**THE DANGER TO YOUNG PEDESTRIANS FROM REVERSING MOTOR VEHICLES**

**Michael Paine**

Vehicle Design and Research

**Adam Macbeth**

Insurance Australia Group (IAG)

**Michael Henderson**

Michael Henderson Consulting

Australia

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## ABSTRACT

There is increasing concern about accidents involving young children being run over by slow moving vehicles, particularly in private driveways. The Motor Accidents Authority of New South Wales co-ordinated and funded the initial investigations into this problem.

Measurement of the rearward field of view for a range of popular passenger vehicles revealed most had a very poor view of objects the size of toddlers behind the vehicle. This was the case with conventional sedans as well as sports utility vehicles that are generally over-represented in this type of accident.

Two vehicle-related countermeasures were examined: proximity sensors that warn the driver when an object is behind the vehicle and visual aids such as video cameras. Theoretical analysis shows that, in order to be able to stop in time, the reversing speed in km/h should be no more than twice the detection distance in metres. Proximity sensors that are designed as a parking aid have a typical detection distance of 1.5m and so the maximum reversing speed is 3km/h. This is likely to be too slow for typical driveway situations but, with simple technology, longer detection distances are likely to be associated with too many false alarms.

Initial results suggest a combination of proximity sensors and video camera would provide the best assistance to the driver although the technology is improving rapidly and other solutions are possible.

A method of assessing and rating the rearward field of view of vehicles has been developed by the Insurance Australia Group and the results for popular vehicles in Australia are presented.

## INTRODUCTION

In recent years the problem of young children being struck by reversing motor vehicles has come to attention. Many of these accidents occur on private property and therefore are not recorded in road accident statistics. A special effort is needed to determine the number and characteristics of these accidents. Such an investigation was initiated by the Motor Accidents Authority of NSW (MAA) in response to initial findings of the Child Death Review Team. The results of those initial investigations are described by Henderson (2000). Briefly, in New South Wales between January 1996 and June 1999, 17 children were killed by reversing motor vehicles on private driveways. Many were toddlers (2 to 4 years old) and the number of deaths in this age group was similar to the number occurring on public roads (in all types of pedestrian accidents - not just reversing motor vehicles) during the same period. In other words, private driveways are as hazardous as public roads for toddlers. Large four-wheel-drives (4WDs) and commercial vehicles appeared to be over-represented in the accidents.

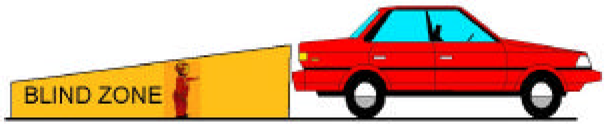


**Figure 1. Illustration of the blind zone behind most vehicles**

In 2002 the Australian Transport Safety Bureau issued a report on driveway child fatalities (Neeman et al (2002). This was in agreement with the earlier work, reported by Henderson.

A range of behavioural and environmental countermeasures have been suggested to reduce the risk of young children being run over by reversing motor vehicles. The Henderson report identified some vehicle-related countermeasures that might be utilised to address the problem. This included proximity sensors that alert the driver when an object is detected within a certain distance of the rear of the vehicle and visual aids that give the driver an improved rearward field of view. The MAA therefore commissioned further research on vehicle-related countermeasures. This paper sets out the results of that research and subsequent developments. The work is reported in detail by Paine and Henderson (2001).

**METHODS**

The MAA project involved the following activities:

a) A review of technology for proximity sensors and visual aids that might address the problem of children being run over by reversing vehicles.

Automotive engineering, sensor technology and occupational safety literature and websites were reviewed. Suppliers of potential equipment and researchers in the field were contacted for additional information.

b) Measuring the rearward field of view of a range of vehicles.

A vacant factory was leased. The floor and walls were marked with a distinctive grid. Arrangements were made for a total of nine vehicles to attend the site. For each, the rearward field of view from the driver's eye position was photographed and the extremities of that view were measured (as projected onto the factory wall or floor). The resulting co-ordinates were mathematically transformed into a contour map of the limits of visibility of objects of nominated height at the rear of the vehicle. For the analysis, object heights of 600mm, 800mm and 1 metre were chosen. Figures 2a and 2b show the test setup.

c) Theoretical investigation of the dynamics of the situation to establish required detection distances.

The analysis considered the initial speed of the vehicle, the distance at which the sensor detects an object (such as a child) and sounds the alarm, the time it takes the driver to react to the alarm and apply the brakes, and the braking distance. Using a technique described by Williams (1999), a distribution of "alert" driver reaction times was used to derive "probability of collision avoidance" for a range of initial speeds and sensor detection distances (Figure 3).

d) Acquiring and evaluating sample proximity sensors and visual aids.

Three ultrasonic and one microwave ("radar") proximity sensors were acquired. These were evaluated using the grid on the factory floor - the tester approached the rear of the vehicle along marked longitudinal lines and noted when the alarm first sounded. This produced a horizontal detection pattern for each device. The vertical detection pattern was also evaluated.

