Informal document **GRSG-126-33**
(126th GRSG, 10– 13 October 2023
Agenda item 4(e)

126TH UNECE GRSG: POTENTIAL AMENDMENT TO ENSURE FRONTAL DIRECT VISION REQUIREMENTS IN UNECE REGULATION 167

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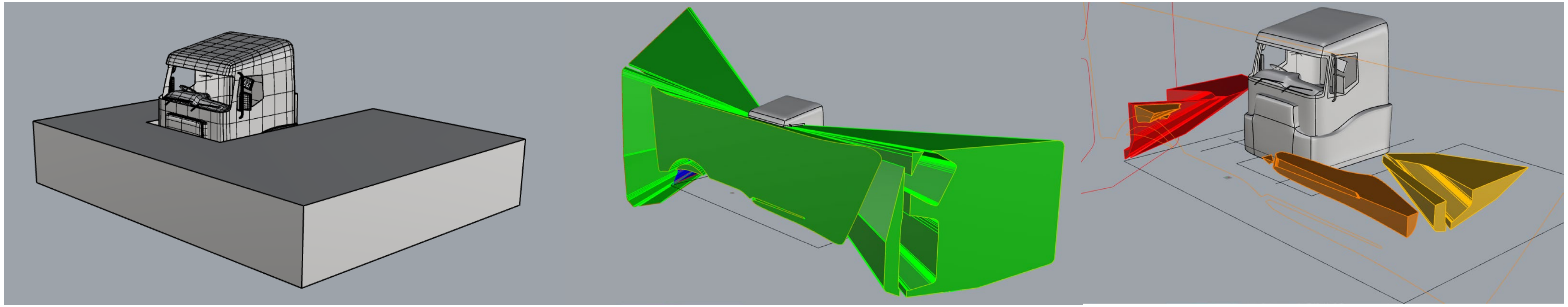
CONTENTS

- Reminder of the premise that established the method used for UNECE regulation 167
- Highlighting a concern that has arisen which means that designs can be produced which do not meet the ‘spirit’ of the regulation which has led to a proposed amendment
- The proposed amendment

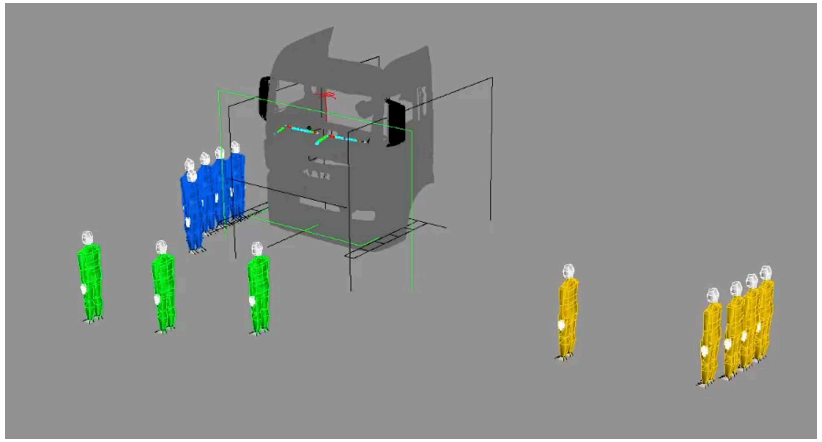
HOW THE DVS WAS DEFINED FOR THE LONDON VERSION

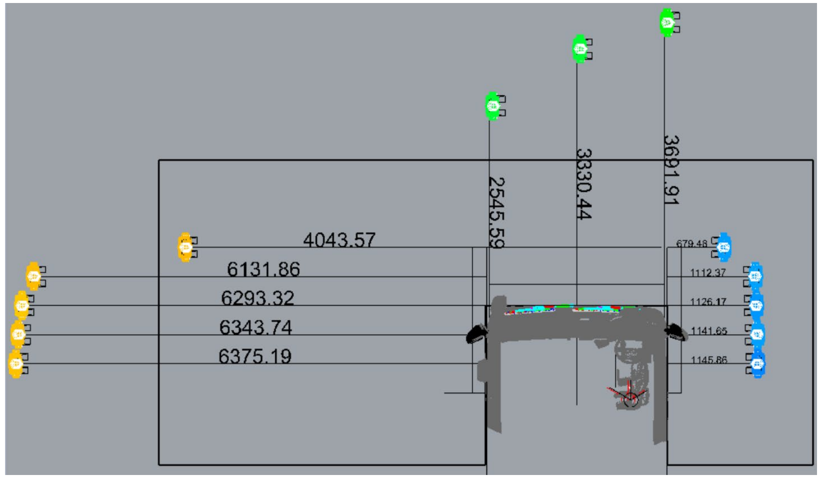
- The Direct Vision Standard was defined provide a method which allows an accurate measure of direct vision, which is quantified using a real world measure of direct vision performance
- The accurate measure of Direct vision takes the form of the amount of an assessment volume that can be seen from a standardised eye point
- The real world measure is the distance at which VRU simulations can be seen by the driver



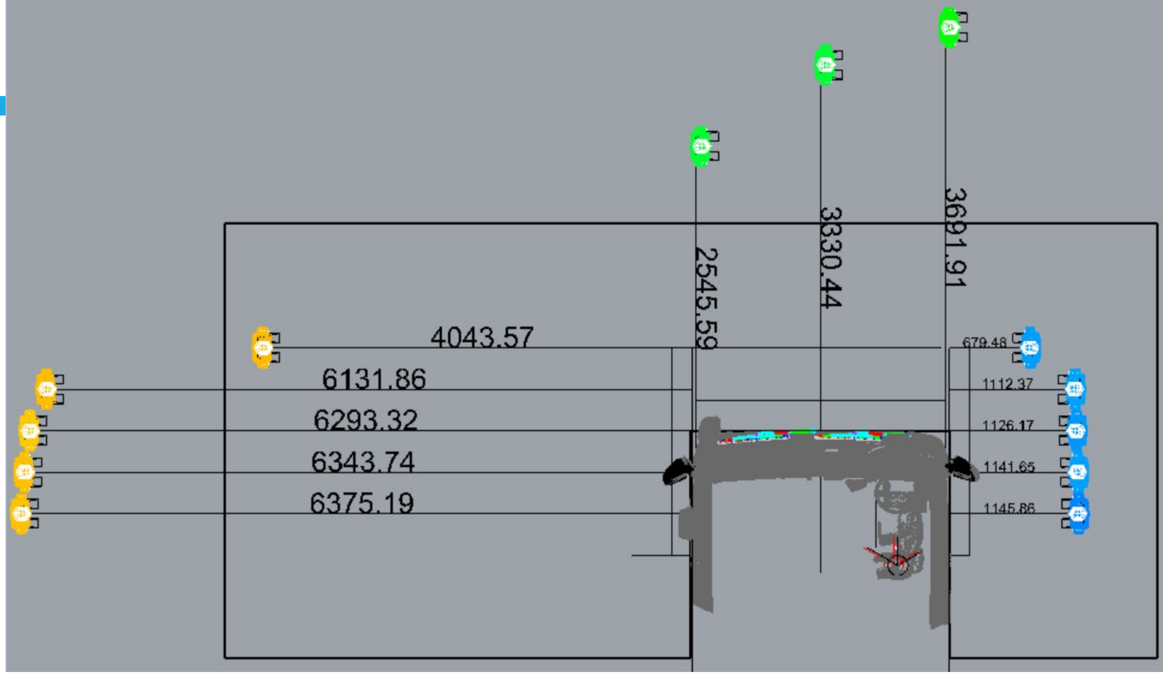
HOW THE VOLUMETRIC SCORES WERE QUANTIFIED IN REAL WORLD TERMS

- As per the diagram, an array of VRU simulations is arranged around the vehicle using a consistent method. Each VRU is then moved away from the side of the truck in one axis only
- The portion of the VRU that must be visible was originally proposed as head and shoulders, then head and neck, and finally half of the VRUs head was required to be visible to the driver
- This is followed by example results for the VRU distances

