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Summary of physical test method and questions on cab tilt for manufacturers

Loughborough University Design School (LDS): Design Ergonomics Research Group

Research Sponsored by Transport for London and the UK Department for Transport

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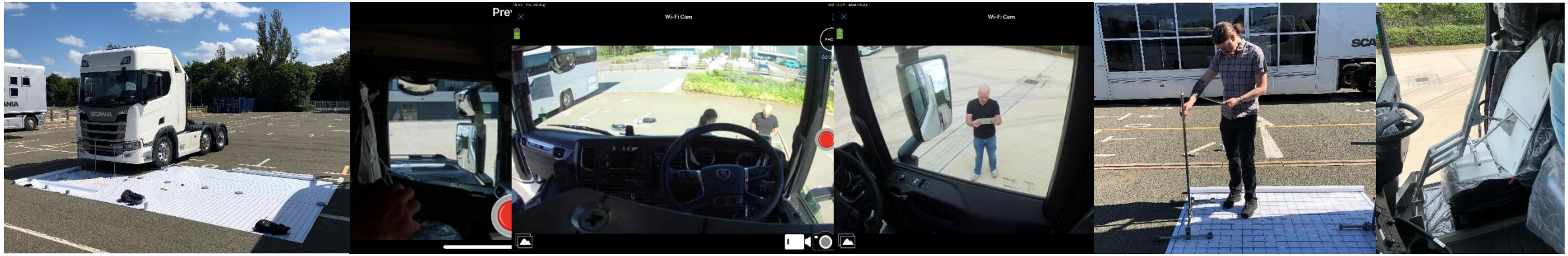

VRU-Proxi-18-04

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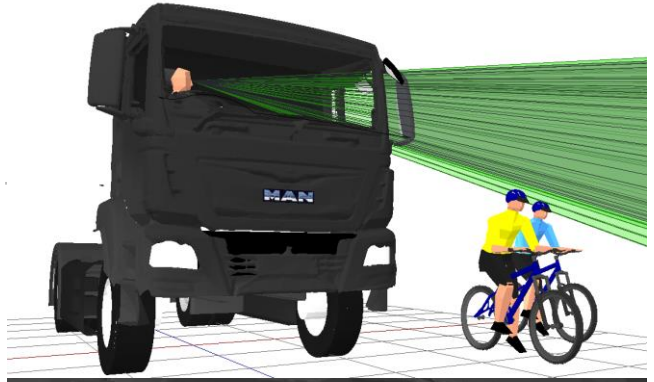
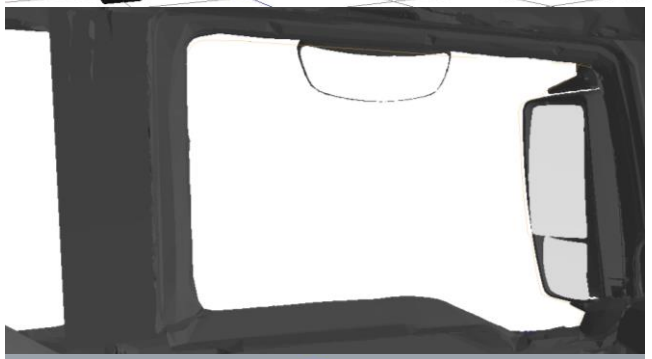
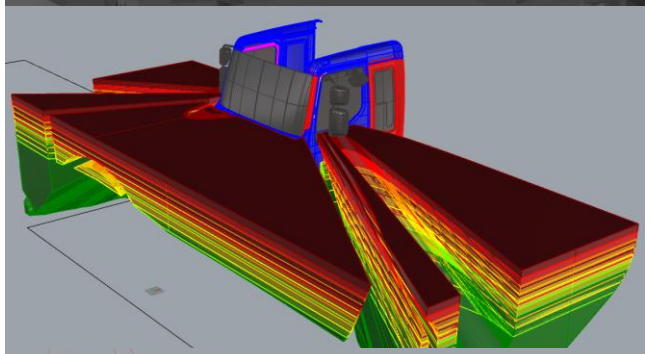
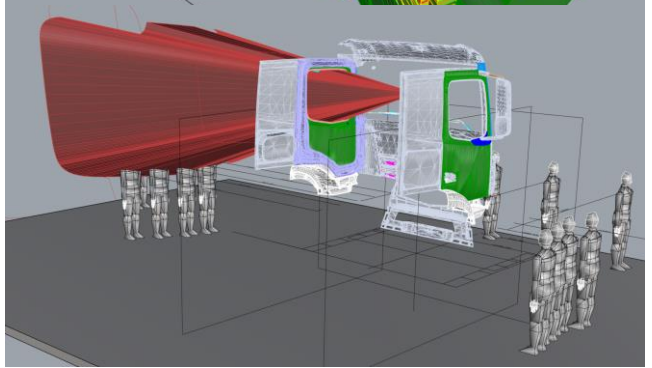






