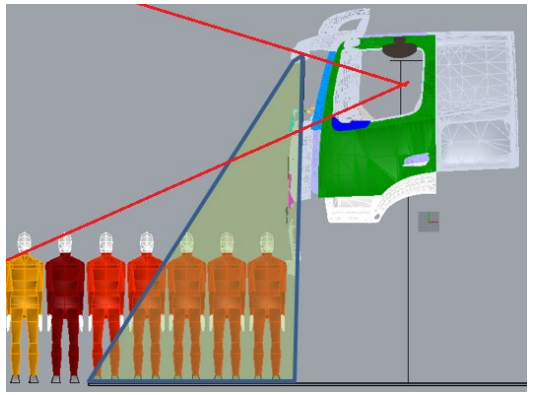
Submitted by the experts of EC

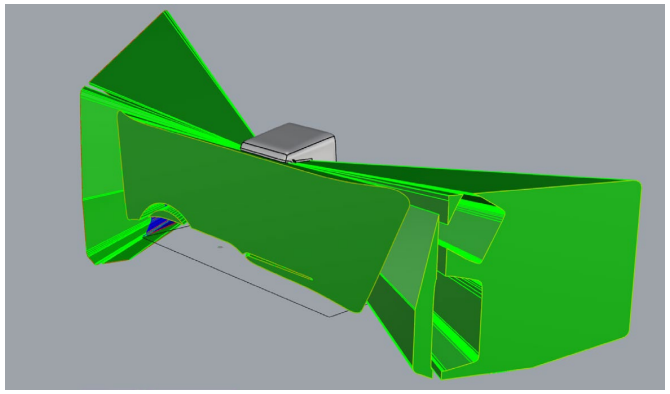
Informal document GRSG-123-30
(123rd GRSG, 28 March - 1 April 2022 Agenda item 4(f))

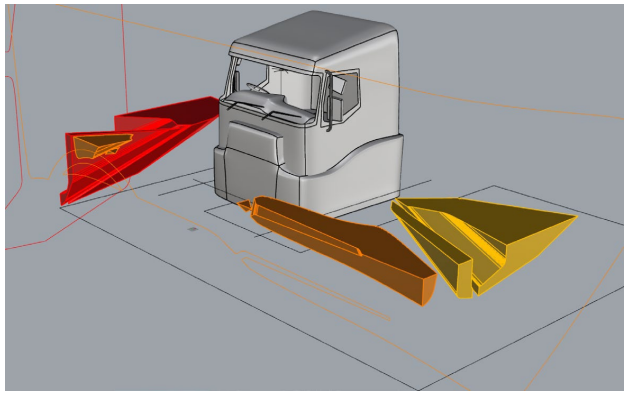
Direct vision for Trucks and busses

The design of the draft standard

Dr Steve Summerskill







Project team
Dr steve Summerskill
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LOUGHBOROUGH
DESIGN SCHOOL