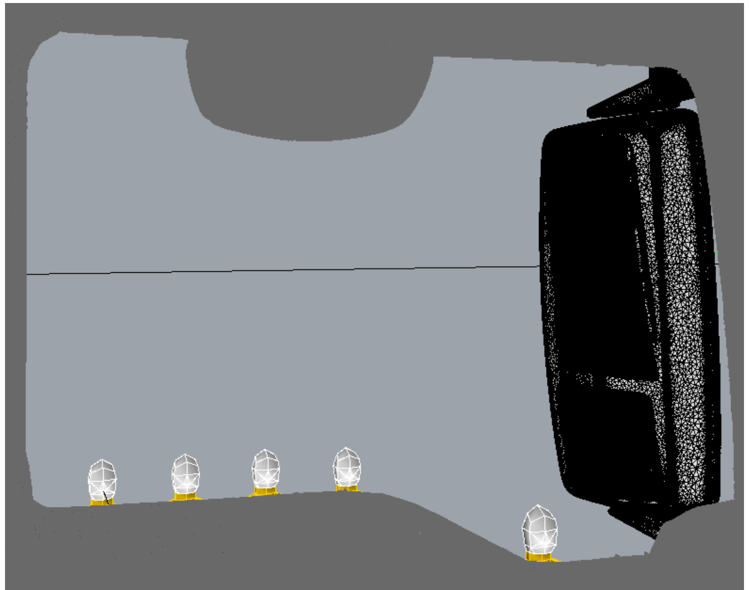


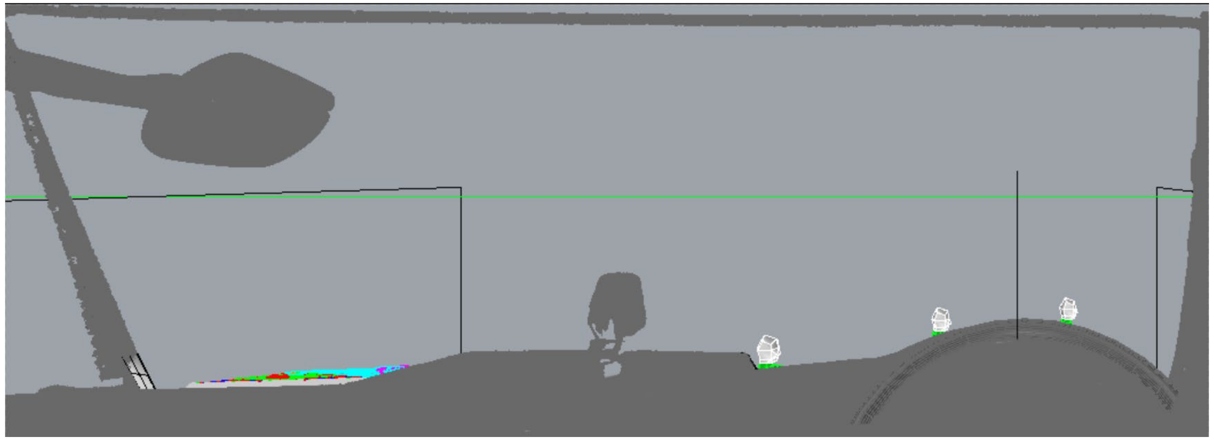


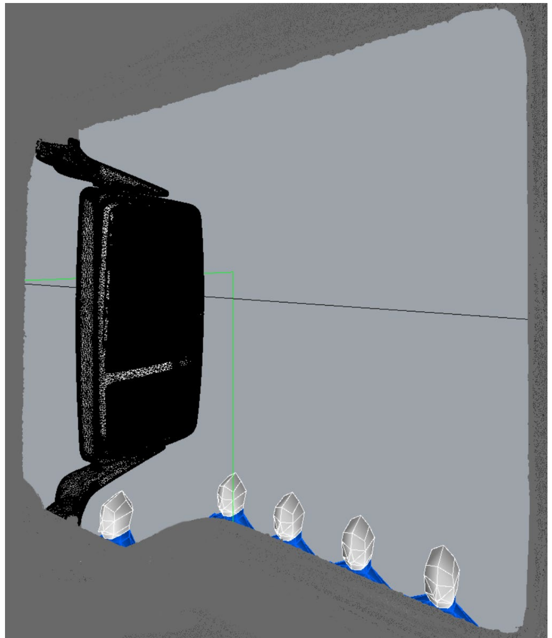
EXAMPLE VRU DISTANCE RESULT



- The bottom images shows the placement of the VRU simulations to the front and sides of the vehicle for **head and neck visibility from the simulated eyepoint, later reduced to half a head**
- Top right shows a plan view of VRU positions

