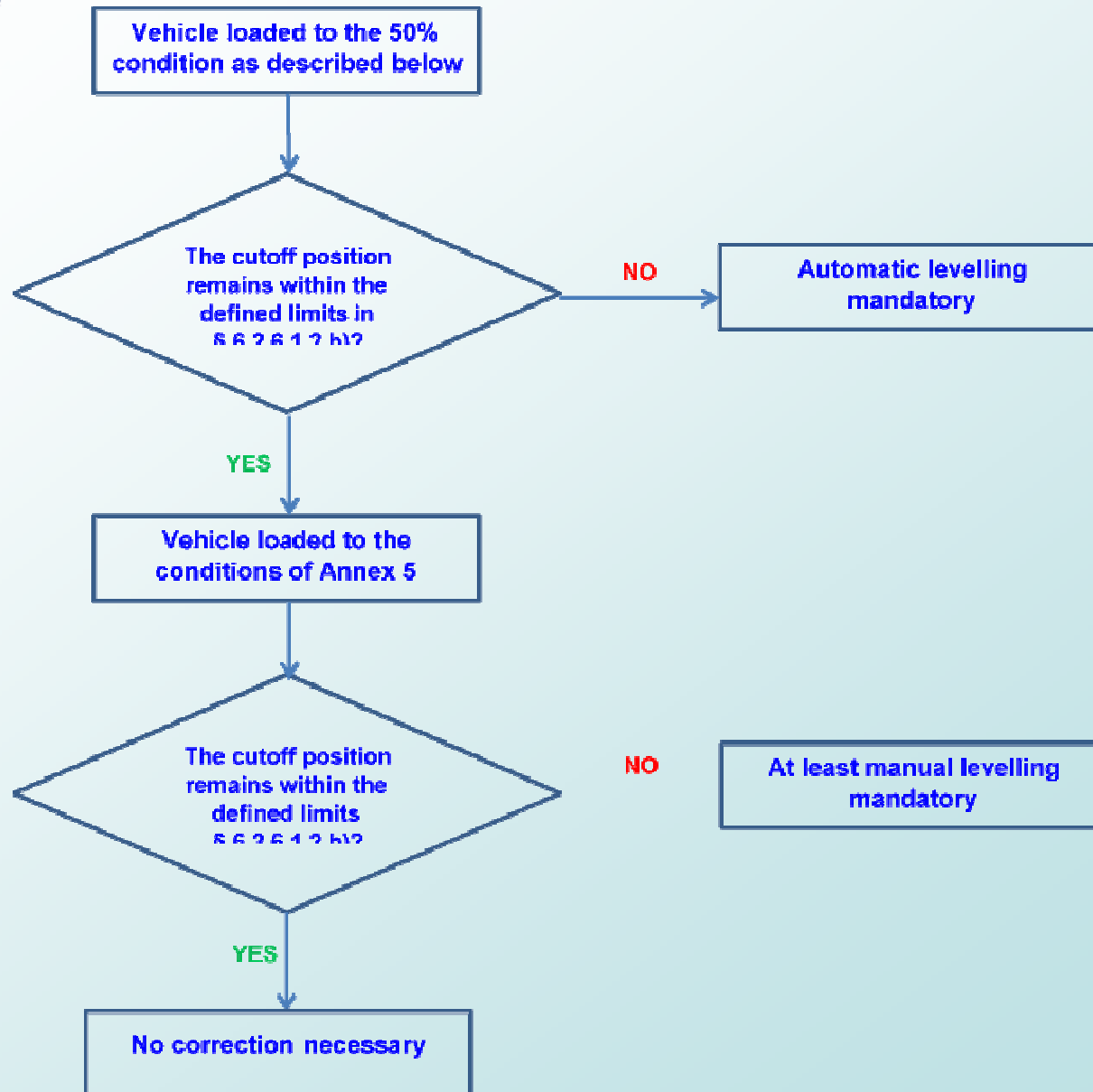   Under the 50% loading condition:
    - ❖ If the cutoff does not remain within the limits of the tolerance zone (diagram), automatic levelling is mandatory
    - ❖ If the cutoff remains within the limits of the tolerance zone (diagram) <u>without any intervention</u>, manual levelling is authorized
  - Then, all cases of current annex 5

