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## AN ASSESSMENT OF THE FIELD OF VIEW REQUIREMENTS IN DIRECTIVE 2003/97 FOR CLASS III MIRRORS FITTED TO PASSENGER CARS AND COMPARISON WITH AN ALTERNATIVE PROPOSAL

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### 1 Methodology

To provide an accurate assessment of the indirect field of view from Class III mirrors TRL selected three vehicles that are typical of the UK fleet. These vehicles when categorised in the European New Car Assessment Program (EuroNCAP) would be categorised as a small MPV, a large family car and a roadster.

The three vehicles dimensions were measured using a 3-dimensional co-ordinate arm and the information imported into SAMMIE CAD, an ergonomic computer package. Using this information an assessment was made of the field of view for the vehicle at the ground plane, for both the driver side and passenger side Class III mirrors. This view was assessed against both Directive 71/127 and Directive 2003/97. The object specified in the alternative industry proposal, a wall of height of 50cm with a width of 1m placed 4m behind the ocular points, was then incorporated. An assessment was made of the extent of the ground plane which would be visible beyond the wall using the Class III mirrors. For the small MPV mirror sizes were adjusted to determine the minimum mirror size required to be compliant with the directives.

In addition a practical assessment of the field of view for the large family car was made. The vehicle was positioned on the TRL test track and the dimensions specified in Directive 2003/97 were marked out for reference. Correct adjustments of the mirrors were made by two test subjects who sat in the driver's seat of the vehicle.

The matrix of tests is shown below in Table1.

**Table 1. Matrix of assessments for Class III mirrors**

		Small MPV	Large family car	Roadster
Directive 71/127	Current requirement	Yes	Yes	Yes
	Minimally compliant mirror for Directive	Yes	X	X
	Future requirement	Yes	Yes	Yes
	Minimally compliant mirror for Directive	Yes	X	X
Directive 2003/97	Practical assessment	X	Yes	X
	5% female, 50% & 95% male	Yes	X	X
	Industry alternative (0.5m high "wall")	Yes	Yes	Yes

## 2 Results

### 2.1 SAMMIE CAD assessment

The indirect field of view for the selected vehicles was assessed against both Directive 71/127 and Directive 2003/97, using SAMMIE CAD. Where Class III mirrors comprised of spherical and aspherical sections the assessment is based on the spherical section only. Screen captures for the results from SAMMIE CAD are re-produced in this section. The grids around the vehicles are of a scale 10metres by 10metres. Note that the vehicles in SAMMIE are reproduced as a wire-frame, and therefore projections of the Class III mirror view pass through the vehicle rather than along the outermost edge of the vehicle.

Table 2 summarises the assessment for each of the vehicles, listing modifications made to meet the directive or reasons directive was not met. As expected all vehicles complied with Directive 71/127 by a considerable margin.