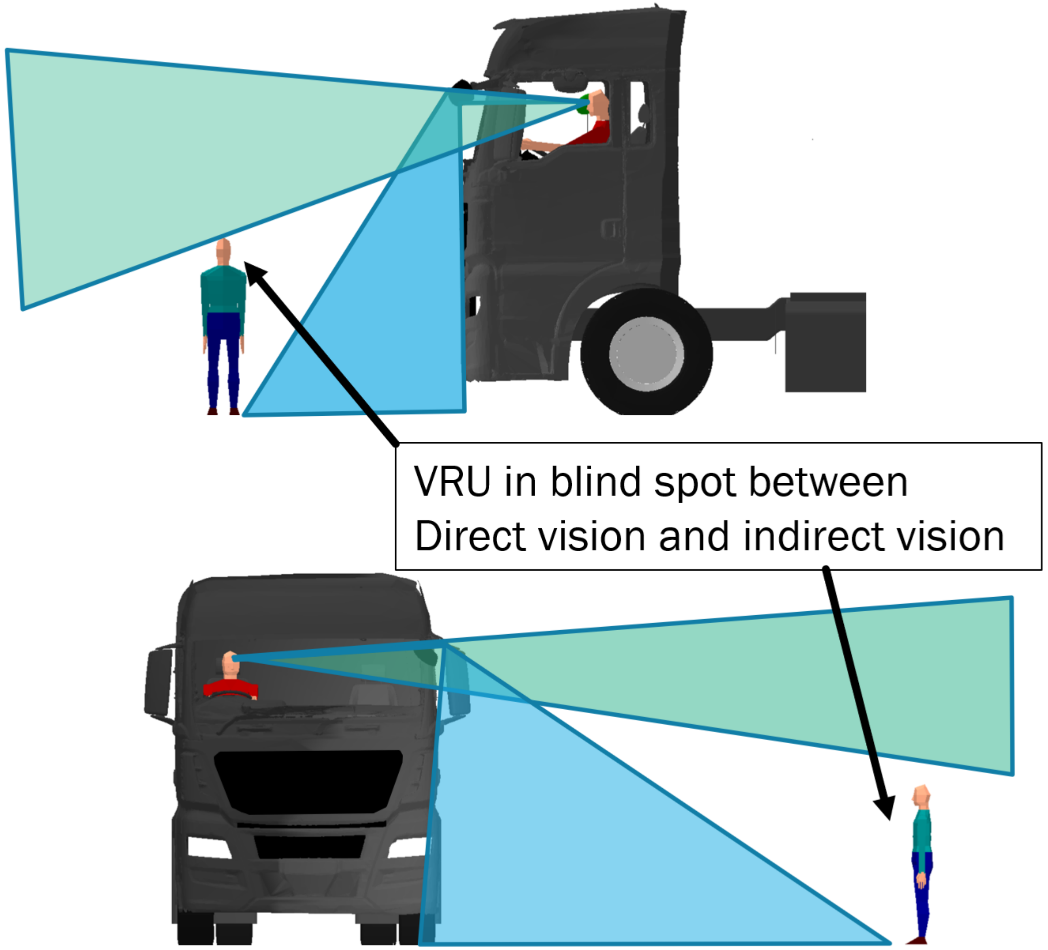




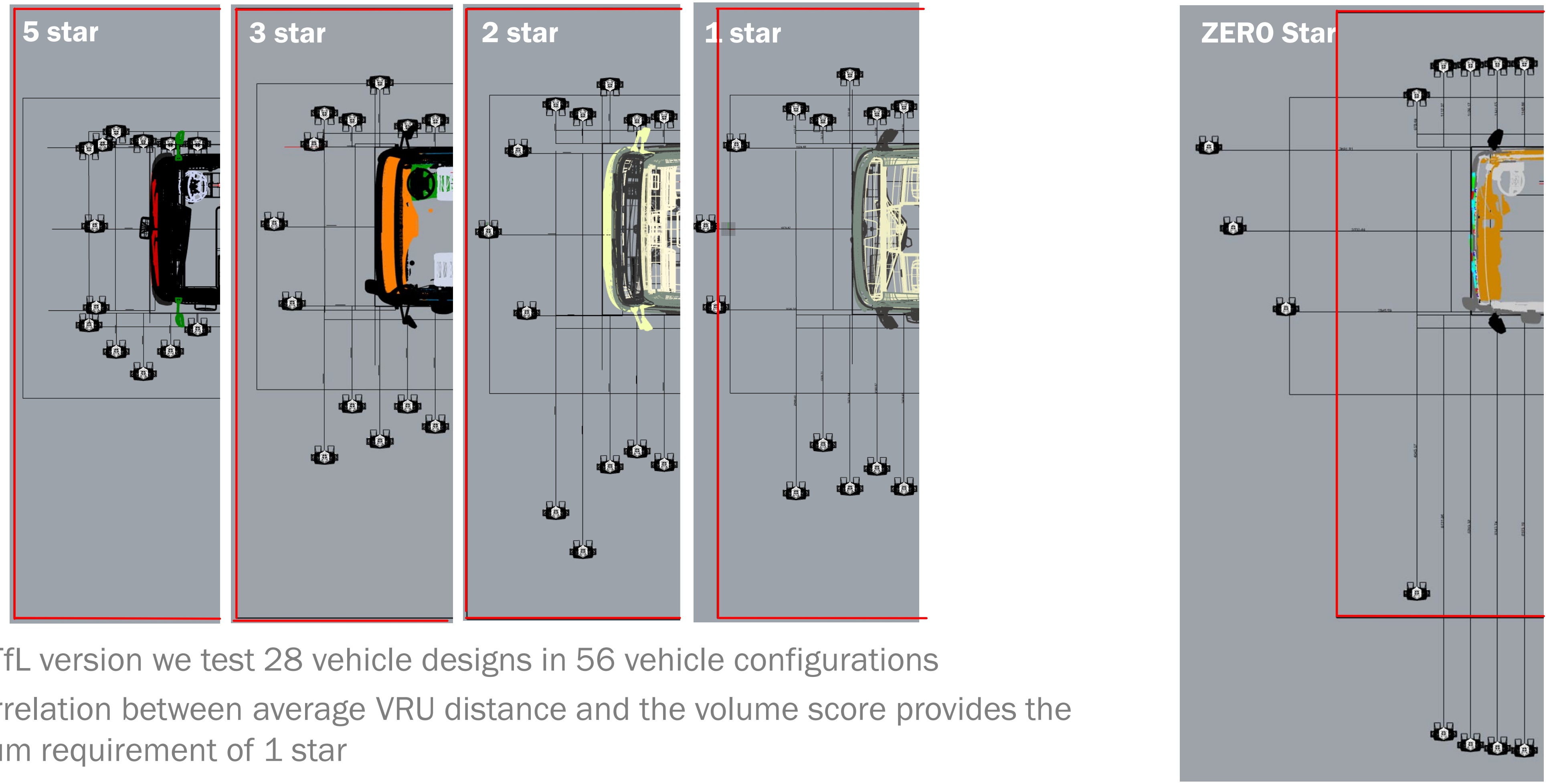


SETTING THE DVS MINIMUM REQUIREMENT

- The performance of the existing vehicle designs in 2018 was worse than anticipated
- A minimum requirement was required
- The minimum requirement was that no vehicle should allow VRUs to be in a blind spot between direct vision through windows and indirect vision through mirrors
- This requirement was a compromise due to the poor performance of many designs
- ANY YET more than half of the vehicles tested were not able to meet this minimum requirement



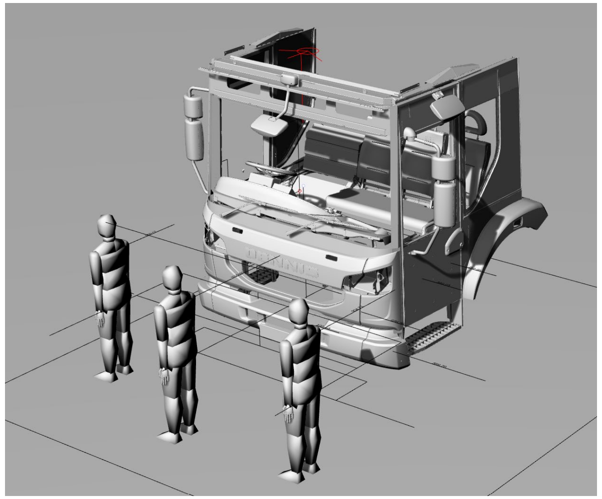
EXAMPLE VRU DISTANCES FOR VEHICLES IN THE STAR BOUNDARY CATEGORIES (NEW VERSION, HEAD & NECK ONLY VISIBLE) TFL VERSION



- In the TfL version we test 28 vehicle designs in 56 vehicle configurations
- The correlation between average VRU distance and the volume score provides the minimum requirement of 1 star

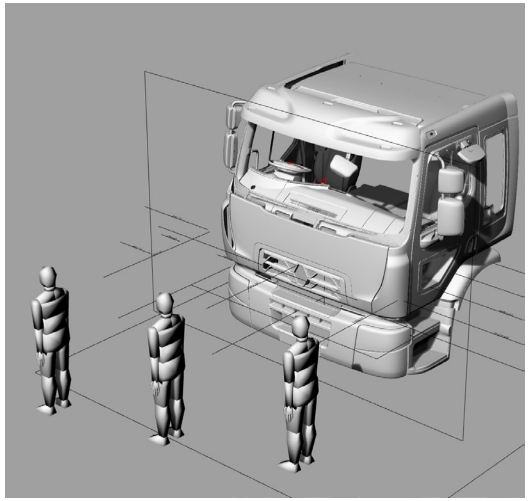
EXAMPLE VRU DISTANCES FOR VEHICLES IN THE STAR BOUNDARY CATEGORIES (NEW VERSION, HEAD & NECK ONLY VISIBLE) TFL VERSION

TfL 5 star – Excellent



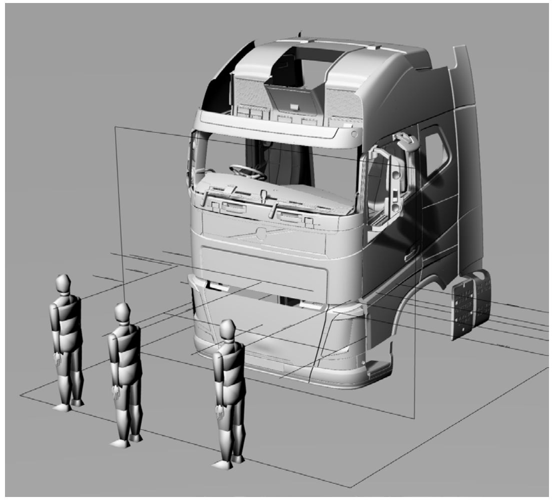
- Average VRU distance to the front = <1m