Four types of visual aid were evaluated: two types of wide-angle lens that attach to the rear window, a convex mirror mounted externally over the rear window and a basic video camera and monitor with the camera mounted on the back window. The performance of each visual aid was evaluated using the grid on the factory floor and a 600mm high test cylinder (approximately the shoulder height of a young toddler – see Figure 2b).

**Figure 2a. Example of the view to the rear from driver's seat, showing the marks on the factory wall and rear seat head restraint.**

**Figure 2b. General view of test layout showing test cylinder (600mm high) and factory wall to rear of vehicle.**

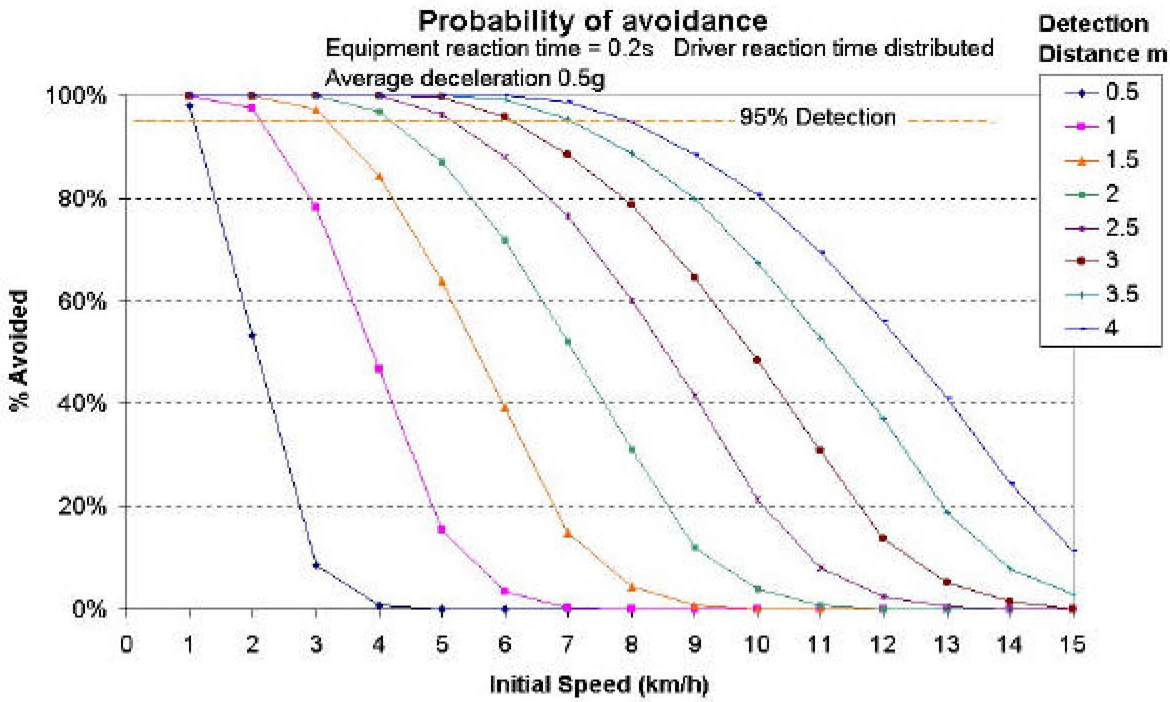


**Figure 3. Theoretical probability of collision avoidance for a range of detection distances and reversing speeds.**

e) Determining the improvement provided by these devices when fitted to motor vehicles.

For one of the test vehicles the data about rearward field of view was combined with data about the detection pattern for the best proximity sensor and the best visual aid (the video camera) to determine if all critical blind spots were covered. Figure 4 shows the results of that analysis.

## RESULTS

Very little research appears to have been done on vehicle-related countermeasures for reversing accidents. The few relevant studies relate to occupational safety in open cut mines. There is a scarcity of information about the rearward field of view from motor vehicles and methods of improving this view.

Theoretical analysis showed that, even for an alert driver, the detection distances were quite demanding. Based on 95% avoidance, a rule of thumb is that the reversing speed in km/h should be no more than twice the detection distance in metres. Therefore for a vehicle reversing at 8km/h the detection distance (at which the driver is alerted to an object in the path of the vehicle) should be no less than four metres.

Trials of a range of vehicles revealed that many have very poor visibility of critical areas at the rear of the vehicle. A test cylinder 600mm high was used to simulate a standing toddler. For the best vehicle that was tested the cylinder was only visible when at least 3 metres from the rear of the vehicle. For a popular large car it was only visible when 19 metres away. Large four-wheel-drives were no worse than some cars. Spoilers, rear seat head restraints, rear-door-mounted spare wheels and some high-mounted brake lights can greatly increase these distances.