This work is Funded by Transport for London, and the UK Department for transport

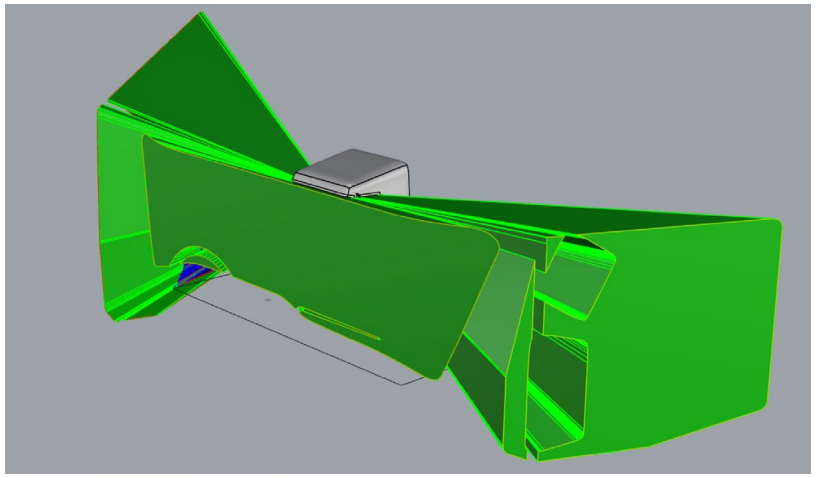
Loughborough University

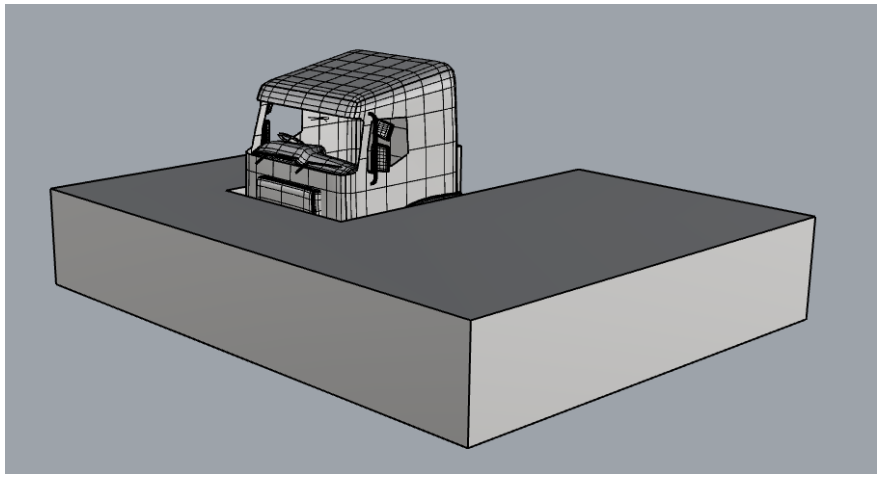
Direct vision requirements in GSR 2019/2144

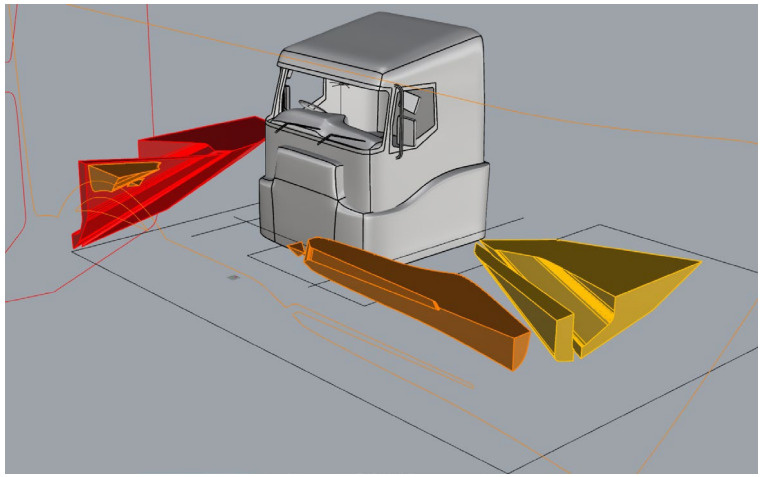
- "(Article 9(5) Vehicles of categories M_2, M_3, N_2 and N_3 shall be designed and constructed to enhance the **direct visibility** of vulnerable road users from the driver seat, by reducing to the greatest possible extent the blind spots in front of and to the side of the driver, while taking into account the specificities of different categories of vehicles".
- How can we measure direct vision to enable this?

How can we measure direct vision?

- Based on the Transport for London (UK) scheme for Direct Vision designed by my team
- Can be performed by means of CAD data of the cab (either scanned by third party or provided by the manufacturer)