**Table 2. Summary of SAMMIE CAD assessment**

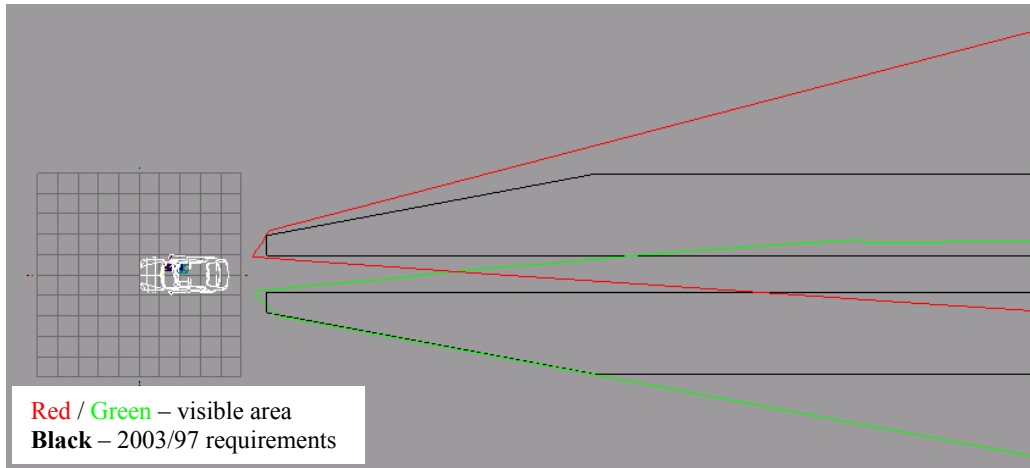
	Occupant size	Driver	Passenger
<b>Small MPV</b>			
Directive 71/127	5 <sup>th</sup> / 50 <sup>th</sup> / 95 <sup>th</sup>	Yes	Yes
Directive 2003/97	5 <sup>th</sup> / 50 <sup>th</sup> / 95 <sup>th</sup>	Yes	Mirror height increased by 18%
Industry alternative	5 <sup>th</sup> / 50 <sup>th</sup> / 95 <sup>th</sup>	Yes	Yes
Minimum size for Directive 71/127	50 <sup>th</sup>	27% decrease in mirror size	54% decrease in mirror size
Minimum size for Industry alternative	50 <sup>th</sup>	36% decrease in mirror size	18% decrease in mirror size
<b>Large family car</b>			
Directive 71/127	50 <sup>th</sup>	Yes	Yes
Directive 2003/97	50 <sup>th</sup>	Yes	Edge of area at 4m from ocular point cannot be seen
Industry alternative	50 <sup>th</sup>	Yes	Yes
<b>Roadster</b>			
Directive 71/127	50 <sup>th</sup>	Yes	Yes
Directive 2003/97	50 <sup>th</sup>	Substantial encroachment of the rear wheel arches into the required area.	
Industry alternative	50 <sup>th</sup>	Yes	Yes

Figures 1, 2 and 3 demonstrate the projected views in the SAMMIE software. Figure 1 shows that while the large family car is unable to meet Directive 2003/97 on the passenger side it is very close to the requirements. This correlates well with the areas from physical measurements in Section 2.2.

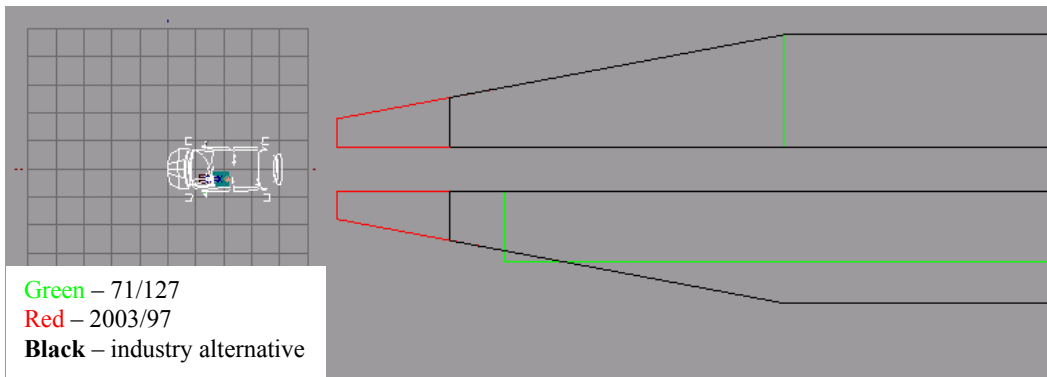
Figure 2 compares the required areas for each directive for the small MPV. The area for the alternative to Directive 2003/97 is calculated by the furthest forward point on the ground plane that could be seen if the 0.5m wall at 4m behind the ocular point was present.

Figure 3 demonstrates the area that can be seen at 0.5m above ground level for mirrors that are modified to be minimally compliant to Directive 2003/97 and the industry alternative. The plot shows