  As today, aim is to check the performance of the levelling device, including under « worst possible cases » (max. inclinations up & down with a 75 kg driver and various load repartitions)

OICA/GTB PROPOSAL IN 2 STEPS

Vehicle loaded to the 50% condition as described below

The cutoff position remains within the defined limits in 8.6.2.6.1.2 b)?

NO → Automatic levelling mandatory

YES

Vehicle loaded to the conditions of Annex 5

The cutoff position remains within the defined limits 8.6.2.6.1.2 b)?

NO   At least manual levelling mandatory

YES

No correction necessary

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Variation of pitch angle according to the load as a decisive aspect

→ Modification suggested by OICA-GTB concerns only the decision criterion to replace the 2,000 lm current decision criterion

→ Why is the « 50% » load case proposed by OICA-GTB relevant as a decision criterion?

GRE/2015/5 : justification
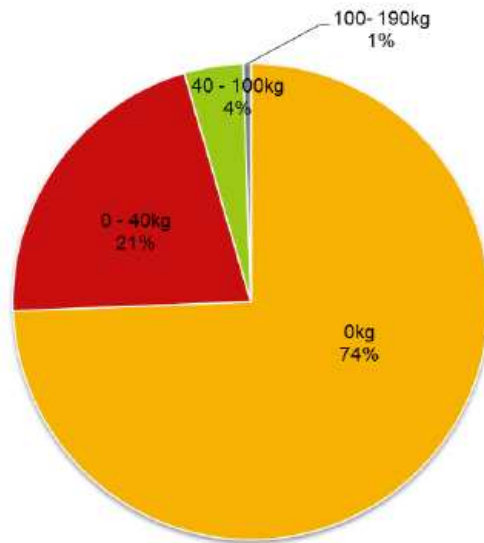
Loading cases & decision criterion

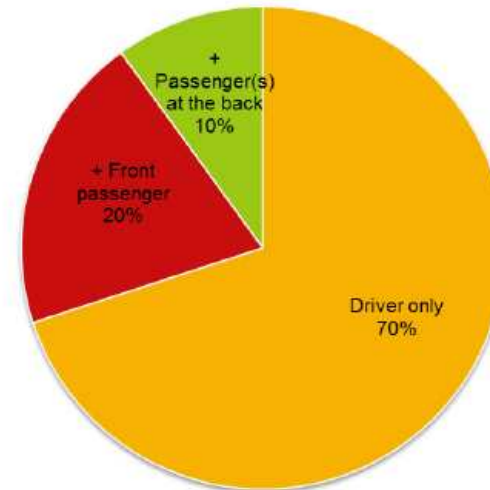*Relevance of 50% load case as decision criterion*

Relevance of 50% load case as decision criterion

➢ Data based on accidentology (LAB Data + EACS & EDA)