Proximity sensors that are mainly intended as a parking aid while reversing have been touted as a child safety device but their effectiveness for this purpose is questionable. Ultrasonic and microwave devices are commercially available in Australia and range in price from US$50 to US$400, but price does not necessarily reflect performance.

Trials of proximity sensors revealed that their detection distances were between one and three metres - too short for typical driveway situations. Although, in some cases, sensitivity could be increased, this is likely to result in too many false alarms and drivers would tend to ignore the warning.

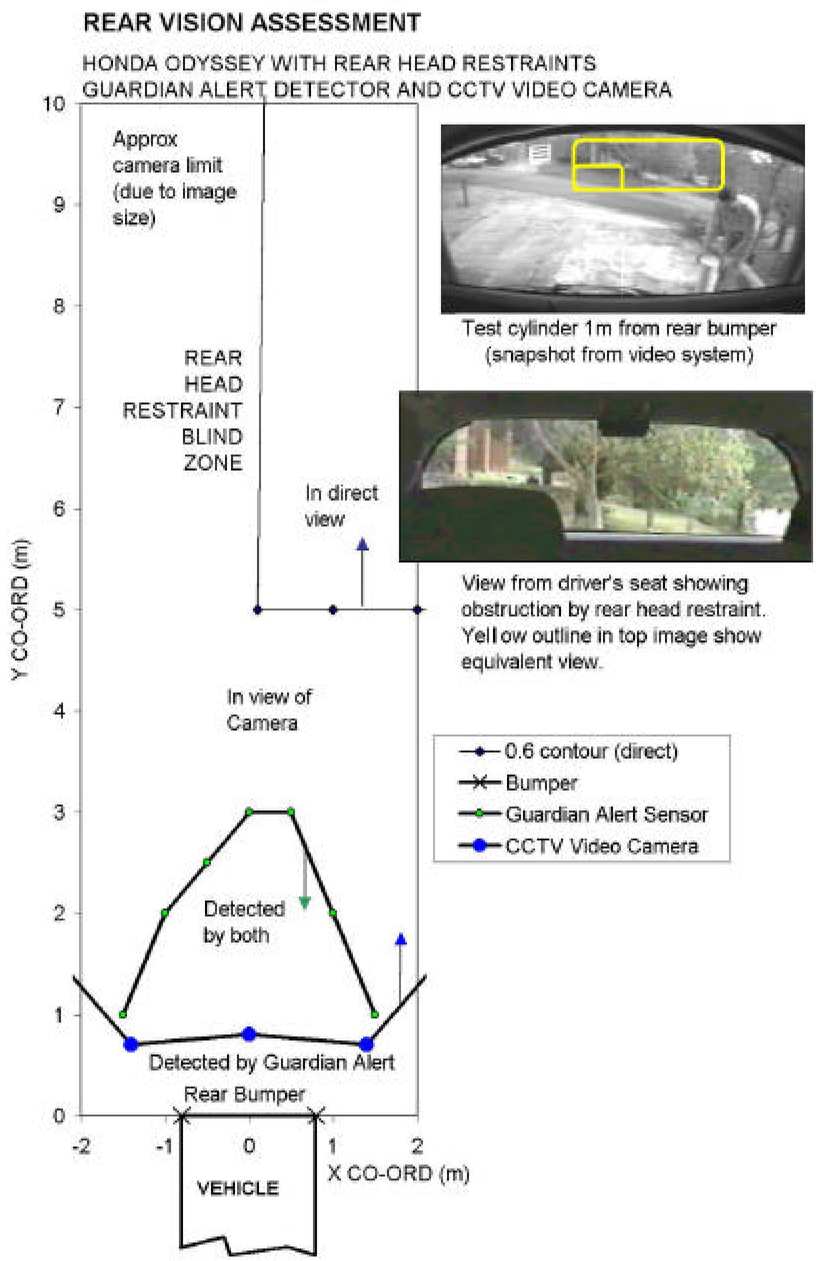


**Figure 4. Performance of a combined system (proximity sensor and video system) fitted to a passenger van.**

Trials of wide angle lenses and a convex external mirror revealed severe limitations with the field of view and quality of image. These devices are unsuitable for avoiding collisions with toddlers. However, a trial of a video camera system showed it had the potential to give the driver a good view of critical areas at the back of the vehicle.

A combined system that included a proximity sensor and a video camera would cover all critical blind spots at the rear of the vehicle.

## DISCUSSION

No complete detection system was available for evaluation at the time this work was undertaken. Potential components of such a system were evaluated separately and the results were combined to give an estimate of the performance of a complete system.

More work is needed on ergonomic aspects of the system, including the location and size of a video monitor and types of warning alarms. It is important that drivers are not overloaded with spurious information and that they heed a valid warning.

It is considered that a combined camera and proximity sensor system could be a very effective countermeasure to the problem of children being run over by vehicles reversing in private driveways. The commercial development of these systems should therefore be encouraged, subject to the development of a performance specification so that consumers could be confident that the system worked as intended. Such a system would also provide benefits in other situations when the vehicle is reversing.