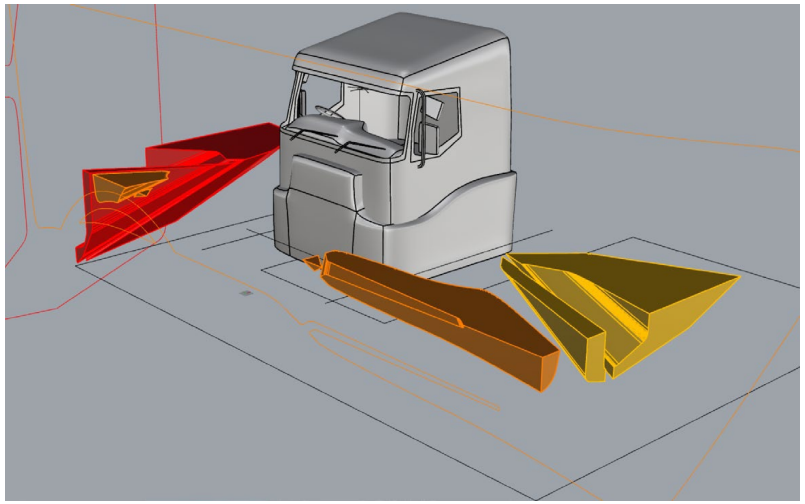




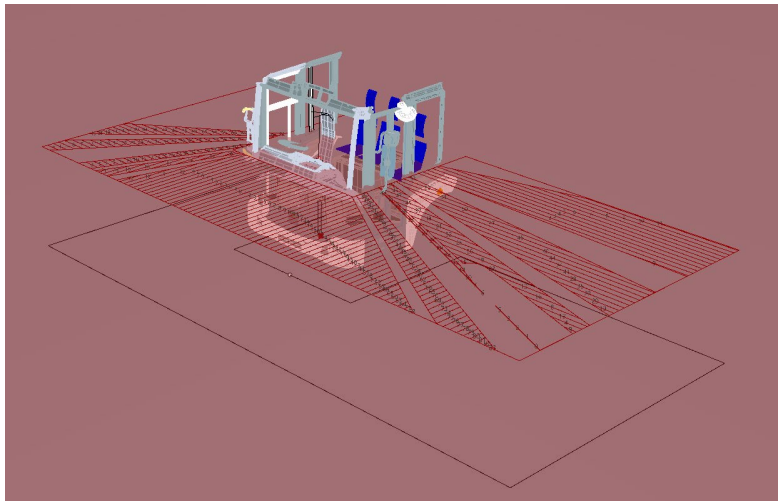


- Necessity to transform this approach into a type-approval procedure
- Can now also be checked by means of simplified test as per the proposed new draft UN Regulation – with excellent correlation

Direct vision concept simplified UN test



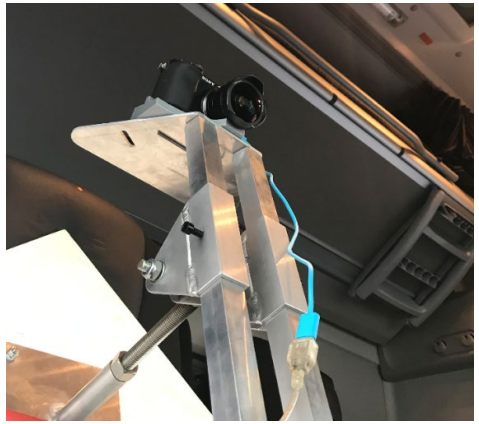
CAD based volumetric approach



Simulation of real world physical test

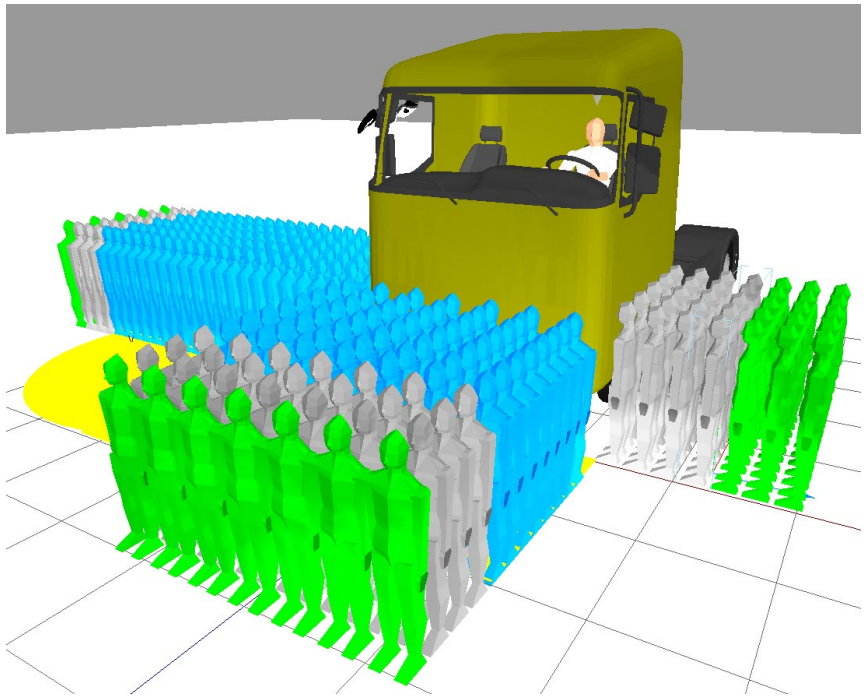
- We have designed a real world physical test which can be used instead of the digital testing technique
- This new physical testing method has been extensively simulated in CAD and then tested in the real world
- This involves the visibility of real world object being mapped to create a ‘section’ of the visible volume