TfL 3 star – Good



- Average VRU distance to the front = 1.6m

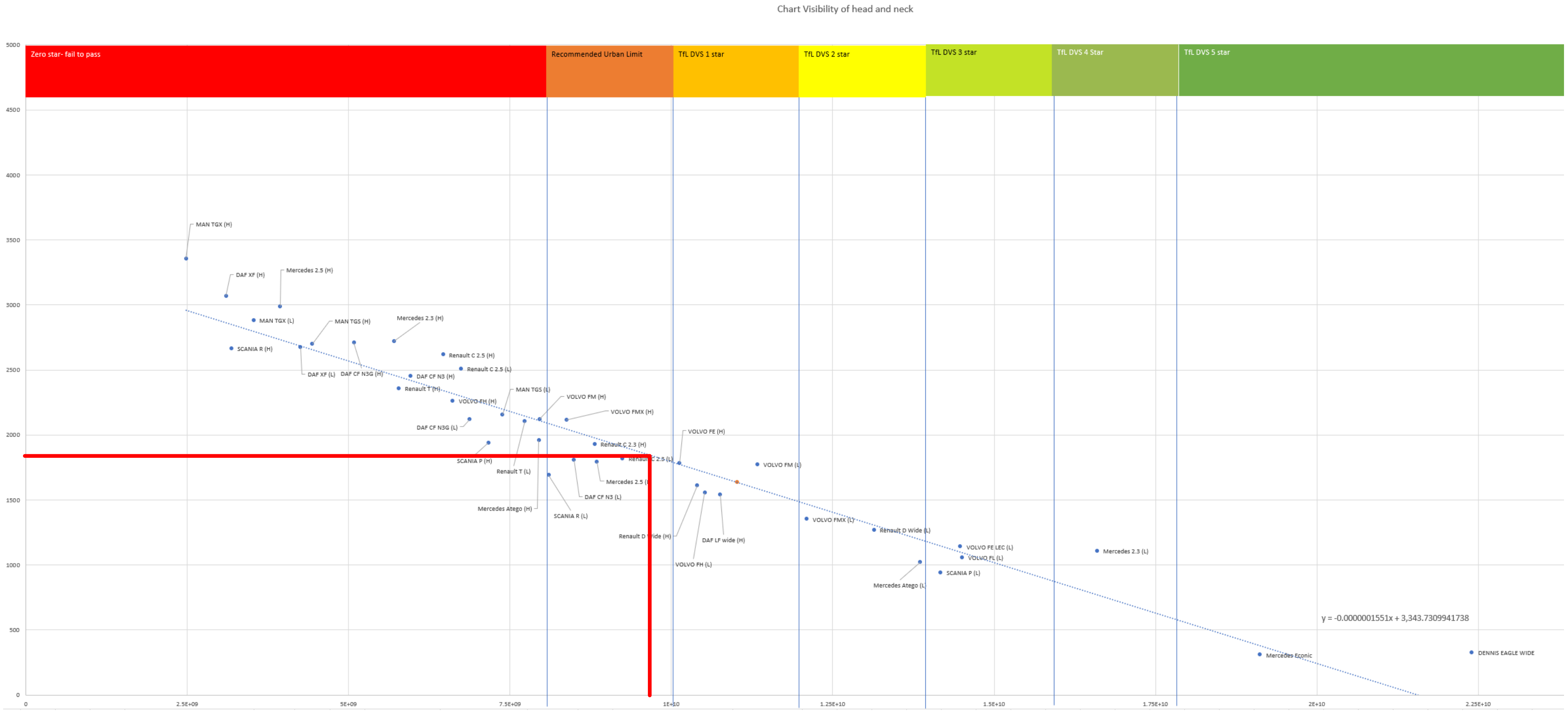
TfL 1 star – pass



- Average VRU distance to the front = 1.9m

- A better performing vehicle allows the VRUs to be seen closer to the vehicle, reducing the size of the blindspot

EXAMPLE VRU DISTANCES FOR VEHICLES IN THE STAR BOUNDARY CATEGORIES (NEW VERSION, HEAD & NECK ONLY VISIBLE) TFL VERSION



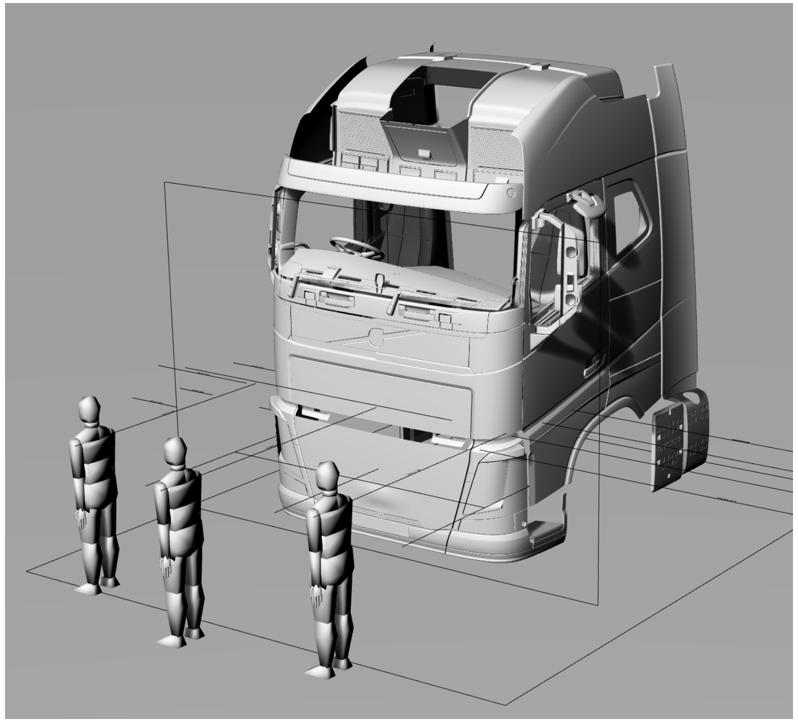
- The Volumetric score and the average VRU distance are correlated to allow a minimum volume requirement to be defined by a minimum VRU distance requirement

HOW THE STANDARD HAS EVOLVED IN THE UNECE VERSION

- The standard is largely the same as the London version with some key differences as this standard is not rating existing vehicles, but supporting the improved design of vehicles for direct vision
- It was noted that it would be possible for manufacturers to improve the volumetric performance by simply improving the vision to the side to meet minimum requirements when using the same method as London
  - By removing mirrors, lowering passenger and driver window lines and adding lower door windows.
  - This meant the difference between passing and failing the minimum requirement
- This potentially results in no improvement in safety to the front of the vehicle and still allows the blind spots between direct vision and indirect vision
- Therefore a **separated approach** was defined which requires minimum performance to the front and sides of the vehicle
- **The minimum frontal volume was DEFINED by the need to see VRUs directly in front of the vehicle at a distance that was within the indirect vision zone, REMOVING the blindspot**