Irrespective of the availability of devices on vehicles, driver and child carer education will be needed to reduce the risk of toddlers being run over. The main vehicle-related messages should be that toddlers are extremely difficult to see if they are behind a typical car or 4WD and that drivers need to be very cautious and reverse very slowly, even if proximity alarms are fitted.

Given the poor rearward field of view of popular cars it appears that poor rearward visibility is not a significant factor in the apparent over-representation of 4WD vehicles in fatal accidents (Neeman et al 2002). Other factors might be:

- the increasing popularity of 4WDs as "family" vehicles
- the increased risk of a child being crushed by the large wheels of a 4WD, compared with a car and
- the relatively poor field of view to the side due to the height of the driver, meaning that small children can approach the danger zone at the back of the vehicle without detection by the driver.

## SUBSEQUENT DEVELOPMENTS

### Technology

Since the initial evaluations were conducted several video systems have come onto the Australian market. Some are quite innovative and include the display screen built into the rear view mirror so that it only becomes visible when reverse gear is engaged (Figure 5). At other times it becomes a wide-angle mirror.

**Figure 5. Rear view mirror with built in display screen for rear view camera.**

There is a need to provide consumers with guidance about the selection of suitable products. Some proximity sensor advertisements suggest that the product, by itself, will prevent driveway accidents when this is clearly not the case with current technology.

### International developments

ISO Technical Report TR 12155 "Commercial vehicles - obstacle detection device during reversing - requirements and tests" was issued in 1994. In effect it is an international "standard" but it is confined to proximity sensors and vehicle speeds up to 5km/h. It is therefore unsuitable for cars reversing on driveways.

An ISO working group is currently working on a similar standard for cars. The convener of Working Group 14 of Technical Committee TC204, kindly provided a copy of Standardization Working Draft N308.1 "Extended Range Backing Aid Systems". However, it is considered that the draft ISO standard does not fulfil the need for the driveway safety issue. Firstly it states that "Visibility enhancement systems, such as video camera aids without distance warning, are not covered by this standard." Secondly, although it allows for proximity sensors extending out to 5m and reversing speeds up to about 10km/h it is not at all certain that any proximity sensors will be able to reliably perform at this range without too many false alarms. In particular, it does not provide for discriminating between people and inanimate objects. The draft seems to be providing for technology that does not exist yet and might not be feasible for some years. None of the proximity sensors evaluated to date would comply with the draft standard.

It was concluded that the ISO developments, while useful for some technical issues, would not provide a mechanism for providing consumers with advice about suitable systems based on existing technology. Consideration is therefore being given to publishing a suitable specification in Australia.

**IAG ASSESSMENT OF REAR VISIBILITY**

The Insurance Australia Group Rear Visibility Index was developed to quantify the degree of rear visibility available to the drivers of motor vehicles. The test procedure is both easily repeatable and standardised to enable accurate comparisons to be made between a range of vehicles. The test procedure is centred around:

i) A standard test cylinder

ii) A H-point measuring device

iii) A laser pointing device

iv) A standardised grid.

A cardboard test cylinder was constructed, which is 200mm in diameter and 600mm high. These dimensions represent the approximate shoulder height of the average 2 year-old child. It was decided to base the cylinder on the shoulder height, as this would allow the driver to discern the identity of the object behind the vehicle. The cylinder was similar to the one illustrated in Figure 2b.

The H-point measuring device utilised for the testing is based on the 50$^{th}$ percentile male and is 178 cm tall and 77 kg in weight. Figure 5 shows this device.

The laser pointing device consists of a laser pointer which is mounted on a camera tripod attachment head and bolted to the H-point machine. The head allows movement of the pointer in both the vertical and horizontal planes. The pointing device is affixed to the H-point machine so that it is approximately at eye level. This device can be seen in Figure 6.

The grid consists of 200mm by 200mm squares and is used to measure a total area of 1.8m wide by 15m long behind the vehicle being tested.

The testing procedure involves the following steps:

i) Record the vehicle's identification and specification details on the measurement sheet.

ii) Ensure all front and rear head restraints are in the fully down position.

**Figure 5. H-point Measuring Device**

iii) Position the front driver's seat in its lowest and furthest back position.

iv) Place the H-point device in the driver's seat and adjust the tilt of the seat until the back of the H-point device is at 25 degrees.

v) Attach the laser pointing device to the H-point machine.

vi) Position the grid behind the vehicle such that is centred in relation to the vehicle.

vii) Turn on the laser pointer and direct the light beam through the rear window.

viii) Place the cylinder in the grid and determine whether the laser is visible. Record the result on the

**Figure 6. Laser Pointing Device**

measurement sheet.

ix) Repeat step viii for all positions in a 1.8m by 15m grid behind the vehicle.