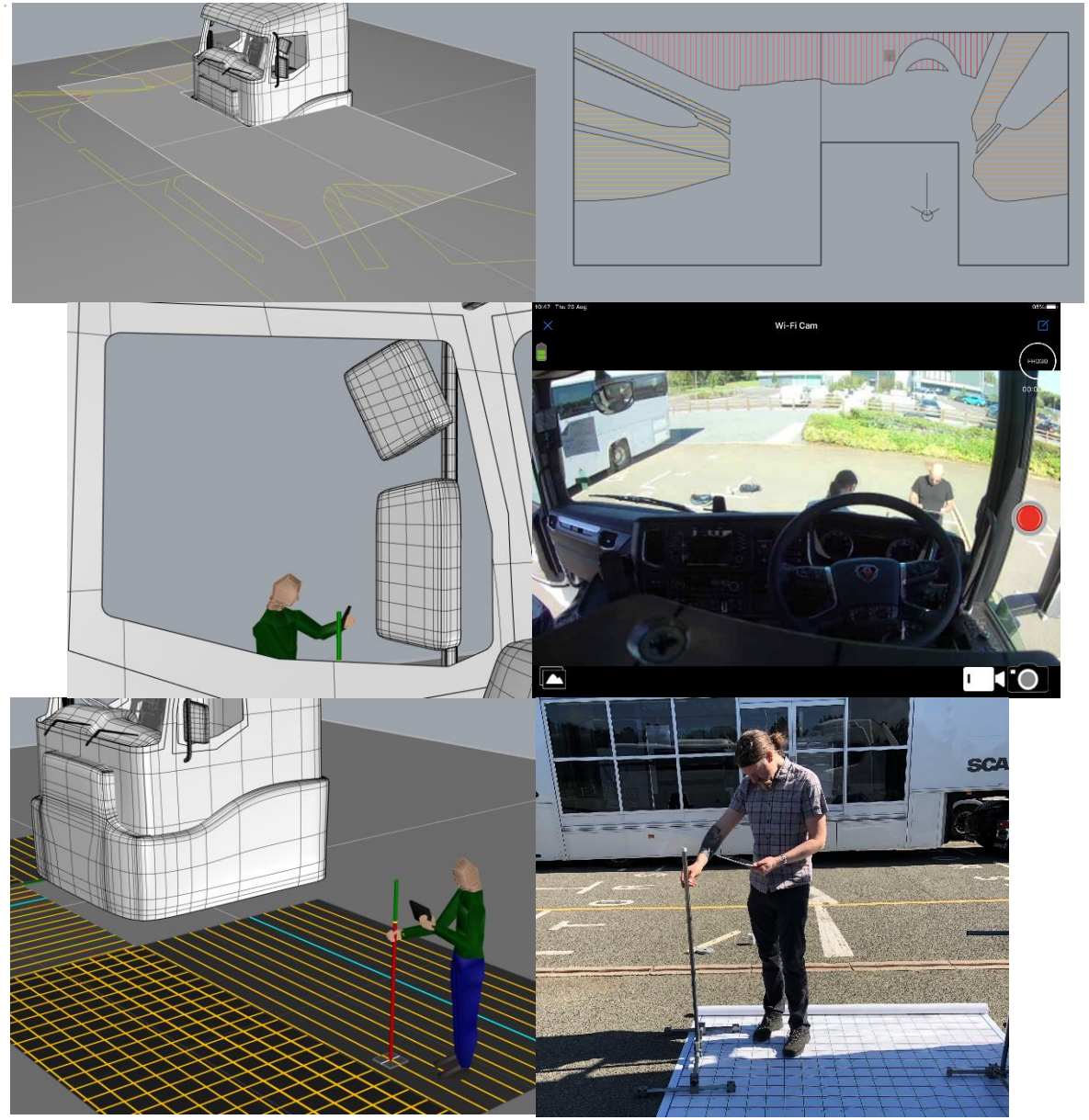


Background – Physical test method

- The UN ECE VRU Proxi group requested a physical test that can be used to complement the digital test that is used to measure direct vision performance.
- Work was performed to develop a method which produces results which are equivalent in accuracy to the digital method.
- A number of different techniques have been explored over the past year.
- The method that has been piloted has the following characteristics.