SPECIFIC FRONTAL REQUIREMENTS IN UNECE 167

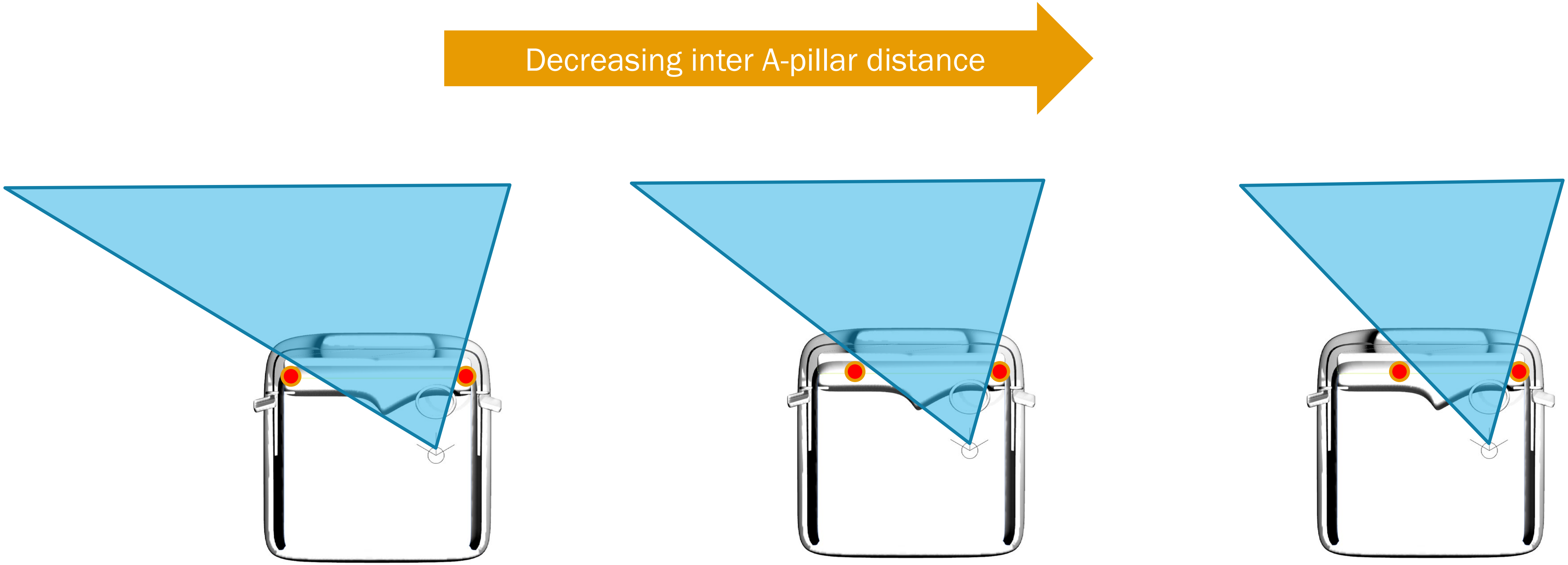
- The frontal volume requirements for UNECE 167 were defined by the agreed minimum average VRU distance (1.958m) of three VRU simulations
- These three VRUs were placed directly in front of the vehicle to represent the area of greatest risk for pedestrians
- An accident data analysis highlighted that 32% of Blind spot accidents occurred when vehicles pulled away (e.g. at pedestrian crossings)
  - mostly with people over the aged of 65 being the victims



Why is an amendment required for UNECE 167?

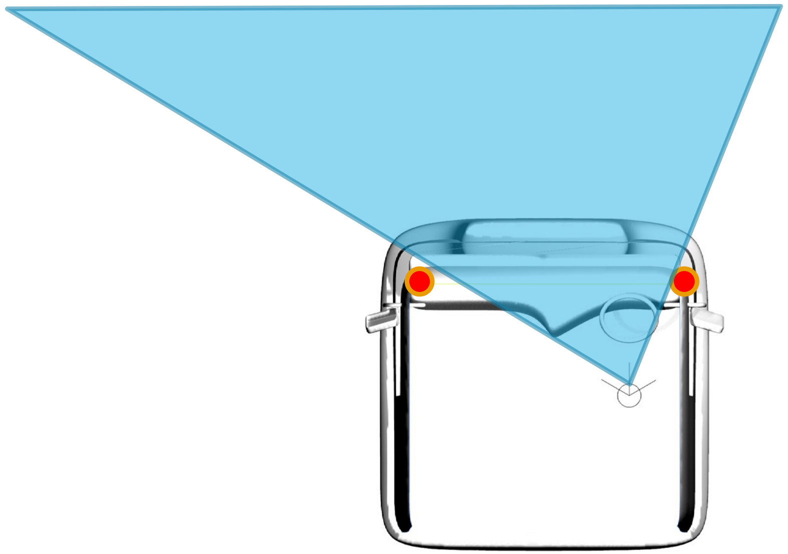
PROPORTIONAL FRONT VOLUME BY A-PILLAR WIDTH

- One issue was highlighted by ACEA in the VRU proxi meetings
- The issue was that the measurement of frontal volume in the series 00 version of UNECE 167 was defined by the visible volume between the A-pillars
- This was seen a not technology Neutral as it penalised potential vehicle designs where the inter A-pillar distance is reduced
- This has been addressed with a suitable amendment
- However this did highlight a further issue

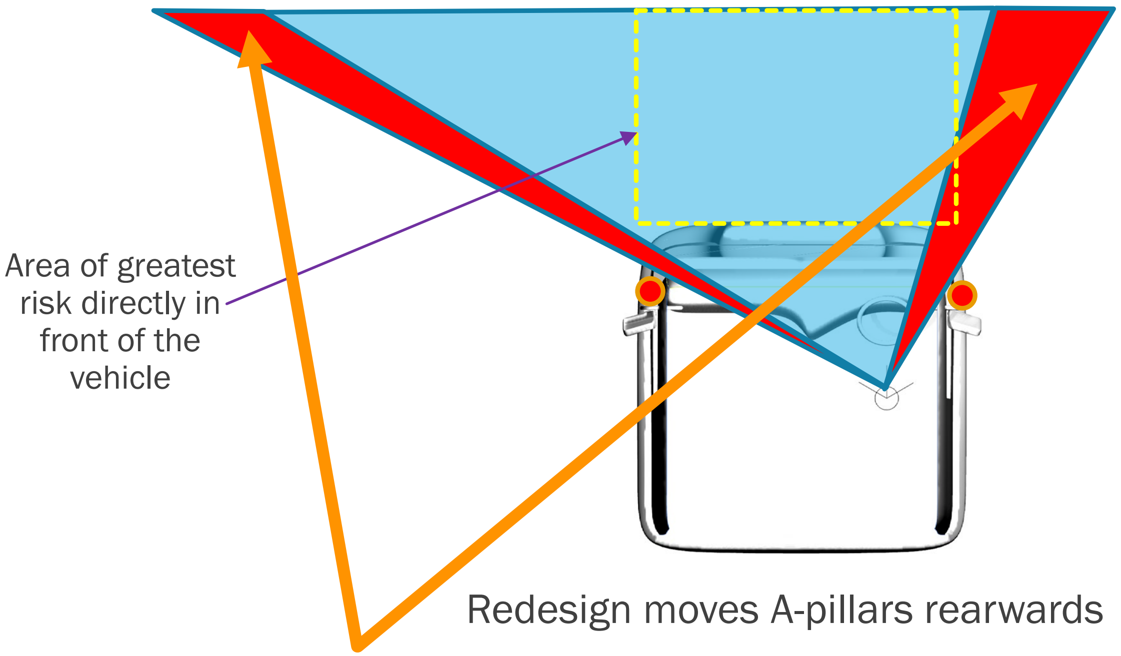


IMPROVING VOLUME SCORE WITHOUT IMPROVING DIRECT VISION OF AREA OF GREATEST RISK

- If manufacturers choose to move the A-pillars rearwards towards the driver compared to the original sample they will able to gain volume without improving the view of the area of greatest risk
- i.e. the design could nothing to improve the visibility of VRUs directly in front of the vehicle in the area of greatest risk and still meet frontal minimum requirements