Once completed, these results are analysed and the vehicle's overall rating calculated. This overall rating is expressed as a "star" rating between 0 stars and 5 stars, in half star increments. The more stars a vehicle obtains, the better the visibility behind the vehicle. Figure 7 shows sample results.

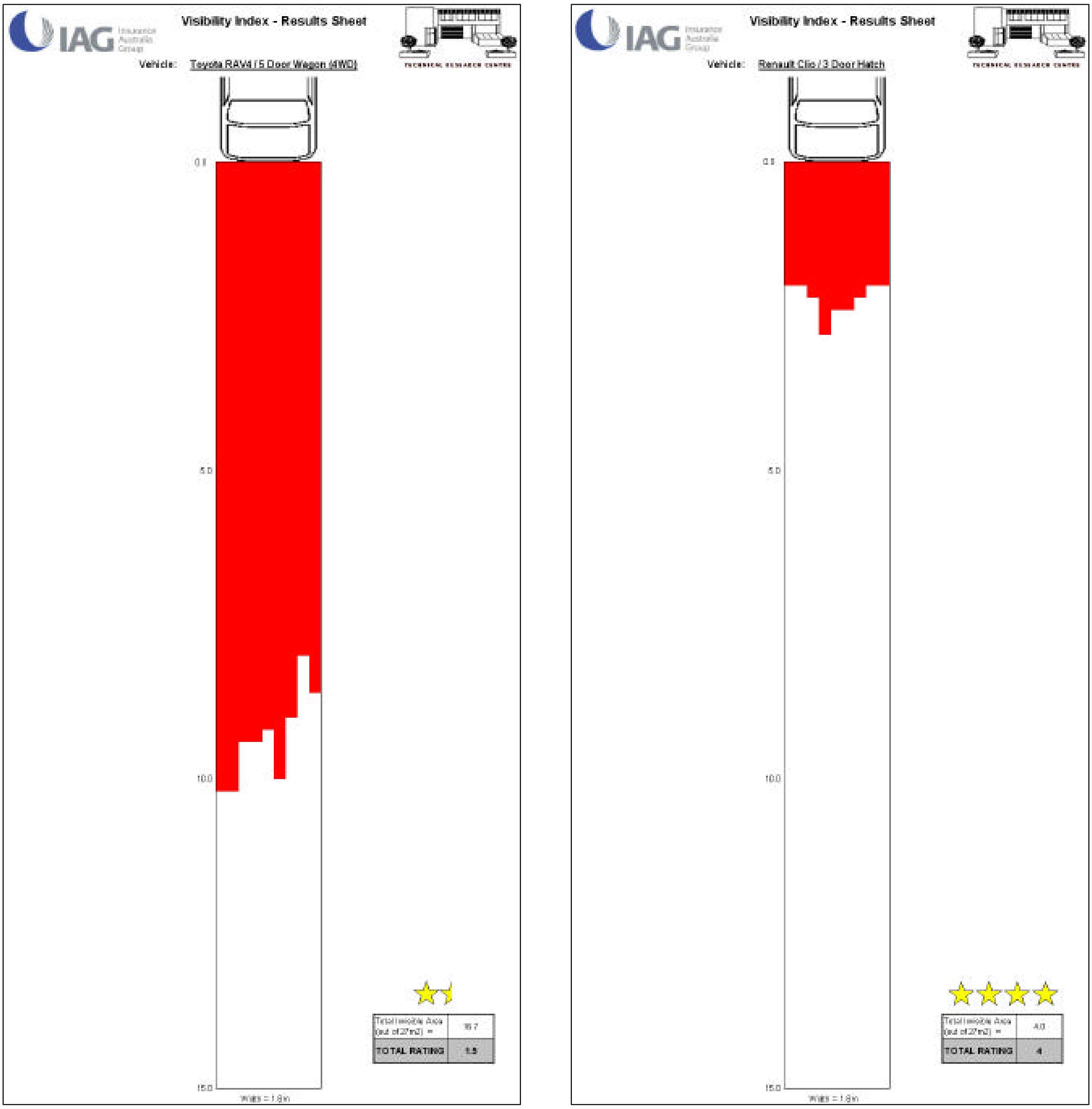


**Figure 7. Sample results of IAG assessments**

The ratings calculations take into account a number of factors including:

i) the total visible area behind the vehicle

ii) the visible distance across the rear of the vehicle

iii) the presence of reversing aids such as proximity sensors and reversing cameras.

**Results of IAG assessments**

In total, over 100 vehicles have been subjected to rear visibility testing. The results for these vehicles are set out in the Appendix. Some are illustrated in Figure 8.

**Figure 8. Demonstration of the test results. The red patterns show the area where the 600mm high cylinder would not be visible to an average male driver.**

Analysis of these results dispels the myth that rear visibility is solely a problem associated with 4WD vehicles, with some of the worst vehicles being sedans. Of the vehicles tested, the worst vehicle would not allow the driver to see a two year old child up to a distance of over 15 metres behind the vehicle. Even the best vehicle in the Insurance Australia Group study had a "blind area" of more than 2 metres behind it.