Background – Taking a section through the volume

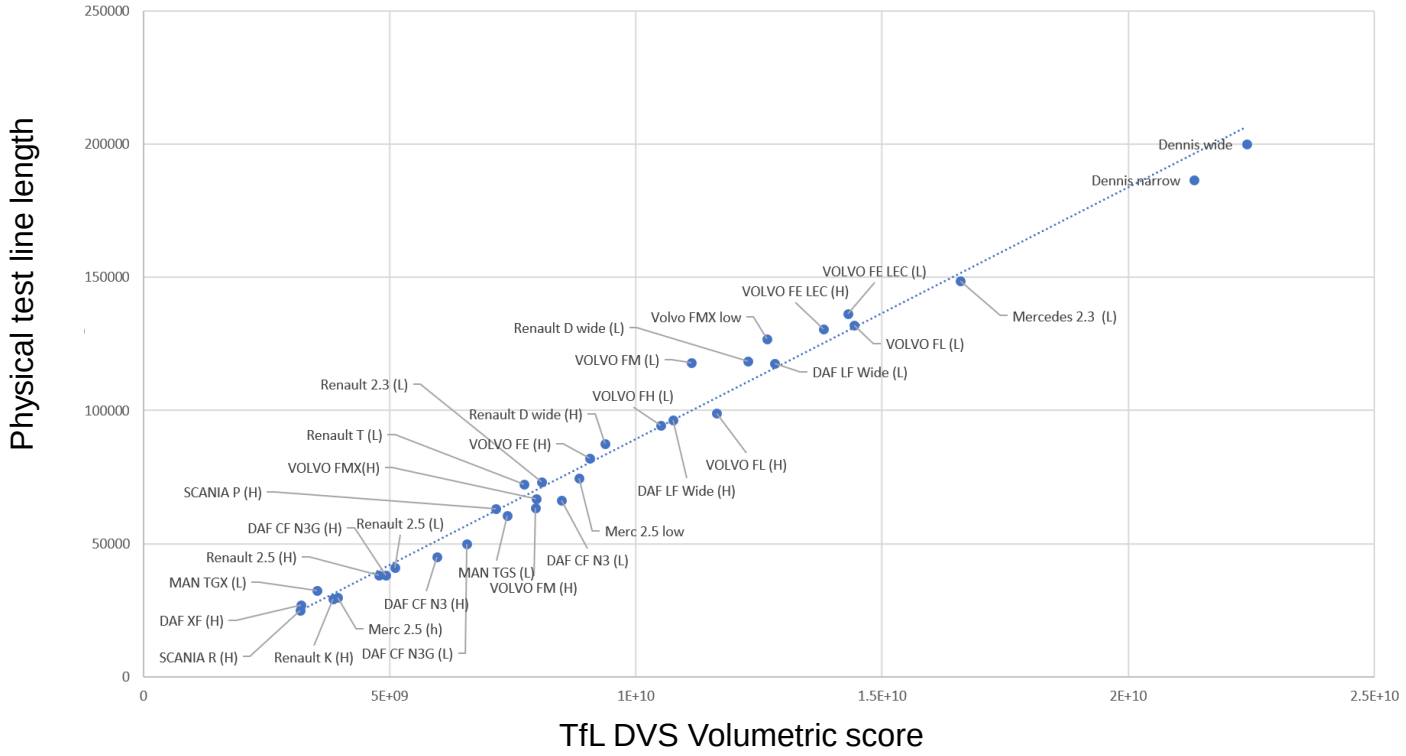
- The physical testing technique that is being developed effectively gathers data that is a **section** through the visible volume.
- This section is taken at a height which is equivalent to the neck height of a 5th%ile Italian Female (1267mm) to reflect the previous use of VRU simulations to quantify the volumetric scores produced by the TfL DVS.
- It is taken by marking a floor grid with the locations at which the top of a stick with a height 1267mm can be seen in a camera view from the eye position
- This produces a set of line lengths which are simply summed



Background – Digital simulation of the physical testing results correlated with the digital testing results

- As discussed above the use of the physical test **defines a section** of the portion of the assessment volume visible to the driver and we would therefore expect there to be a high correlation between the volumetric approach and the physical testing approach