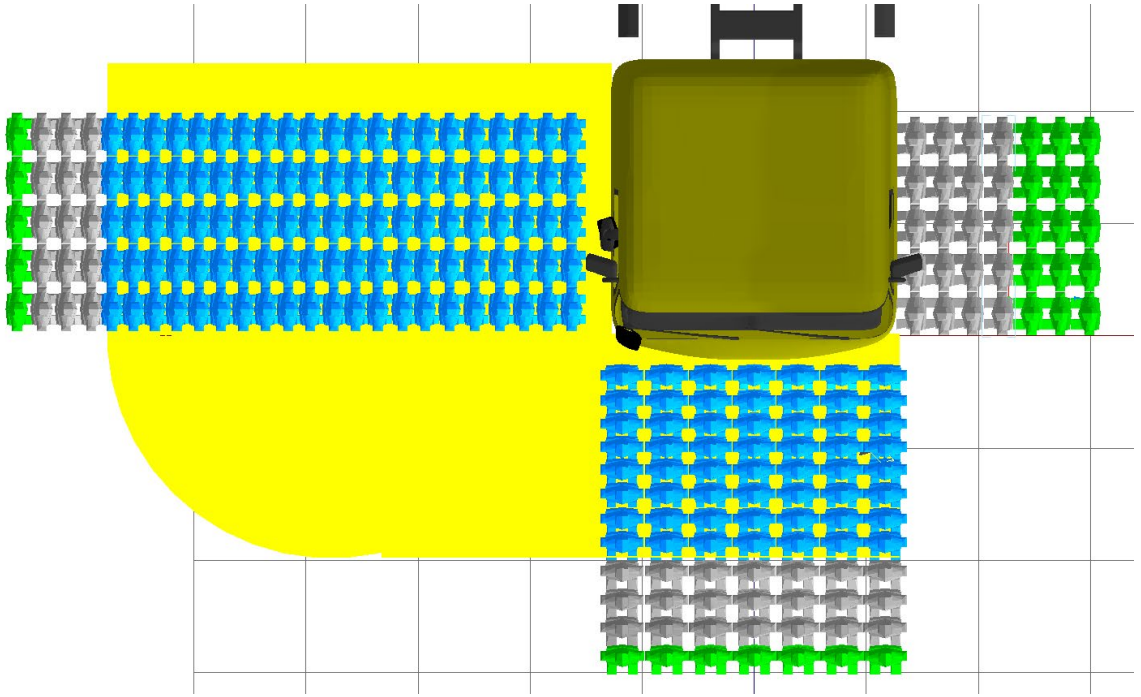
Direct vision concept – simplified UN test



- The results of the physical test correlate to a high standard with the digital volumetric test

Current state of play





= Directly visible = Visible through indirect vision devices only = Not visible

Yellow pattern on the floor is the combined mandatory UN Regulation No 46 **field for Class V and VI** indirect vision devices (i.e. mirrors or CMS)