LOADING CONDITIONS OF VEHICLES INVOLVED IN ACCIDENT

ECE/TRANS/WP29/GRE/65/16

Trunk load

- 100- 190kg 1%
- 40 - 100kg 4%
- 0 - 40kg 21%
- 0kg 74%

Passengers load

- + Passenger(s) at the back 10%
- + Front passenger 20%
- Driver only 70%
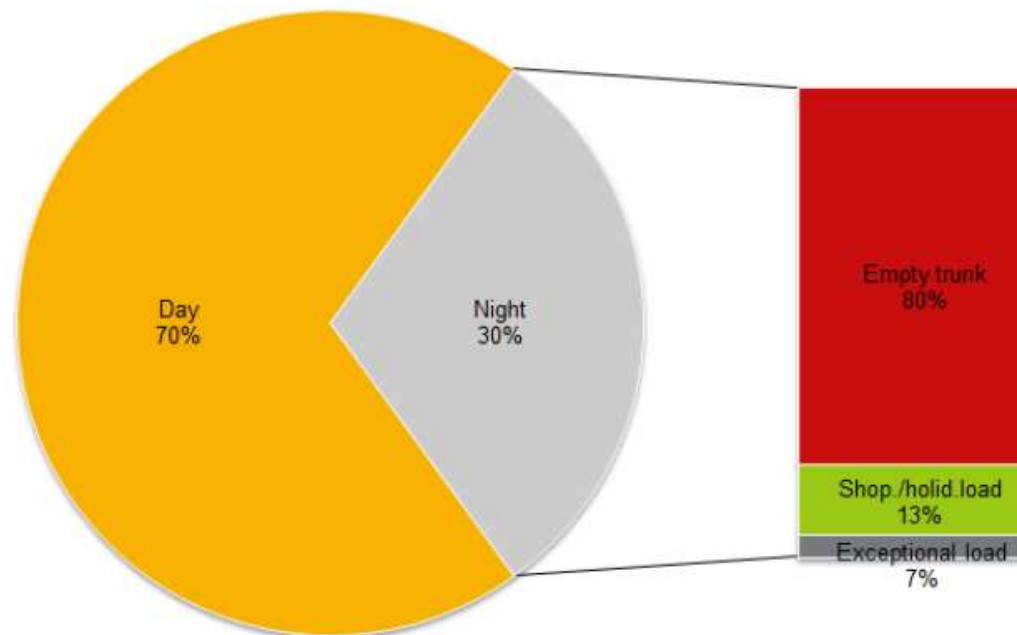
Relevance of 50% load case as decision criterion

➢ Data based on accidentology (LAB Data + EACS & EDA)

CUSTOMER HABITS REGARDING LOAD IN VEHICLE'S TRUNK

ECE/TRANS/WP29/GRE/65/16

Relevance of 50% load case as decision criterion

2. Data based on international « independent » surveys confirms statistics previously provided by OICA

Studies used by OEMs to define the « mission profiles » (/!\ confidentiality issues) → Reliable source of information

For example:

- Marketing survey NCBS 2014 and 2015
    - ❖ *New Car Buyer Survey*, multi-builder survey of buying behavior and customer satisfaction vis-à-vis the product and the service, carried out 4 months on average after the purchase
    - ❖ Europe 5 countries (France, Germany, Spain, Italy, Britain), China, Russia, Brazil, Argentina, Algeria, Turkey, South Africa
    - ❖ Segments A, B, B_SUV, C, C_SUV, D, D_SUV, E, E_SUV
    - ❖ Analysis enables to determine for instance
        - – Average number of adults and number of children
        - – % of the number of journeys unladen and loaded
- Many others surveys possible…

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Relevance of 50% load case as decision criterion

Example of NCBS question

Vehicle loading:

I would like you to tell me whether your vehicle is used for this purpose or not, and how frequently

5. With large packages, luggage or objects in the trunk or inside the car

For each of the items, the answers are given in the form of optional MCQsmultiples:	→	Almost every day
		At least once a week
		At least once a month
		At least once a year
		Never
		Does not know / Does not remember
		Refused to answer

Relevance of 50% load case as decision criterion

NCBS 2014 & 2015 (extract sample of about 350 000 cars) / Some interesting data:

/!\ does not take into account day/night repartition

- Average repartition of the number of occupants: some specificities based on geographic location, but similar tendencies → <u>limited average number of occupants</u>
  - ❖ In Europe : average is around 1,6-1,7 adults (including the driver) / around 0,3 children
  - ❖ In China : average is about 2 adults (including the driver) / around 0,5 children
  - ❖ In Russia : average is about 1,8-1,9 adults (including the driver) / around 0,4 children
  - ❖ Etc.