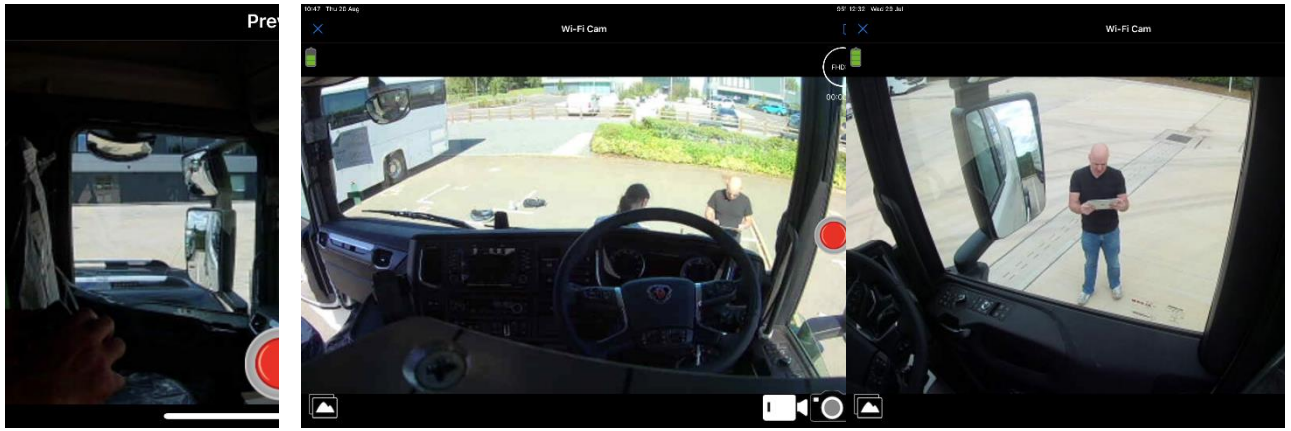
- Our simulations have shown that the correlation between this method and volumetric method is **almost perfect** with a correlation coefficient of 0.992



Background – Eye rig

- The eye positions that have been defined in the digital DVS have been recreated with a specific rig

- WIFI cameras are located with their lenses exactly at the eye point locations required using specific 3D printed camera mounts providing a view that can be used externally on a tablet computer



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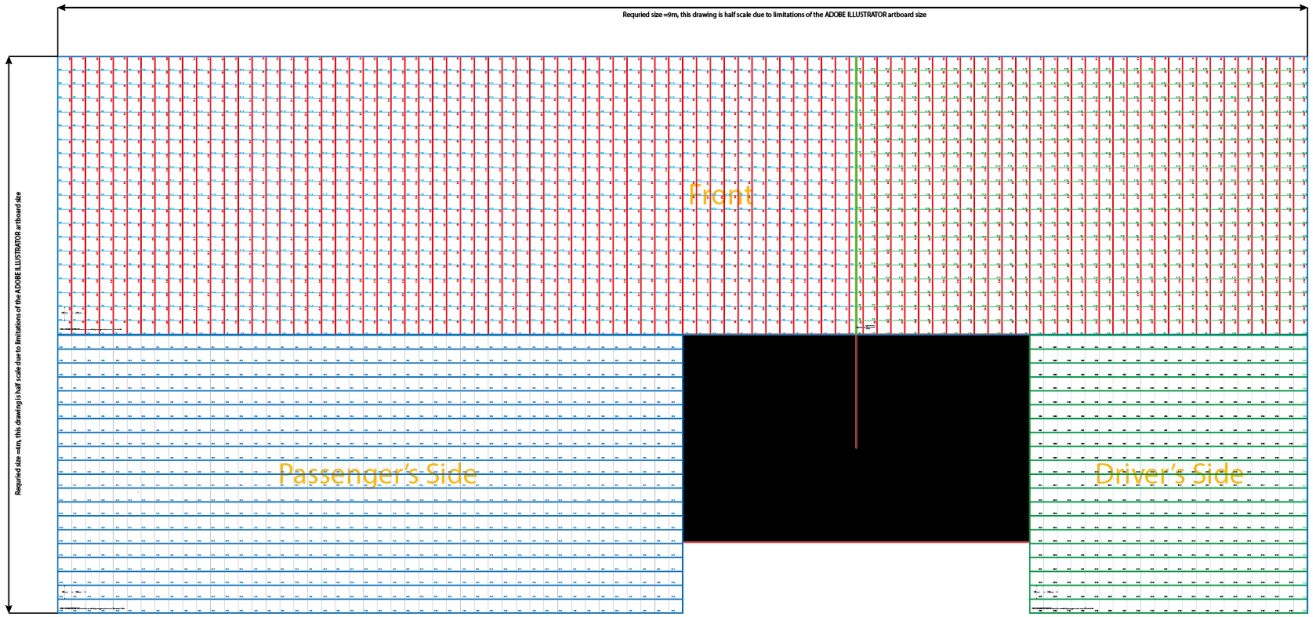
Background – Assessment matts