Original vehicle design

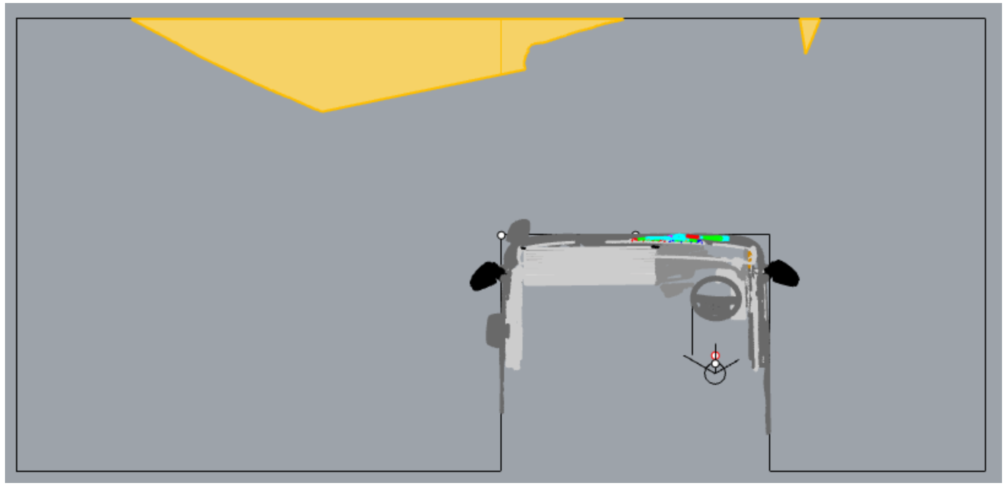


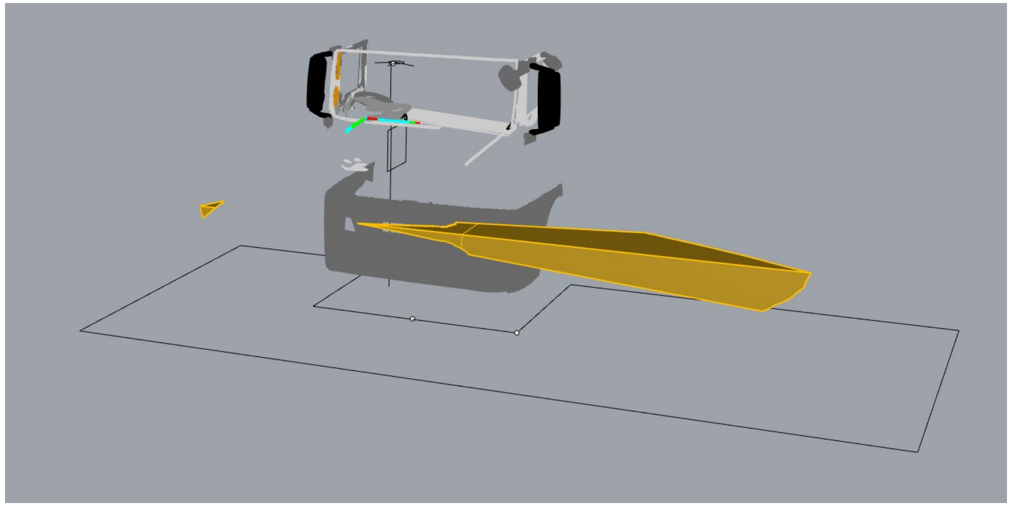
Redesign moves A-pillars rearwards

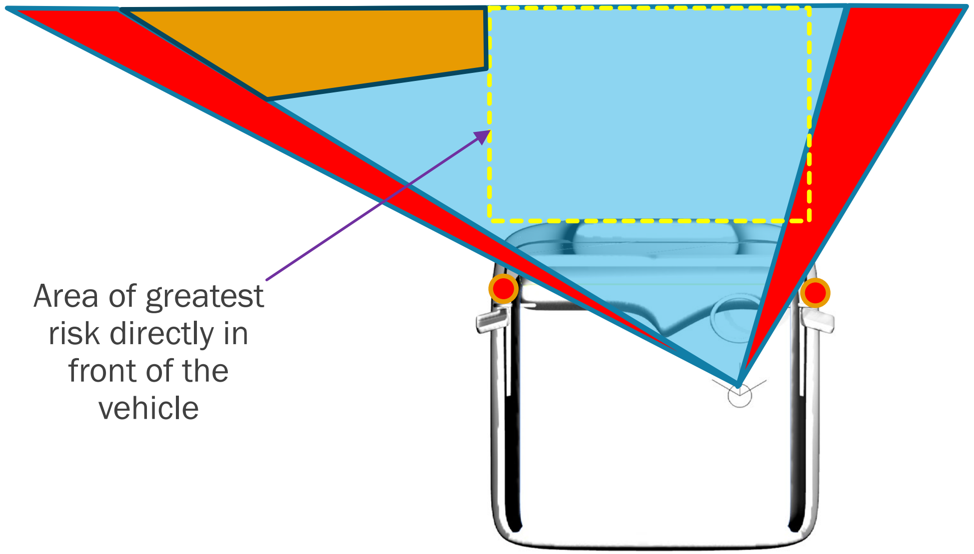
Red areas show volume gained outside of area of greatest risk for frontal collisions, **potentially allowing a vehicle to pass the minimum requirements without improving direct vision directly in front of the vehicle in the area of greatest risk.**

IMPROVING VOLUME SCORE WITHOUT IMPROVING DIRECT VISION OF AREA OF GREATEST RISK

- In addition, further volume can be gained by lowering the passenger side dash board area, but this volume is also outside of the area of greatest risk. This approach has been suggested by ACEA







Redesigned dashboard on the passenger side

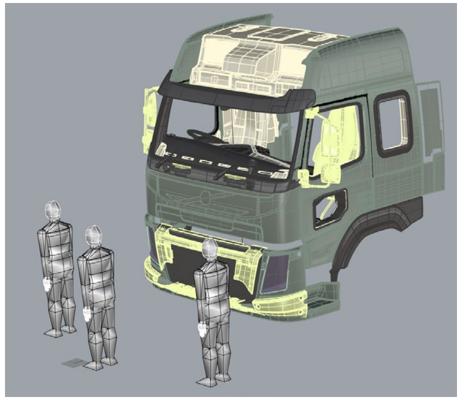
Orange areas show volume gained outside of area of greatest risk for frontal collisions, **potentially allowing a vehicle to pass the minimum requirements without improving direct vision directly in front of the vehicle in the area of greatest risk.**

- We therefore designed a new method to ensure that the intent of the standard is met (to allow the VRUs in front of the vehicle to be seen) as per the content in the next three sides.

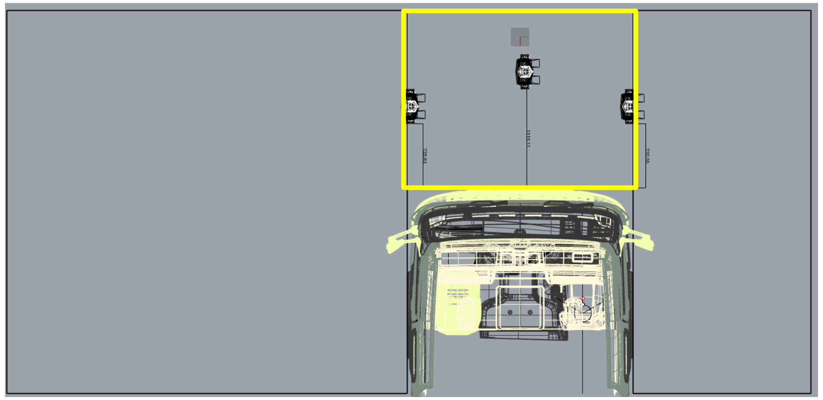
HOW CAN WE ENSURE EQUIVALENCE BETWEEN THE TWO METHODS?