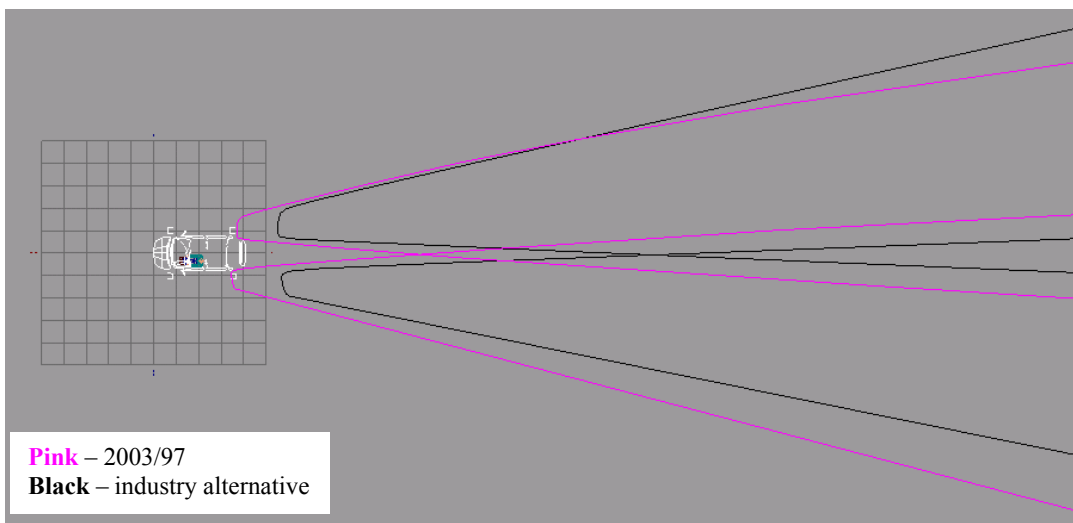
that a greater area can be seen with mirrors that are required to meet Directive 2003/97, including an area substantially closer to the rear of the vehicle.



**Figure 1. Large family car ground plane field of view compared with Directive 2003/97 (RHD)**



**Figure 2. Required visible areas at ground level for the small MPV (LHD)**



**Figure 3. Area visible at 0.5m above ground level for the small MPV**

## 2.2 Physical assessment

To ensure that the assessment of all the vehicles using SAMMIE was objective, the large family car was also subject to a practical assessment on the TRL track. Two test subjects sat in the driver's seat and adjusted the mirrors until they obtained the best view, for themselves in their normal seated position, of objects which marked out the directive area. These tests confirmed that the SAMMIE assessment was representative.

Photographs of the views for a test subject are shown below in Figure 4. Note that for clarity of the mirror image the zoom function of the camera has been used.



**Figure 4. Test subject view of 50cm high post, view from large family car (RHD)**

The driver side mirror was found to be capable of fully meeting the requirements of Directive 2003/97. However, the passenger mirror, as shown in the SAMMIE analysis, does not quite meet Directive 2003/97 (the SAMMIE assessment showed that the outer edge could not be seen). The view of the ground plane at four metres behind the ocular point is just visible, and the horizon is also just visible.

As a comparison with the industry proposal a 0.5 metre high traffic post was used. It is acknowledged that the post was not of 30centimetre diameter (the post is 10cm diameter), but it was felt it was representative of the industry proposal. The results can be seen in Figure 4. The majority of the traffic post could be seen in either the passenger mirror or the driver's side mirror (the area at the base of the post and the horizontal markers is representative of Directive 2003/97. Note that in Figure 4 the object on the passenger side 20metres behind the ocular points representing the outermost line of the vehicle body was removed and thus was not available to be seen in the mirror.

## 3 Conclusion

For the research conducted, it appears that there are already production vehicles that meet Directive 2003/97 for the driver side mirror and almost meet the Directive 2003/97 for the passenger side mirror.

Comparisons of the mirror size showed that for the small MPV the spherical section of the passenger mirror could be increased to be minimally compliant to Directive 2003/97. Whereas to be minimally compliant with the industry proposal (where the very top of the wall could be detected) the driver mirror would decrease in size by 40mm and the passenger mirror by 20mm.

The assessment for variation in human size showed that the increased in 20mm of the size of the passenger mirror would be adequate to meet Directive 32003/97 for a 5% female, up to a 95% male.

A practical assessment of the large family car (2001 production model) showed that the vehicle could meet Directive 2003/97 for the driver's side and almost meet it for the passenger's side.

Therefore, adoption of Reg 46.02 would seem most logical as the cars used in this assessment almost meet the Directive 2003/97 and it is felt that the industry proposal would be a retrograde step.