- A set of three assessment mats have been designed and printed to enable the correct movement of the assessment pole.
- These have been printed as large banners. The material properties are ideal.
- The mats allow white board pens to be used to mark locations and are easily wipeable
- The mats produce a 100mm grid

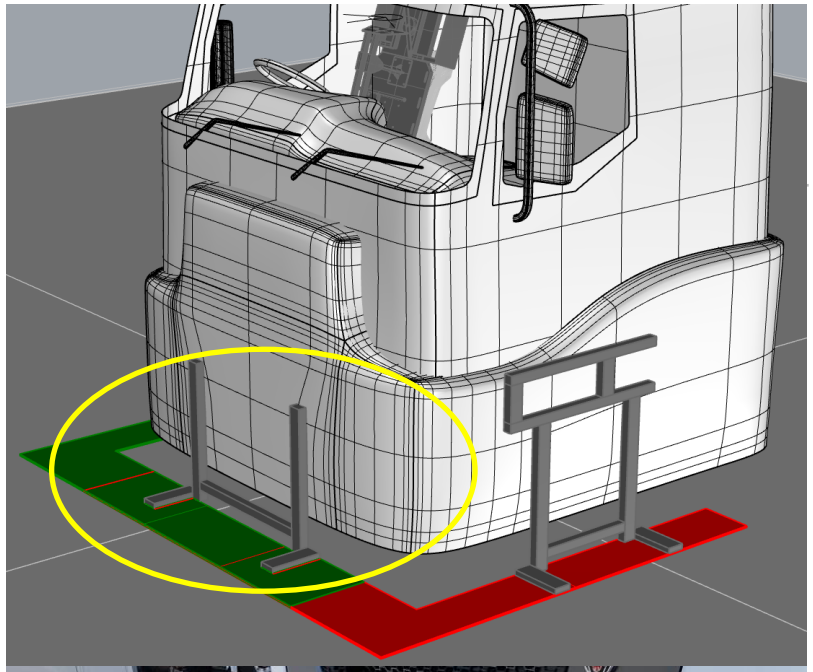


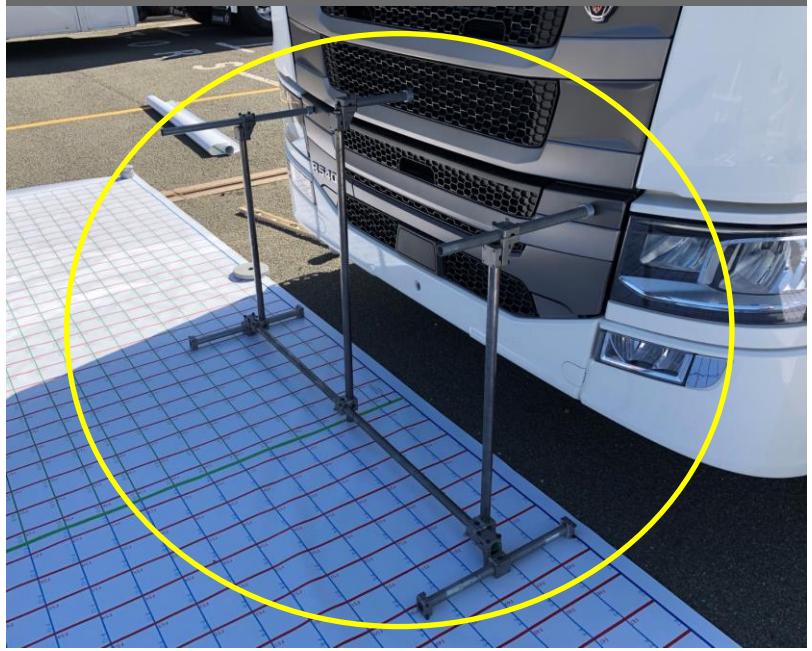
Background – Alignment structures

- Alignment structures are used to ensure that the mats are aligned correctly to the front and sides of the truck.

- An assessment area of 9m x 9m is required, with a flat floor.