The premise is as follows;

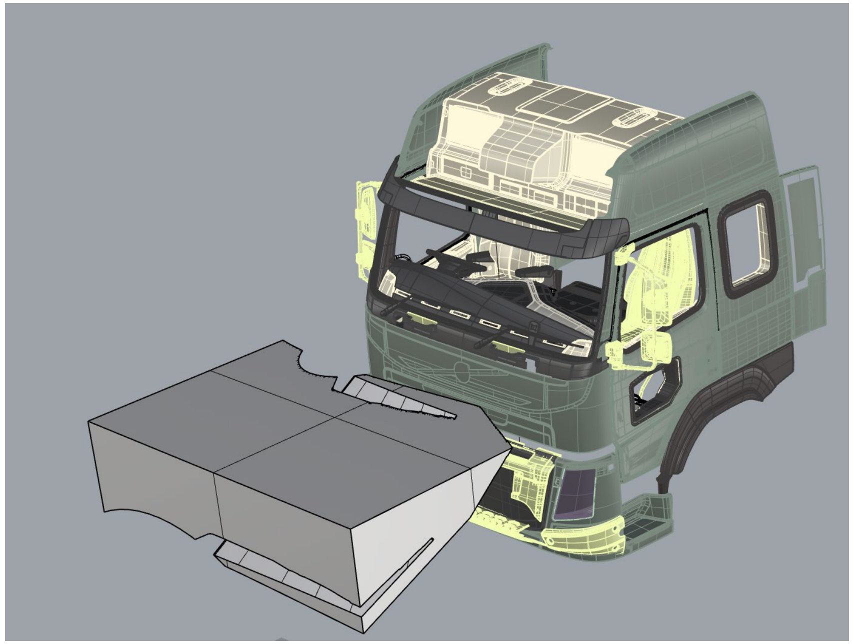
- What volume is equivalent to the need to see three VRUs directly in front of the vehicle?
- We needed a way to define a frontal volume
- We have taken the lateral extents of the vehicle to define the volume directly in front of the vehicle as this is the area that contains the three VRUs for the Series 00 method. Subsection Frontal Visible Volume (SFVV)
- Therefore plotting the VRU distance against the Volume gives a trend line that can be used to calculate the volume that should be seen at a certain VRU distance in the same way as the method used to define the volume requirement for the series 00 version, but for a subsection of the frontal volume



Three VRUs in front of the cab as defined in Series 00



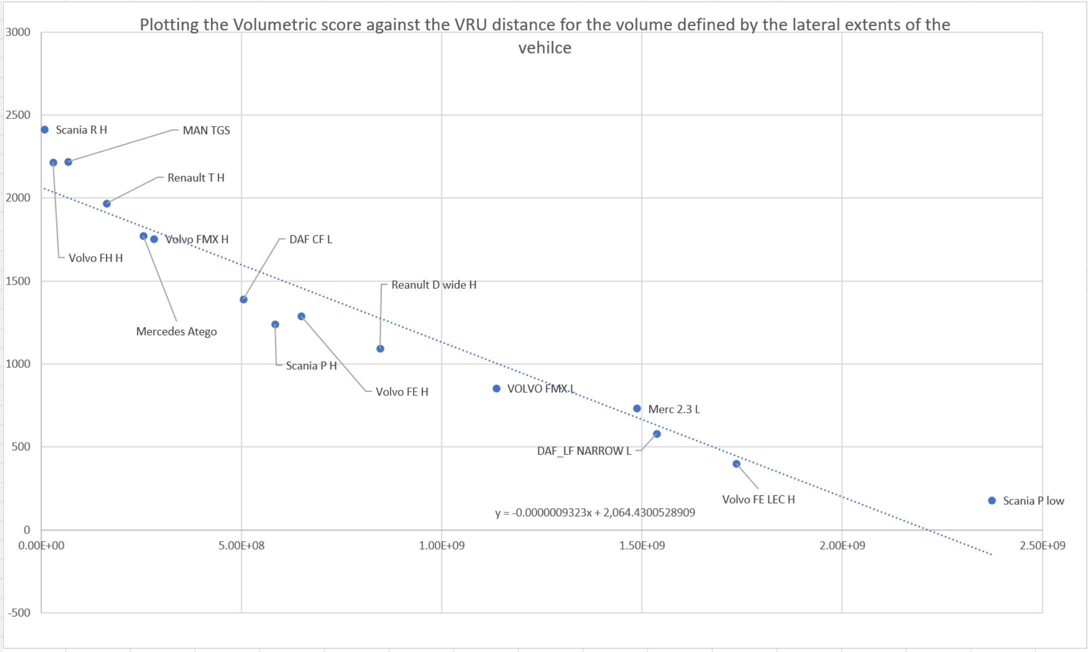
Plan view of the area within which the VRUs are contained, therefore VRU distance should corelate well with volume as per the previous uses of this method



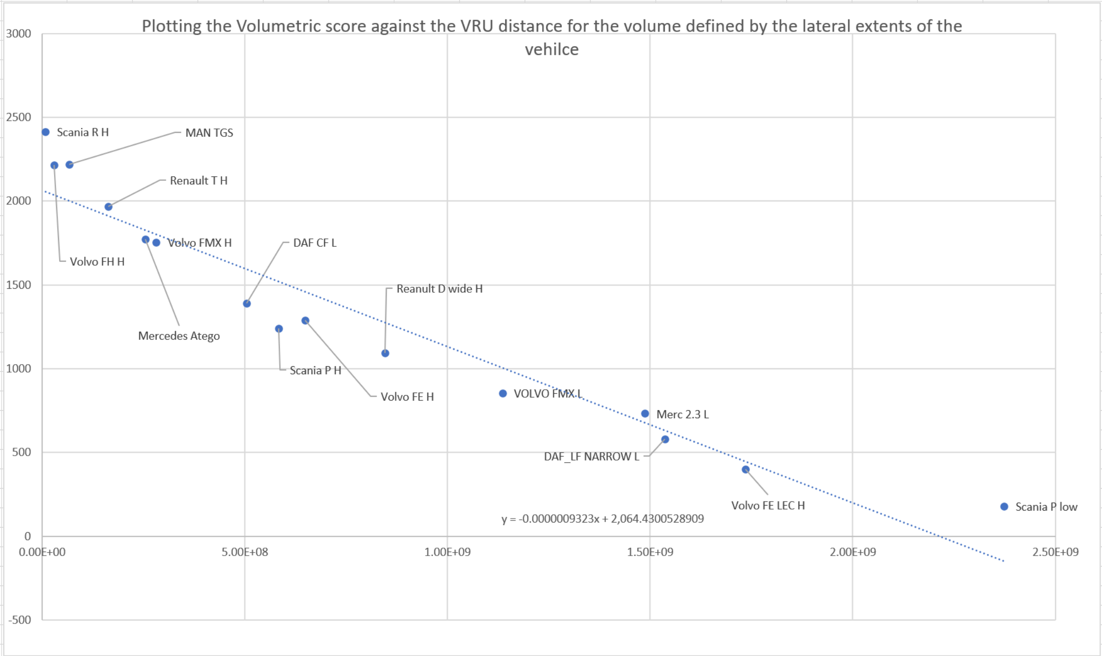
Volume that is visible between the lateral extents of the vehicle

HOW CAN WE ENSURE EQUIVALENCE BETWEEN THE TWO METHODS?