The Visibility Index highlighted that vehicle design plays a major role in the rear visibility of vehicles. Some design factors that influence the rear visibility are:

i) high rear windows

ii) high bootlid

iii) rear mounted spare tyres

iv) rear head restraints

v) rear mounted brake lights

vi) rear mounted wipers

vii) rear spoilers.

A number of parking assistance devices were also tested to determine their value in improving rear visibility. Testing found that if travelling at 5 km/h or more, the proximity sensors had limited effectiveness. This, along with their potential to produce "nuisance alarms" in situations such as narrow driveways, means proximity sensors as the only reversing aid are not a viable option to reduce reversing accidents. A more feasible system that incorporates sensors with a wide-angle video camera system could aid in reducing such accidents. However, it should be noted that there is no substitute for close parental supervision of children around reversing vehicles.

## CONCLUSIONS AND RECOMMENDATIONS

Our main conclusions are:

- Objective methods of measuring and rating the rearward field of view of vehicles have been developed
- Most cars and 4WDs have very poor rearward visibility for detecting objects the size of toddlers
- Proximity sensors (parking aids) alone cannot provide sufficient warning to drivers that a toddler is in the path of a reversing vehicle.
- A video camera system can provide the driver with a good view to the rear except, possibly, for locations very close to the back of the vehicle.
- A combination of video camera and short-range proximity sensor could cover all critical blind spots at the rear of the vehicle.
- There is no substitute for close adult supervision of children around reversing vehicles.

It is recommended that the commercial development of a combined system of proximity sensor and video camera be encouraged and that the voluntary fitting such systems be promoted. More work is needed on the ergonomic characteristics of such systems to ensure that drivers respond to appropriate warnings and that they are not overloaded with spurious information and false alarms. The outcome of our research should be taken into account in the preparation of educational material aimed at reducing child accidents on driveways.

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## APPENDIX - RESULTS OF IAG REAR VISIBILITY TESTING OF AUSTRALIAN VEHICLES

| Rank | Vehicle | Year Model | Minimum Distance to View Test Object (m) | Test Object Invisible Area - $m^2$ (out of $27m^2$) | Star Rating (out of 5) |
|---|---|---|---|---|---|
| 1 | Renault Clio Sport (3 Door Hatch) | 01/02 - | 2.0 | 4.0 | 4 |
| 2 | Holden Barina (3 Door Hatch) | 02/01 - | 2.6 | 4.8 | 4 |
| 3 | Suzuki Ignis (3 Door Hatch) | 10/00 - | 2.8 | 5.0 | 4 |
| 4 | Mazda 121 Metro (5 Door Hatch) | 10/96 - | 2.5 | 5.5 | 3.5 |
| 5 | Audi TT Roadster | 05/00 - | 3.0 | 5.8 | 3.5 |
| 6 | Toyota Echo (3 Door Hatch) | 10/99 - | 2.5 | 5.8 | 3.5 |
| 7 | MG-TF Convertible | 09/02 - | 2.9 | 6.0 | 3.5 |
| 8 | Peugeot 206 (5 Door Hatch) | 02/01 - | 2.8 | 6.1 | 3.5 |
| 9 | Kia Sportage | 10/00 - | 2.8 | 6.1 | 3.5 |
| 10 | Ford Focus (Hatch - CL) | 10/02 - | 2.9 | 6.1 | 3.5 |
| 11 | Jaguar XJ8 - (Sedan) | 10/97 - | 2.4 | 6.2 | 3.5 |
| 12 | Peugeot 206 GTi (3 Door Hatch) | 09/99 - | 2.7 | 6.4 | 3.5 |
| 13 | Volkswagen Transporter | 10/99 - | 3.6 | 6.5 | 3.5 |
| 14 | Hyundai Getz (3 Door Hatch) | 09/02 - | 3.2 | 7.0 | 3.5 |
| 15 | Mercedes. Benz SL500 – With OEM Sensors | 06/02 - | 4.9 | 7.0 | 3.5 |