- The first pilot was conducted outside and this highlighted that an interior space is required due to wind moving the mats (and the excessive sun burn suffered by the experimenters)





Background – Collecting the data –video from second pilot

- The time lapse video shown here shows all of the data collection over a **four-hour period**.
- The data was gathered using a pole and tape measure
- We are now exploring using laser distance measurement technology to improve the time frame involved in gathering data before testing at Millbrook with type approval technicians
- We think that the measurement time can be **halved**

Time lapse video

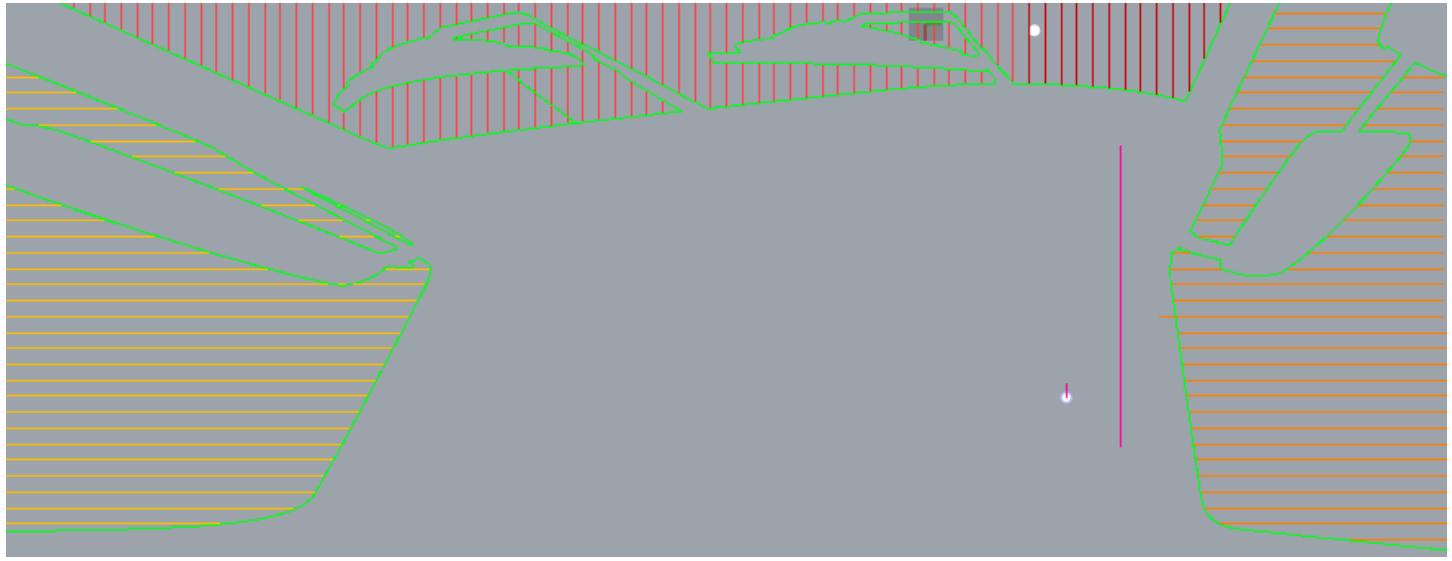
Pilots conducted to date

- Pilot testing has been performed with the following vehicles
- Volvo FM for which we have a CAD data
- Scania R for which we have 3D scanned data