- We have performed this process for 15 vehicles across the sample of 50+
  - As an indicative value for review by manufactures based upon the VRU distances agreed in the Series 00 version table
    - Level 1 vehicles (urban) would need to be able to see 0.441m^3 in the SFVV area (average VRU distance 1653mm)
    - Level 2 (construction) and 3 (long haul) vehicles would need to be able to see 0.114m^3 in the SFVV area (average VRU distance 1958mm)



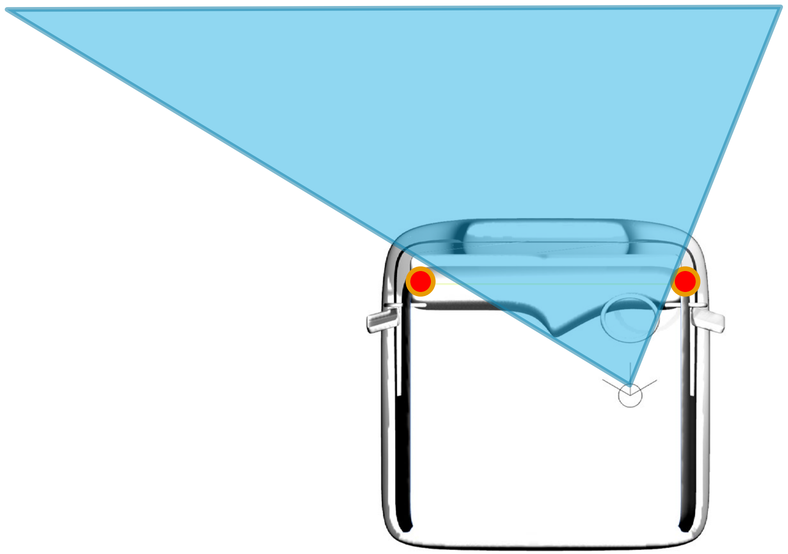
	Average VRU DIST	VOLUME
CALC	1653	4.41E+08 or 0.441m3



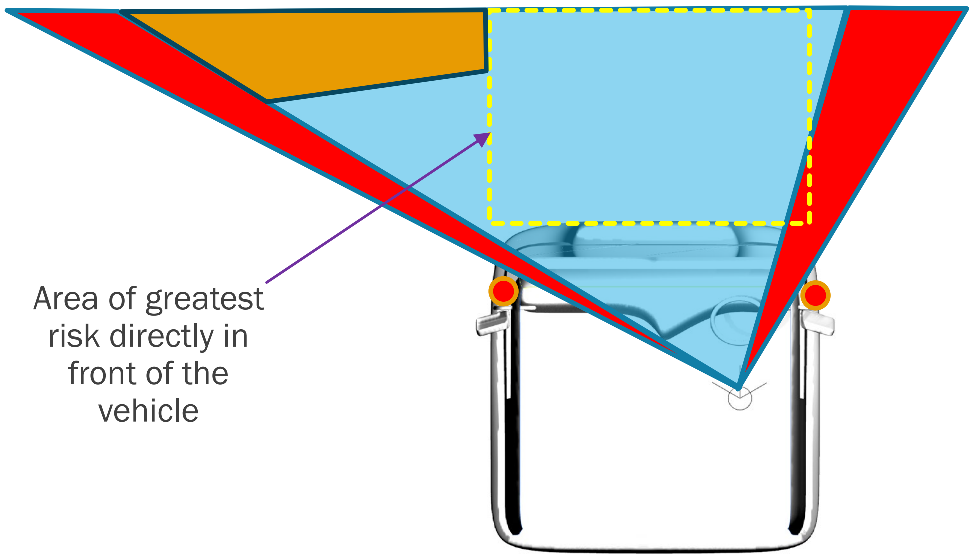
	Average VRU DIST	VOLUME
CALC	1958	1.14E+08 or 0.114m3

ADDRESSING THE CONCERNS

- By requiring a design to allow visibility of the **Subsection Frontal Visible Volume (SFVV)** area we can avoid the issue shown below.



Original vehicle design



Redesign moves A-pillars rearwards

Red areas show volume gained outside of area of greatest risk for frontal collisions, potentially allowing a vehicle to pass the minimum requirements without improving direct vision directly in front of the vehicle.

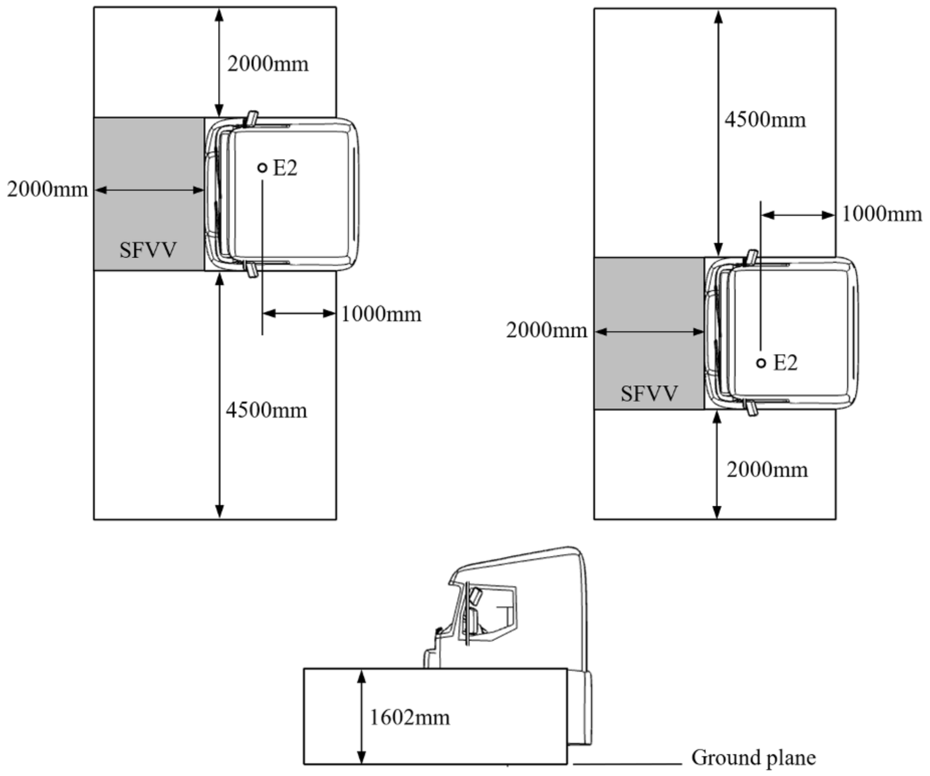
ADDRESSING THE CONCERNS

- The proposed amendment adds requirements for specific volumes to be seen directly in front of the vehicle in the Subsection Frontal Visible Volume (SFVV)

Table 1
Minimum Values of Visible Volume

		Minimum Volume (m^3) of Direct Vision			
		Level 1		Level 2	Level 3
Nearside Visible Volume		3.4		Not Specified	Not Specified
Front Visible Volume	**IAPD ≥ [2156mm]**	1.8	**IAPD ≥ [2154mm]**	1.0	1.0
	IAPD < [2156mm]	**See paragraph 5.3**	**IAPD < [2154mm]**	**See paragraph 5.3**	**See paragraph 5.3**
Subsection Frontal Visible Volume		**0.441**		**0.114**	**0.114**
Offside Visible Volume		2.8		Not Specified	Not Specified
Total Visible Volume		11.2		8.0	7.0

Replace Annex 4 Figure 1 with the following which shows the SFVV:



SUMMARY

- The volume required by the Series 00 version was defined by the use of VRUs directly in front of the vehicle.
- It is clear that manufacturers are considering design interventions which will not allow the visibility of volume directly in front of the vehicle to be improved, e.g. ACEA have shown an option to lower the passenger side edge of the dashboard – which again improves direct vision outside of the area of greatest risk
- To be clear we propose that the existing frontal requirements be augmented with the requirement for a level 1 vehicle to see $0.441m^3$ of the SFVV area
- Level 2 & 3 vehicles should be able to see $0.114m^3$ of the SFVV area

Project information

Thank you for your attention, are there any questions?

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