Relevance of 50% load case as decision criterion

NCBS 2014 & 2015 (extract sample of about 350 000 cars) / Some interesting data:

/!\ does not take into account day/night repartition

- Average repartition of loading: some specificities based on geographic location, but similar tendencies → <u>more than 9 journeys out of 10 « unladen »</u>
 - ❖ In Europe: in all segments, > 90% of journeys « unladen »; in total, around 95% of journeys « unladen »
  - ❖ In China: in all segments, >96% of journeys « unladen »; in total, around 98% of journeys « unladen »
  - ❖ In Russia: in all segments, >94% of journeys « unladen »; in total, around 97% of journeys « unladen »
  - ❖ In Brazil: in all segments, >90% of journeys « unladen »; in total, around 92% of journeys « unladen »
  - ❖ In Argentina: in all segments, >83% of journeys « unladen »; in total around 90% of journeys « unladen »
  - ❖ In Turkey: in all segments, >94% of journeys « unladen »; in total, around 96% of journeys « unladen »
  - ❖ In South Africa: in all segments, >90% of journeys « unladen »; in total around 96% of journeys « unladen »

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Relevance of 50% load case as decision criterion

➤ The OICA-GTB proposal took into account real usage of vehicles (frequency of « laden »/ « unladen », average number of occupants) to elaborate the « 50% load condition »

"50% Load" Distribution in the Vehicle

| Step 1 | Step 2 | Step 3 |

M_1 M_2

Driver M_3

$M_{50\%} = (M_1 + M_2 + M_3)$

$M_2 = M_3$
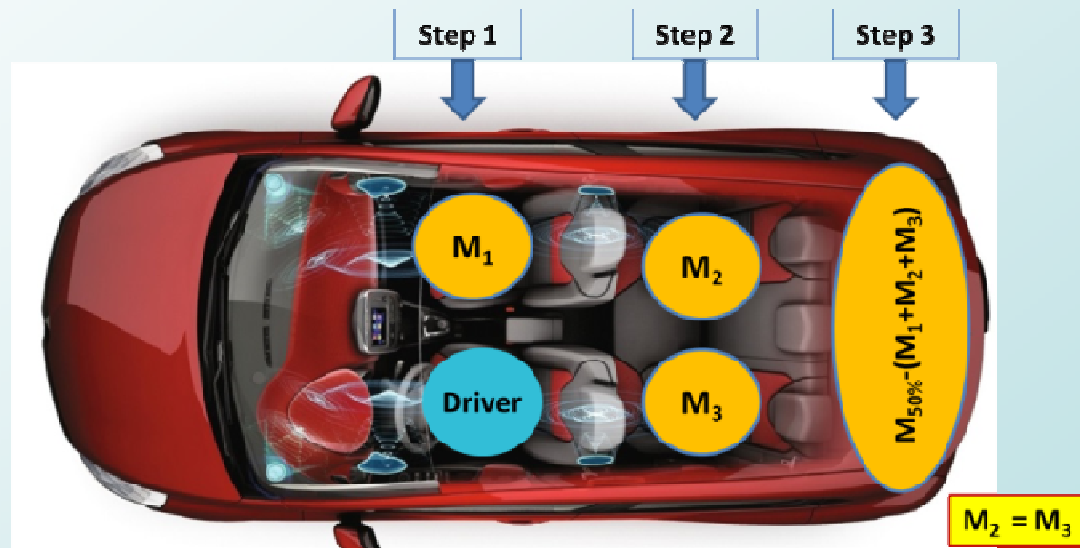
"50% loading" means 50% of the difference between the laden and unladen state of the vehicle

The following sequence shall be used in the order proposed below to achieve the 50% loading condition:

STEP 1: On the front seat furthest from the driver a mass up to 75kg

STEP 2: For the row immediately behind the driver's seat, load the two outer seats with a mass up to 75 kg per seat

STEP 3: Where additional load is necessary to reach the "50% loading" value, it shall be evenly distributed in the luggage / load compartment(s).