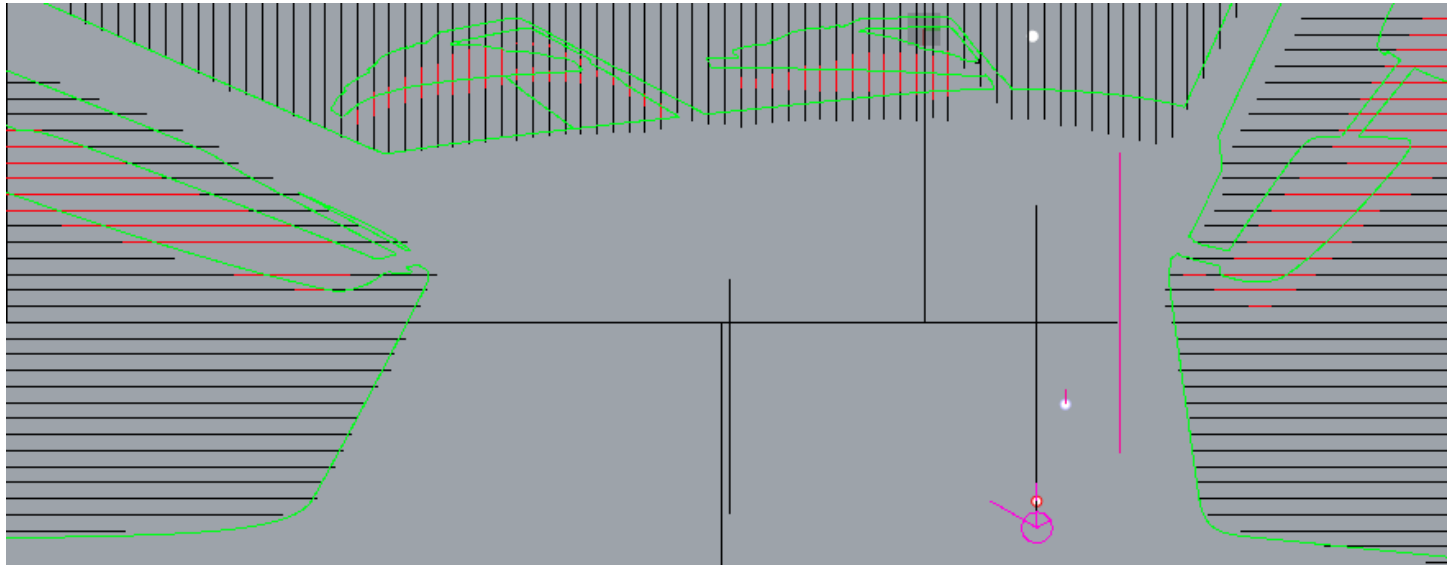
Results for the VOLVO FM Pilot testing

Results for the Volvo FM version 1

- CAD based simulation of the physical testing for the VOLVO FM



- Physical testing results plotted in CAD system
- There is a mismatch associated with cab tilt in the real world



Results for the Volvo FM version 1

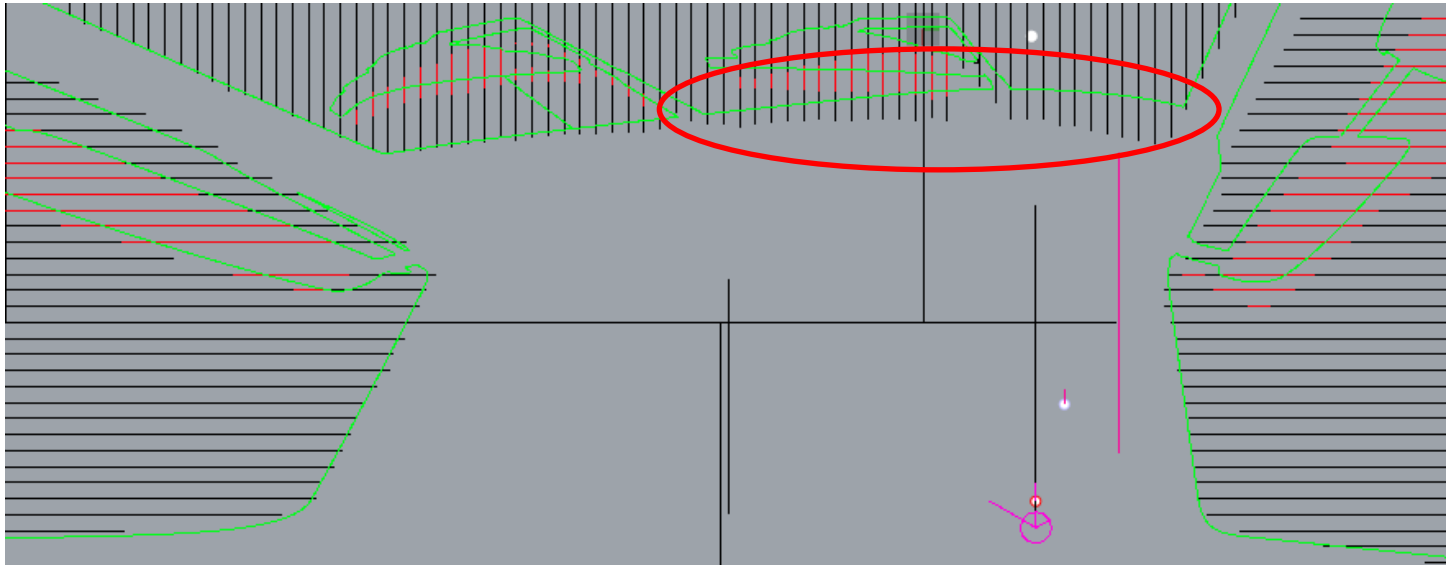
- There was a 0.63 degree tilt in the real world cab which is not accounted for in the CAD