Blue human surrogates are visible **indirectly**

Grey human surrogates **may not be visible at all**

Green human surrogates are **directly visible by the driver**

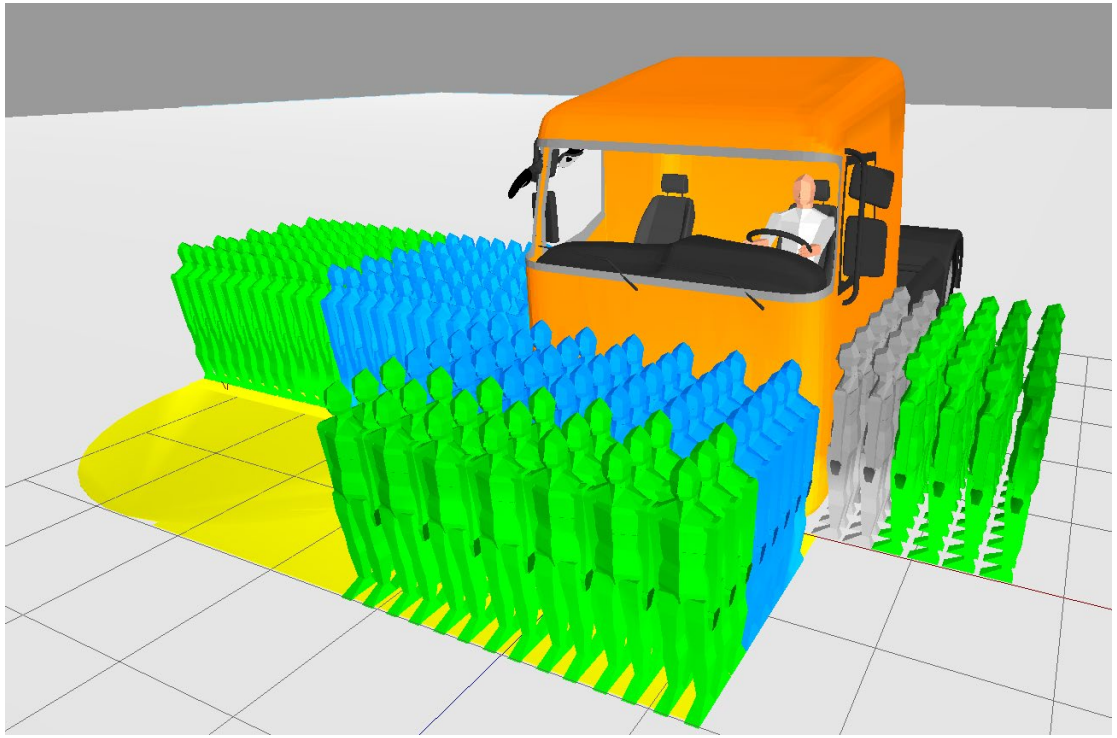
Interpretation of images and considerations

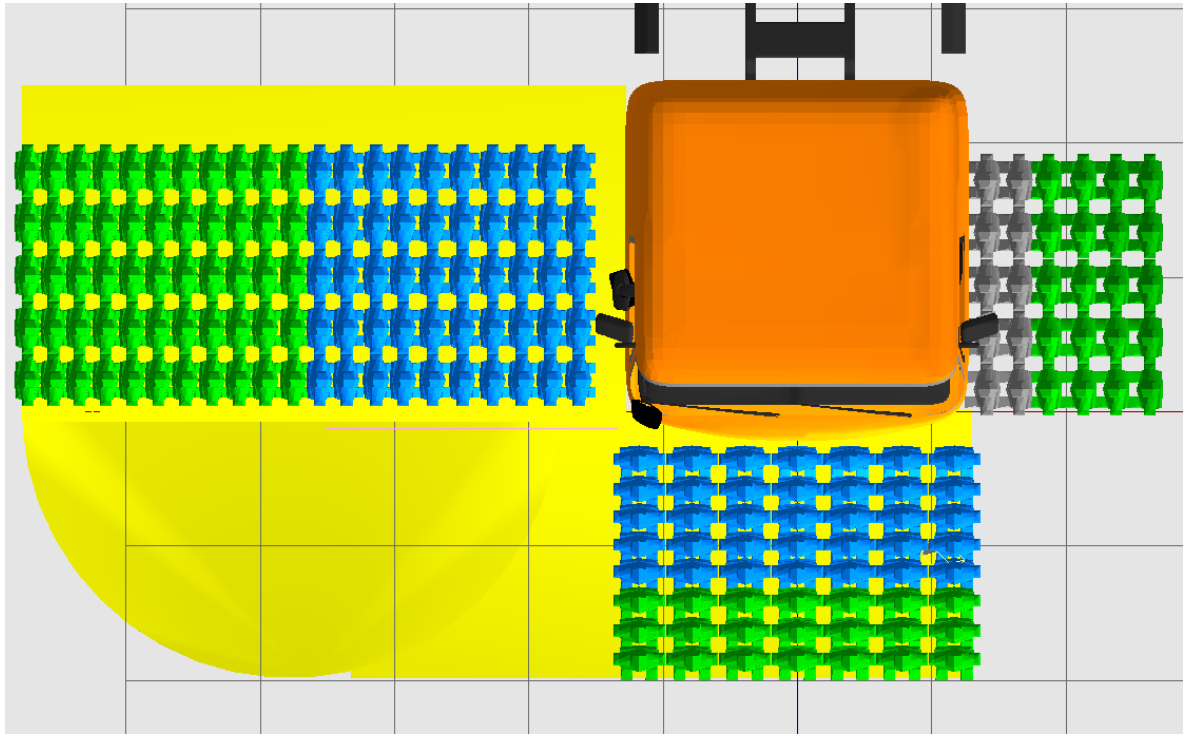
- The visibility in Class V and VI mirrors suffers from distortion and also from mal-adjustment
  - Some field data suggested that mirrors are often mal-adjusted
  - IWG chose to consider implementation with a safety margin / overlap
  - IWG agreed on differentiation based on the use of vehicles in the real-world
- Basic concept, there should not be a situation, where through the design of the vehicle it is possible for VRUs to be invisible in both direct and indirect vision (as shown by the Grey people to the front of the truck in the previous page)