| Rank | Vehicle | Year Model | Minimum Distance to View Test Object (m) | Test Object Invisible Area - $m^2$ (out of $27m^2$) | Star Rating (out of 5) |
|---|---|---|---|---|---|
| 16 | Citroen C3 (5 Door Hatch) | 12/02 - | 3.1 | 7.1 | 3.5 |
| 17 | Subaru Impreza RS (Sedan) | 10/00 - | 4.1 | 7.5 | 3.5 |
| 18 | Honda Jazz (5 Door Hatch) | 11/02 - | 3.4 | 7.6 | 3.5 |
| 19 | Holden Cruze (5 Door) | 06/02 - | 3.4 | 7.8 | 3.5 |
| 20 | Nissan Pulsar (5 Door Hatch) | 06/01 - | 4.2 | 8.0 | 3.5 |
| 21 | Nissan 350Z | 03/03 - | 4.3 | 8.2 | 3 |
| 22 | Mazda 2 (5 Door Hatch) | 12/02 - | 4.2 | 8.3 | 3 |
| 23 | Subaru Impreza WRX (Sedan) | 12/02 - | 4.7 | 8.4 | 3 |
| 24 | Subaru Forester | 06/02 - | 3.9 | 8.6 | 3 |
| 25 | Porsche 911 Carrera | 08/02 - | 4.8 | 9.2 | 3 |
| 26 | Peugeot 307 (3 Door Hatch) | 03/02 - | 4.4 | 9.2 | 3 |
| 27 | Honda Civic (5 Door Hatch) | 11/00 - | 4.4 | 9.4 | 3 |
| 28 | Mazda 323 Astina | 09/98 - | 3.6 | 9.5 | 3 |
| 29 | Ford Fairmont Ghia (Sedan) – With OEM Sensors | 10/02 - | 5.9 | 9.6 | 3 |
| 30 | Volvo V70 XC | 09/00 - | 4.3 | 9.7 | 3 |
| 31 | Toyota Corolla (Hatch) | 12/01 - | 4.6 | 10.1 | 3 |
| 32 | Toyota Corolla (Sedan) | 12/01 - | 4.9 | 10.3 | 3 |
| 33 | Mitsubishi Lancer (Sedan) | 10/98 - | 4.9 | 10.4 | 3 |
| 34 | Toyota Landcruiser (100 Series) | 03/98 - | 5.6 | 10.6 | 3 |
| 35 | Mazda Tribute | 02/01 - | 4.6 | 10.8 | 3 |
| 36 | Mercedes. S430 (Sedan) – With OEM Sensors | 04/99 - | 6.3 | 11.3 | 3 |
| 37 | Mercedes A160 (5 Door Hatch) | 07/01 - | 3.0 | 9.2 | 2.5 |
| 38 | VW Polo (3 Door Hatch) | 06/02 - | 5.2 | 10.8 | 2.5 |
| 39 | Nissan X-Trail | 10/01 - | 6.1 | 10.9 | 2.5 |
| 40 | Toyota Hiace | 01/97 - | 6.2 | 11.1 | 2.5 |
| 41 | Toyota Hilux SR5 | 10/02 - | 6.1 | 11.2 | 2.5 |
| 42 | Mazda Bravo Freestyle | 11/02 - | 6.2 | 11.2 | 2.5 |
| 43 | Ford Falcon AU (Wagon) | 09/98 - 10/02 | 6.5 | 11.6 | 2.5 |
| 44 | Holden Rodeo (4X2 Crew Cab) | 12/95 - | 6.5 | 11.6 | 2.5 |
| 45 | Ford Courier | 11/02 - | 6.7 | 12.1 | 2.5 |
| 46 | Subaru Outback H6 (Wagon) | 10/98 - | 6.3 | 12.7 | 2.5 |
| 47 | Hyundai Santa Fe | 01/01 - | 6.5 | 12.7 | 2.5 |
| 48 | Ford Falcon BA (Sedan) | 10/02 - | 6.4 | 12.9 | 2.5 |
| 49 | Holden Astra (5 Door Hatch) | 09/98 - | 6.8 | 13.2 | 2.5 |
| 50 | Kia Rio | 07/00 - | 6.3 | 13.2 | 2.5 |
| 51 | VW Caravelle (1991) | 01/91 - 10/97 | 7.2 | 13.6 | 2.5 |
| 52 | Hyundai Terracan | 11/01 - | 7.4 | 13.9 | 2.5 |
| 53 | Toyota Hilux (4X2 Cab Chassis) | 11/97 - | 7.8 | 14.1 | 2.5 |
| 54 | Saab 95 (Sedan) | 10/02 - | 7.9 | 14.1 | 2.5 |
| 55 | Saab 93 2.0t – With OEM Sensors | 11/02 - | 9.2 | 16.8 | 2.5 |
| 56 | Ford Transit Van | 01/97 - | 4.1 | 12.4 | 2 |
| 57 | Daewoo Tacuma | 11/00 - | 4.6 | 12.5 | 2 |
| 58 | Hyundai Trajet | 07/00 - | 5.6 | 13.1 | 2 |
| 59 | Range Rover | 08/02 - | 5.0 | 14.0 | 2 |
| 60 | Honda CR-V (Previous Model) | 09/97 - 11/01 | 5.3 | 14.2 | 2 |
| 61 | Ford Falcon AU2 (Sedan) | 09/98 - 08/02 | 5.9 | 14.3 | 2 |