Flat cab

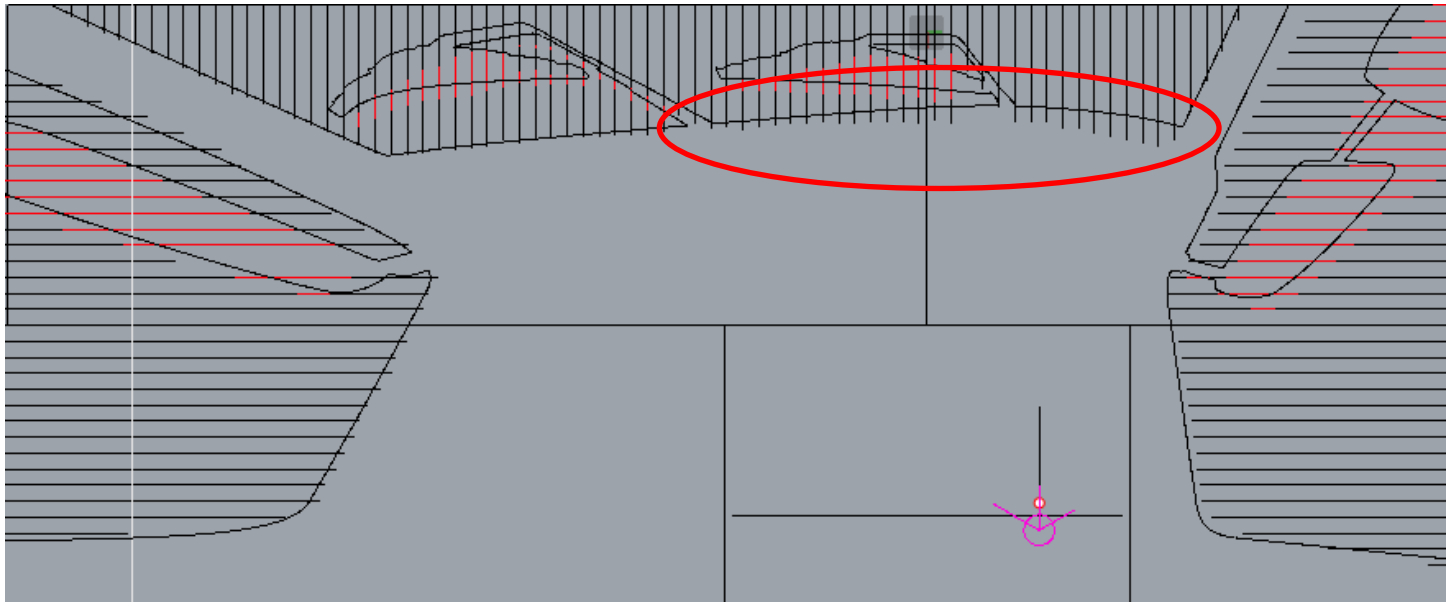
Tilted cab (0.63 degrees)

Comparison between flat and tilted cabs

- Physical testing result plotted in the CAD system for the **flat cab**



- Physical testing result plotted in the CAD system for the **tilted cab**



- The alignment to the simulated approach is improved by tilting the cab to reflect the real world

Questions for vehicle manufacturers

- The real world method automatically includes the tilt in the cab
- The digital method, which is must faster and more accurate has currently been done on flat cabs represented by CAD data (no tilt)

- How much do cabs tilt in the real world?

- Is the tilt consistent or dependant upon suspension type?

- Can it be qualitied and the tilt added to CAD data used in the Digital test method?

- Do manufacturers still favour the digital method for Type approval?

Improvements to the physical testing

- The data collection can be improved by using laser measurement technology
  - This will reduce the testing time considerably

- We have now designed and built new rigs which will allow laser based measurement

Improvements to the physical testing

- The resolution of the image used on the tablet computer can be improved with better quality cameras to improve the accuracy of data collection for areas such as wiper obscuration

- The rig that simulated the neck height of the Italian female can be improved by adding a light source at the top, and contrast panel behind
  - This should improve the accuracy of tasks such as measuring obscuration by wipers

Old version, smaller cameras
Lower quality

New version, new 3D printed support rig and much higher quality wide angle camera

Project information

Thank you for your attention, are there any questions?

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