Differentiation methodology

- Developed in the IWG VRU-proxi (under T&E leadership)
- On basis of EC legislation VECTO criteria linked to real-use field data
- 3-level approach:
  - Level 1 city trucks and buses
  - Level 2 off-road (trucks that may however also travel in cities)
  - Level 3 motorway long-hauling
- Concept captured in a table with specific criteria:
  - Number of axles
  - Sleeper cab
  - Engine power
  - …
- This differentiated approach was necessary as defining only one level of performance for all truck types was counter productive, i.e. the candidate value would show little or no improvement in vehicle performance for urban vehicles compared to the status quo, and therefore little safety benefit

Proposed Level 1 (city trucks and buses)





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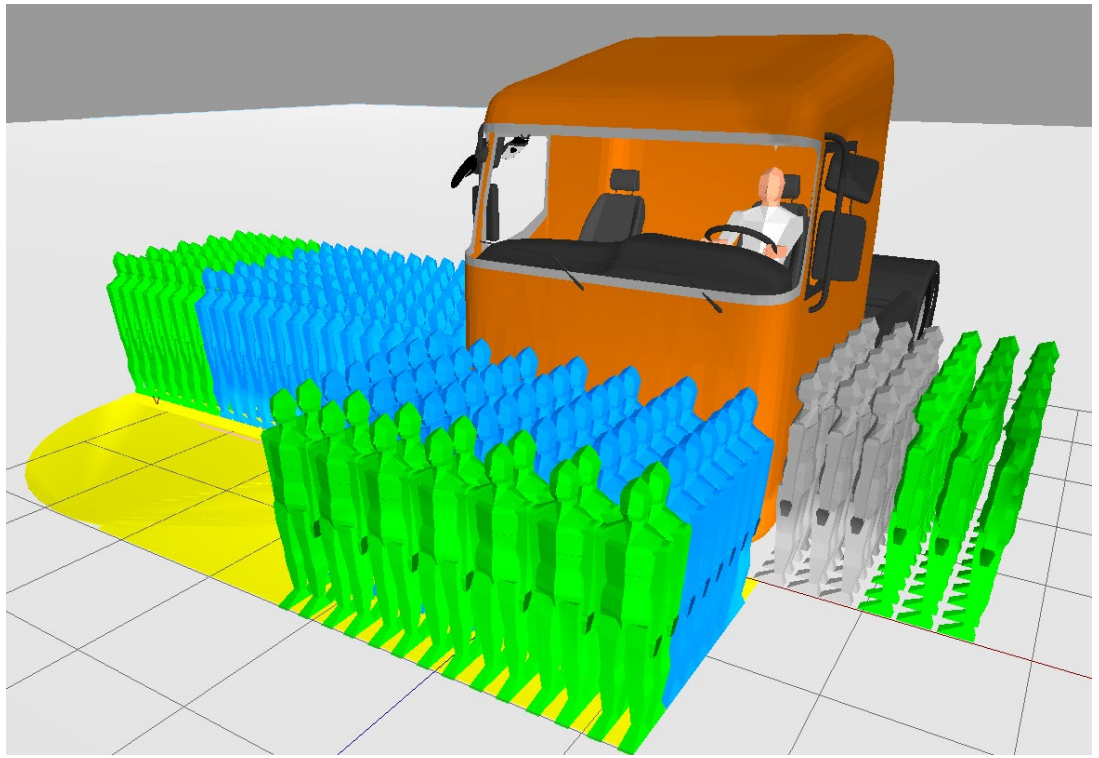
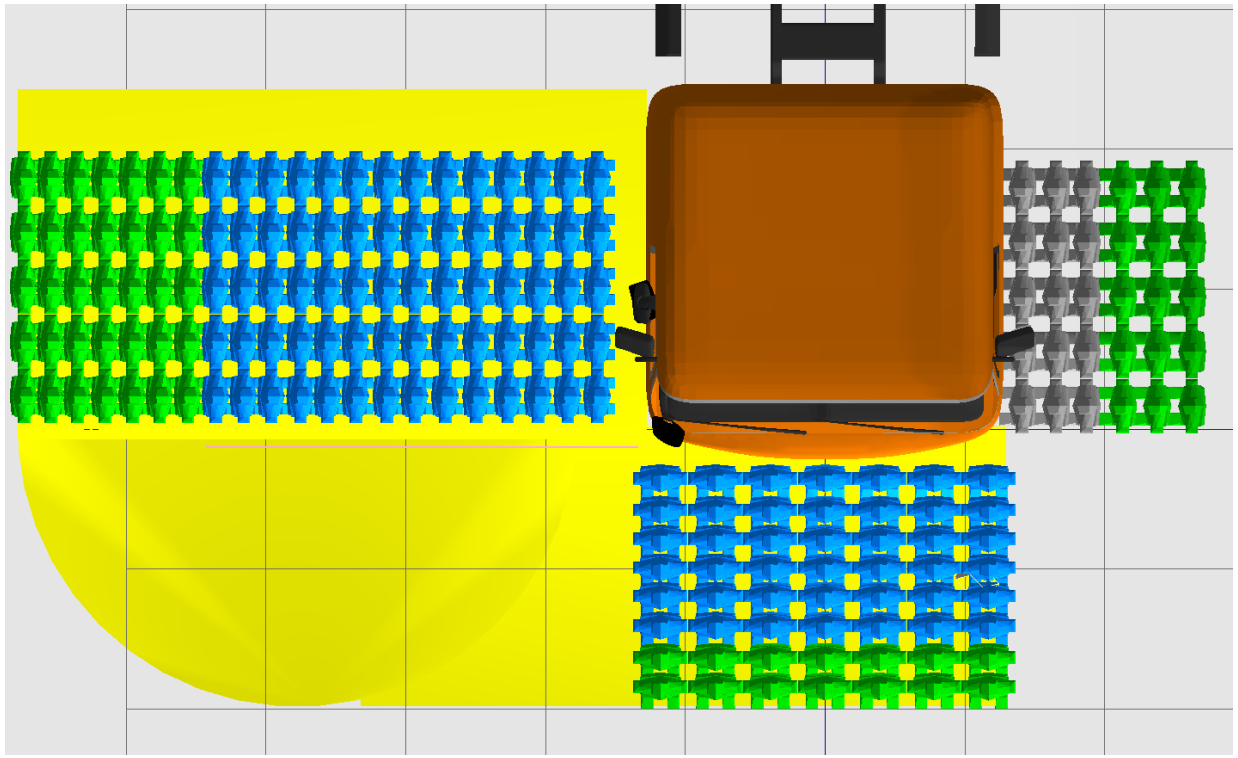
Proposed Level 2 (Off)