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Relevance of 50% load case as decision criterion

- **Load Condition 0% : $M_{0\%}$**
  - **Mass of the vehicle with 90% min. fuel tank and 75kg driver**

    (as described in Reg. 48, paragraph 2.4 and Annex 6 paragraph 4.2 plus mass of the driver)

- **Load Condition 100% : $M_{100\%}$**
  - **Mass of the vehicle with maximum load authorized**

    (F1 information on Type Approval certificate)
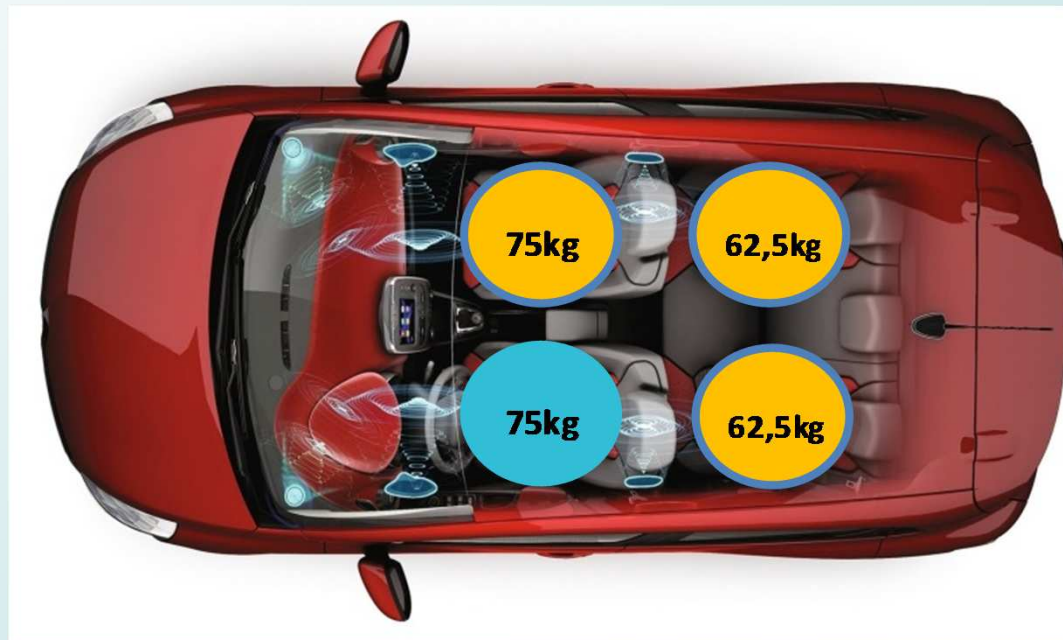
- **Load Condition 50% : $M_{50\%}$**
  - $M_{50\%} = M_{0\%} + \left(\frac{M_{100\%} - M_{0\%}}{2}\right)$

