Definition and testing of a Direct Vision Standard for HGVs – Physical testing method

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Update on physical testing development

• Progress since last meeting

• Virtual testing to help in the design of the physical

• How will the test be performed?
The definition of a ‘real world’ test that can be used for 'on the spot' checks

• At the last VRU Proxy meeting our proposal for physical test method which automates the process using cameras and QR markers was rejected as this would require bespoke software which would be difficult to implement in legislation

• We have therefore produced a test method prototype which is much more simple to implement and would not require bespoke software

• The following presentation outlines this new proposal and the work done so far to define and validate the new test
What is the visual target that is used?

- We need a test that is analogous to the digital TfL DVS technique
- Therefore we have defined a test object that is the same height as the DVS VRU (5th percentile Italian female)
- We have also explored how much of this visual target should be visible during the testing
- The red section shown in the image is equivalent to the head and shoulders being visible
- In the first instance we have defined a test method where the top or bottom half of the test object can be acceptable as visible to the driver (more on this later)
Using the data from the DVS definition to test the number of visual targets required

• Before attempting any physical testing we have used the data that we have from the TfL DVS definition to test the ‘Stick’ based approach with the following aims;

  • We have a digital sample of 56 HGVs (volumetric projections) which can be used to test different versions

  • To remove variables that will exist in the real world testing which would reduce the ability to diagnose issues with the pilot testing

  • To determine the number of ‘Sticks’ (or measurement points around the vehicle) that should be used to allow a good correlation with Digital DVS volumetric scores, as few as possible

  • To perform a virtual dry run of the methodology that is required in the real world
Test requirements

• The real world test needs to produce results that are equivalent to the digital results
  
  • For example being able to differentiate between a vehicle that achieves Zero star, or 1 star and better using the Digital volumetric approach
  
  • Therefore the real world test is being designed with some of the parameters of the digital DVS test in mind
Recreating the virtual eye points in the DVS in the real world

- One of the key elements of the digital DVS is the eye point rig to provide 3 repeatable eye points
- A rig has been built to allow these eye points to be created in a real cab (see real rig during presentation)
- It is positioned in the vehicle cab, adjusted using the screw thread until the top plate is horizontal, and then 3 cameras are placed on the rig to create the eye points in the same location as the digital version, these cameras can transmit their images wirelessly to a screen that an external operator can view
Positioning the stick arrays

- The digital DVS was validated using 13 VRU simulations and these were used in a specific manner.
- The ‘Sticks’ have been used in the same manner but we have increased the resolution to over a hundred measurement locations in the first instance.
  - The ‘Sticks’ are moved away from the sides or front of the cab until the top section is visible.
  - In constrained locations such as the wiper blade, or under mirrors, we have allowed either the top half or the bottom half of the stick to be visible.
  - Only ‘Sticks’ that are in front of the eye points have been used for the current analysis.
The positions of the ‘Sticks’ when they are visible (head and shoulders of 5th%ile Italian female)
The results of the correlation between the DVS results and the ‘sticks’ method

- The digital simulation has been run on 27 of the 52 available vehicle sample at this point
- In the graph the average of all stick distances has been plotted against the Digital DVS volume score
- This has shown a good correlation between the Digital Volumetric DVS method and the ‘Stick’ based method (Pearson’s correlation coefficient =0.98 where above 0.5 is considered to be strong, 1 is perfect)
Recreating the virtual eye points in the DVS in the real world

Key messages

- Excellent correlation between sticks results and DVS digital Volumetric results
- The stick based system can differentiate between zero star and one star vehicles
- Where 1 star is the minimum requirement as defined by the TfL DVS
Virtual testing of a number of ‘sticks’

• For the initial virtual testing of the prototype the sticks have been placed every 100mm

• This has produced a result where for most vehicles this would require approx. 110 measurement locations

• This is most likely too many locations for a real world test and so the next step is to explore increasing the spacing between the measure locations (less locations) to see what the minimum number of measure locations are without affecting the quality of the correlation coefficient between the digital DVS result and the physical DVS result

• We will then validate the prototype with real world testing
How will the real world test be performed?

- Floor mats are produced which can be located around the cab using reference structures.
- Floor mats contain markings to place the reference sticks and markings to show distances.
How will the real world test be performed?

- The cab rig will cameras will transmit the camera view to the experimenter using a laptop/tablet to view the camera view allowing them to align the assessment stick.
How will the real world test be performed?

Front and side rigs used to determine extremes of cab and align mats

Three mats: front, left and right placed around vehicle
How will the real world test be performed?

- Each mat is marked with a series of parallel marker lines to guide the measuring sticks.
- For ease of measurement each marker line has a scale.
How will the real world test be performed?

- Marker sticks used in two stages
- Place three sticks in predetermined extreme positions on each side
- Slide sticks along marker lines, away from the vehicle until top section is visible in the camera
- If all sticks are in the red zone, vehicle is zero star – no need for further analysis
How will the real world test be performed?

- Each stick is moved until 4 consecutive segments of the top eight segments are visible.
- Unless partially obscured due to a wiper blade or mirror body, the bottom four segments take priority (i.e. must be seen).
How will the real world test be performed?

- If a second stage is required
- Each marker line must be assessed by moving sticks along it until the top section is visible and the distance recorded
How will the real world test be performed?

- The result is a form of visible area plot at the height of the shoulder point of the 5th %ile Italian female.

- The average of the measurements provides a value that can be used to determine the rating of the vehicle.
Summary

- We have defined a simple test method in CAD and virtual testing shows a good correlation with the TfL DVS scores.
- This has validated the approach and we will soon be ready to pilot test the process with a sample of real trucks knowing that any inconsistencies will be easier to identify and account for.
- We have built a physical rig to enable the eye point locations to consistently recreated.
- This approach can distinguish between 1 star and zero star vehicles with ease and zero star vehicles can be identified in a short period with the defined test methodology.
Next Steps

• Complete the analysis of the remaining vehicles in the digital version
• Commission the production of the floor mats and the assessment sticks
  • 3 required

• Attempt to test the new method and see how repeatable the results are a number of experimenters

• Produce a protocol for the test and the engineering drawings required for the rig production
Project information

Thank you for your attention, are there any questions?

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