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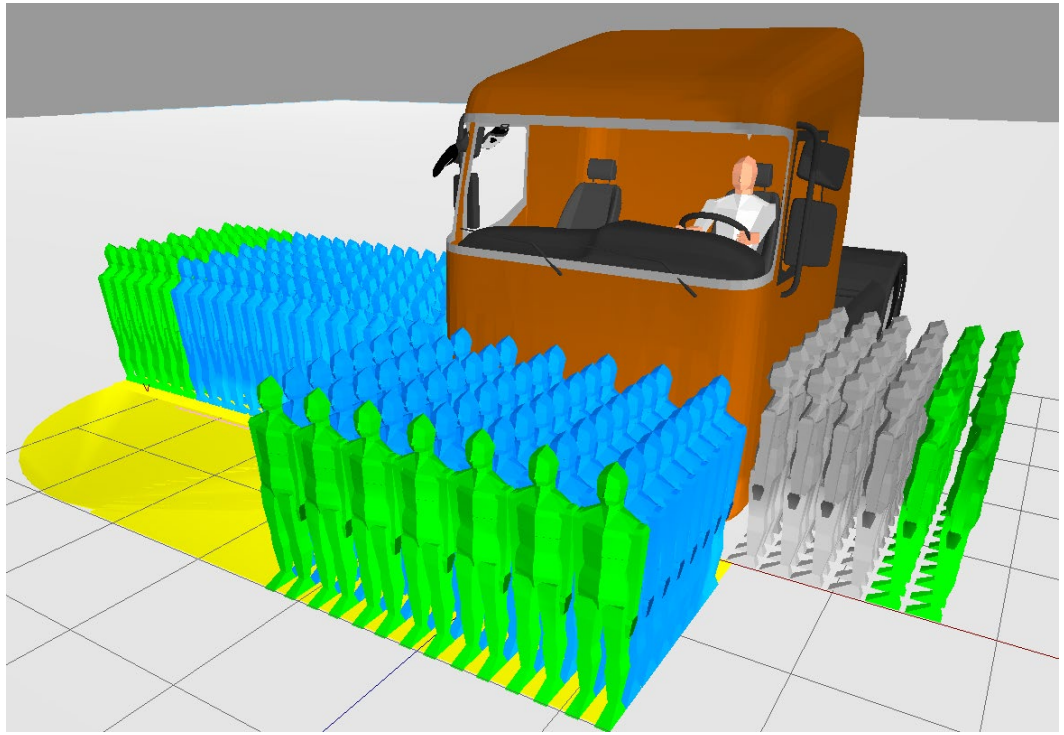
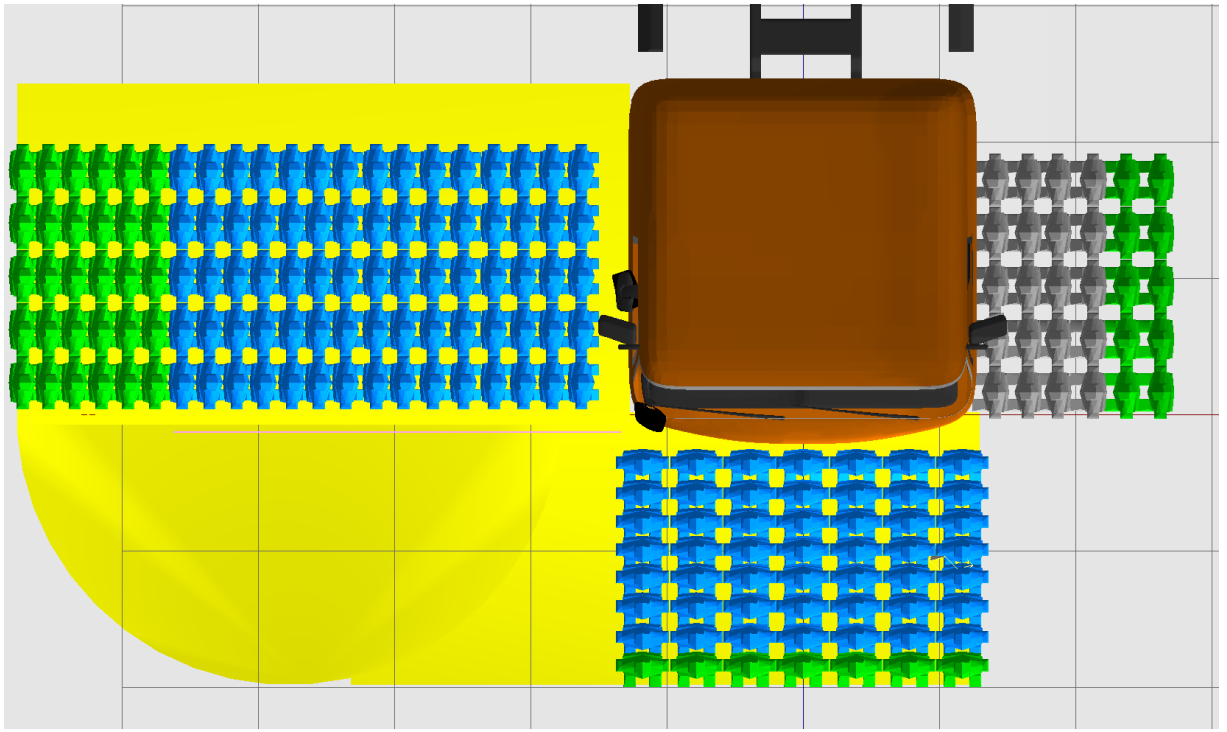
Proposed Level 3 (motorway cruising)





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The state of the art

- A number of manufacturers have already produced new cab designs which improve direct vision across the range of vehicle use cases including SCANIA and DAF
- Other manufacturers have already made changes to existing cab designs to include improved Direct Vision, e.g. Volvo FM.

- Thank you for your attention, are there any questions?

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- Anthony Eland

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