- **The size of a 50% load $\left(\frac{M_{100\%} - M_{0\%}}{2}\right)$ will be approximately 150kg to 300kg and is dependent on the vehicle type.**
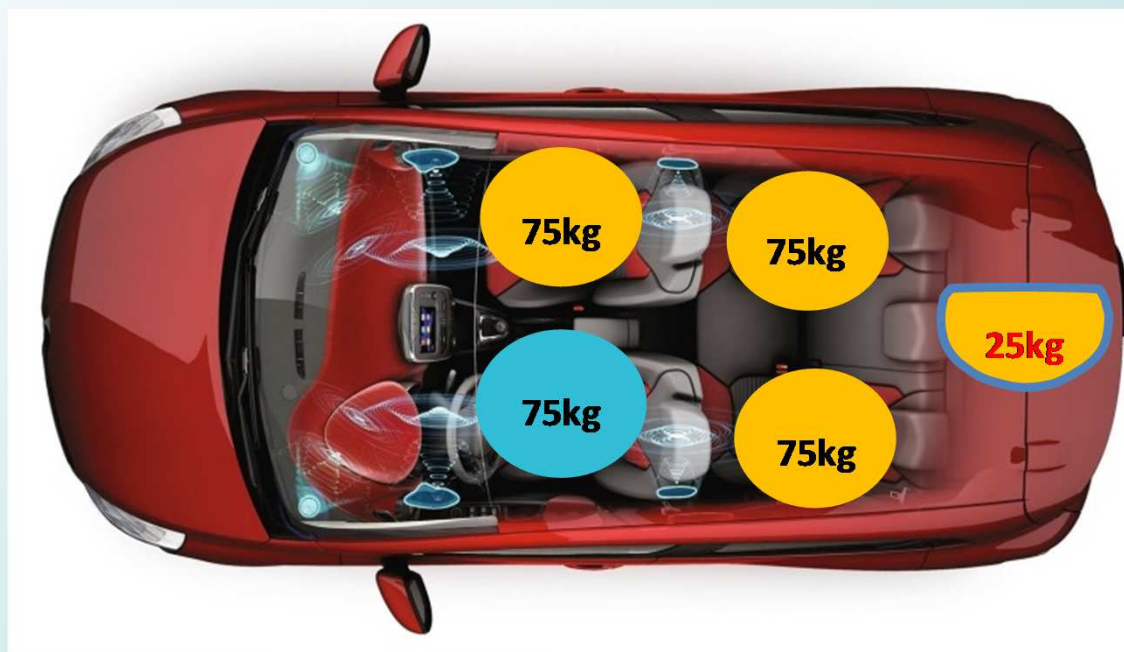
Relevance of 50% load case as decision criterion

➢ Example for a 50% load case of 200kg

Relevance of 50% load case as decision criterion

➢ Example for a 50% load case of 250kg

Relevance of 50% load case as decision criterion

With the 50% load condition, if the cutoff remains within the limits of the tolerance zone (diagram) <u>without any intervention</u> (= without any levelling), manual levelling is authorized.

Consequence, for a case where manual levelling would be authorized:

→**In at least 90% of life situations, no manual levelling needed**

→Manual levelling to be used for the remaining <u>rare occasions </u>where load is « exceptional » (e.g. holidays, Ikea…)

This will simplify explanation of usage to the drivers, and thus help ensure (right) usage !

Otherwise, mandatory automatic levelling – if the cutoff does not remain within the limits of the tolerance zone *(except if no levelling needed at all)*.

GRE/2015/5 : justification

Loading cases & decision criterion

Worst possible cases are covered

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➢ OICA-GTB proposal : 50% load case to determine whether manual levelling authorized or automatic levelling mandatory, and then, all cases of current annex 5, to check the performance of the levelling device

➢ Therefore, « worst possible cases » (max. inclinations up & down with a 75 kg driver and various load repartitions) will be covered / checked

  ● Loading cases of Annex 5 of ECE R48 already include worst possible cases of inclination up & down
    ❖ Maximum pitch angle down: case 2 (or case 1) of Annex 5
    ❖ Maximum pitch angle up: case 6 of Annex 5

  ● This has been confirmed by PSA, Renault & Volvo Trucks work (see presentations)

  → OICA-GTB proposal covers worst possible loading cases

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Conclusion

OICA-GTB proposal proposes
a simple compromise approach to
glare and levelling debates,
increasing minimum visibility and
covering worst possible cases

OICA-GTB proposal proposes a simple compromise approach to glare and levelling debates, increasing minimum visibility and covering worst possible cases

➢ Creates a new loading case (50%) as a decision criterion for manual vs. automatic levelling to replace the 2,000 lm criterion

Concept:

  ❖ manual leveling only authorized if in > 90% of life situations, no levelling required/needed at all

  ❖ Worst possible inclination are still covered with loading cases of Annex 5 (manual leveling to cover in particular case 6 of annex 5 - which is a rare occurence)

➢ covers **all** curent loading cases of Annex 5 of ECE R48.

This includes « worst » possible cases (max. inclinations up & down with a 75 kg driver and various load repartitions)