| Rank | Vehicle | Year Model | Minimum Distance to View Test Object (m) | Test Object Invisible Area - $m^2$ (out of $27m^2$) | Star Rating (out of 5) |
|---|---|---|---|---|---|
| 62 | Toyota Landcruiser (80 Series) | 01/93 - 02/98 | 7.9 | 15.1 | 2 |
| 63 | Toyota Camry (2000 - Sedan) | 08/97 - 09/02 | 7.7 | 15.4 | 2 |
| 64 | Holden Vectra (Sedan) | 08/99 - | 8.3 | 16.6 | 2 |
| 65 | Holden Commodore Ute (VU) | 12/00 - | 9.3 | 16.7 | 2 |
| 66 | Mitsubsihi Magna (Sedan) | 08/00 - | 9.7 | 17.5 | 2 |
| 67 | Subaru Liberty GX (Sedan) | 03/99 - | 5.1 | 15.3 | 1.5 |
| 68 | Nissan Pulsar (Sedan) | 06/00 - | 6.7 | 15.7 | 1.5 |
| 69 | VW Caravelle (2002) | 11/97 - | 5.8 | 16.0 | 1.5 |
| 70 | Toyota Camry (2002 - No Spoiler) | 09/02 - | 6.7 | 16.1 | 1.5 |
| 71 | Toyota RAV4 (5 Door) | 06/00 - | 7.9 | 16.7 | 1.5 |
| 72 | Subaru Liberty RX (Sedan) | 03/99 - | 5.2 | 16.7 | 1.5 |
| 73 | Mazda Premacy | 02/01 - | 4.6 | 17.1 | 1.5 |
| 74 | VW Golf (5 Door Hatch) | 10/98 - | 4.0 | 17.1 | 1.5 |
| 75 | Ford Focus (Sedan - Ghia) | 10/02 - | 9.8 | 18.2 | 1.5 |
| 76 | Jaguar S-Type R (Sedan) – With OEM Sensors | 11/00 - | 7.7 | 18.8 | 1.5 |
| 77 | Mercedes C-Class (Sedan) | 08/01 - | 10.6 | 19.0 | 1.5 |
| 78 | Holden Commodore VY (Sedan) | 09/02 - | 11.5 | 21.2 | 1.5 |
| 79 | Toyota Camry (2002 - Spoiler) | 09/02 - | 11.8 | 21.3 | 1.5 |
| 80 | Toyota Tarago | 06/00 - | 9.0 | 18.1 | 1 |
| 81 | BMW 320i Wagon | 06/02 - | 4.9 | 18.1 | 1 |
| 82 | Audi Allroad | 02/01 - | 6.1 | 18.4 | 1 |
| 83 | Honda Odyssey | 03/00 - | 5.5 | 18.5 | 1 |
| 84 | Hyundai Accent (3 Door Hatch) | 06/00 - | 7.2 | 18.8 | 1 |
| 85 | Toyota RAV4 (3 Door) | 06/00 - | 5.5 | 18.8 | 1 |
| 86 | BMW X5 (3.0L) | 10/00 - | 10.2 | 19.9 | 1 |
| 87 | Audi A4 Avant (5 Door Wagon) | 09/02 - | 8.9 | 20.0 | 1 |
| 88 | Nissan Patrol | 04/00 - | 6.4 | 20.1 | 1 |
| 89 | Toyota Avensis | 12/01 - | 8.5 | 20.7 | 1 |
| 90 | Kia Carnival | 09/99 - | 9.3 | 20.7 | 1 |
| 91 | Holden Commodore (VS ute) | 03/95 - 12/00 | 10.5 | 20.8 | 1 |
| 92 | Mazda 6 (Sedan) | 09/02 - | 10.3 | 21.5 | 1 |
| 93 | VW Passat | 05/01 - | 7.5 | 21.6 | 1 |
| 94 | Holden Commodore Ute (VY - SS) | 10/02 - | 12.6 | 22.7 | 1 |
| 95 | Ford Explorer | 11/01 - | 10.8 | 22.8 | 0.5 |
| 96 | Hyundai Elantra (5 Door Hatch) | 10/00 - | 10.6 | 22.9 | 0.5 |
| 97 | Honda CR-V (Current Model) | 12/01 - | 9.6 | 23.5 | 0.5 |
| 98 | BMW 325ti (3 Door Coupe) | 02/02 - | 12.6 | 23.9 | 0.5 |
| 99 | Holden Combo | 09/02 - | 12.2 | 25.0 | 0.5 |
| 100 | Holden Commodore (VX Wagon) | 09/97 - 09/02 | 13.2 | 25.1 | 0.5 |
| 101 | Mitsubishi Pajero | 05/02 - | 11.1 | 25.4 | 0.5 |
| 102 | Mazda MPV | 08/99 - | 13.7 | 26.4 | 0.5 |
| 103 | Holden Commodore (VX Sedan) | 09/97 - 09/02 | 16.8 | 27.0 | 0 |
| 104 | Land Rover Discovery | 02/02 - | 20.9 | 27.0 | 0 |
| 105 | Toyota Prado | 06/96 - | 15.6 | 27.0 | 0 |