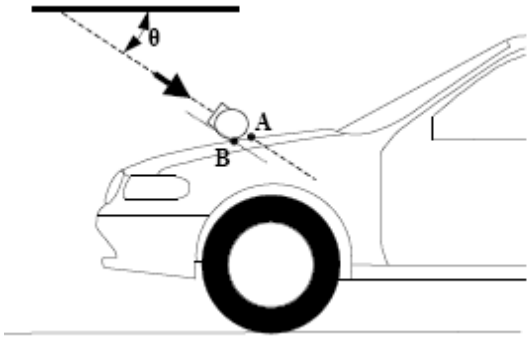
Australian Government

Department of Infrastructure and Transport

Regulation Impact Statement

for

Pedestrian Safety



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ABSTRACT

In Australia, during the period of 2000 to 2009, an average of 232 pedestrians and 31 cyclists were killed each year as a result of collisions with vehicles. There have been a number of approaches to reducing the cost to the community of these crashes. However, the problem remains a long running one throughout the world.

Research has shown that modifications to the design of vehicle fronts can increase the chance of a vulnerable road user, such as a pedestrian or a cyclist, surviving a collision.

The Australian vehicle market has responded to the problem of pedestrian trauma by developing measures for pedestrian protection. However, manufacturers and importers in Australia have indicated that there is no overall plan for the future in this regard. In addition, as the measures reduce road trauma for pedestrians, there is little incentive for a vehicle owner to demand pedestrian friendly designs from the vehicle manufacturer. There are currently no vehicle regulations in Australia dealing explicitly with the safety of vulnerable road users such as pedestrians or cyclists.

This Regulation Impact Statement (RIS) examined the case for Australian Government intervention aimed at improving the pedestrian safety performance of the Australian new vehicle fleet. A total of six options, including both regulatory and non-regulatory options, were identified to address the problem. It was recommended that a mandatory standard, known as an Australian Design Rule (ADR) under the *Motor Vehicle Standards Act 1989 (Cwth)* (MVSA) be implemented. This would result in net benefits and a number of lives saved of $185m and 65 respectively, as well as over 3,000 serious injuries saved, assuming that the standard was active for fifteen years.

The recommended standard to be applied was the internationally accepted Global Technical Regulation (GTR) No. 9 Pedestrian Safety, as adopted by the United Nations (UN) through the UN Economic Commission for Europe (UNECE) regulations. The standard would be applied to the Australian vehicle categories of MA (passenger cars), MB (passenger vans), MC (four-wheel drives or Sports Utility Vehicles) and NA (light commercial vehicles) over a phase-in period of 2013 to 2019, depending on the vehicle mass and whether the vehicle was a new model or ongoing model. “Flat fronted” vehicles would be exempted.

Compliance with pedestrian safety requirements would in all certainty be affected by the practice of fitting aftermarket Vehicle Front Protection Systems (VFPS) (known as “bull bars”) to vehicles. Although this comes under state and territory legislation rather than Commonwealth legislation, it was proposed that the fitting of VFPS to new vehicles could be accommodated through the ADRs. Stringent requirements based on European Union Directive 2005/66/EC would be placed on VFPS fitted to passenger cars and two-wheel drive light commercial vehicles. Adjustments based on compliance to part or all of Australian Standard AS 4876.1 for VFPS (bull bars) would be applied to vehicles purposely designed for off-road use i.e. Sport Utility Vehicles and light commercial vehicles with four-wheel drive. The implementation timing would match that of the base vehicle, the intention being to maintain the pedestrian safety performance of the base vehicle, rather than set requirements for VFPS alone.

As part of the RIS process, the proposal will be circulated for 60 days public comment. The Federal Minister for Infrastructure and Transport may subsequently choose to determine an ADR under section 7 of the MVSA.

CONTENTS

ABSTRACT.....3
EXECUTIVE SUMMARY 5
1. STATEMENT OF THE PROBLEM.....8
2. THE EXTENT OF THE PROBLEM 11
3. WHY GOVERNMENT INTERVENTION MAY BE NEEDED.....13
4. EXISTING REGULATIONS.....17
5. OPTIONS.....17
6. DISCUSSION OF THE OPTIONS.....18
7. ECONOMIC ASPECTS - BENEFIT-COST ANALYSIS 27
8. ECONOMIC ASPECTS - IMPACT ANALYSIS.....43
9. DISCUSSION.....49
10. CONSULTATION.....56
11. CONCLUSION AND RECOMMENDED OPTION.....58
12. IMPLEMENTATION AND REVIEW.....59
13. REFERENCES 60
Appendix 1 - Vehicle Categories .....**Error! Bookmark not defined.**
Appendix 2 - Effectiveness of Pedestrian Safety Measures**Error! Bookmark not defined.**
Appendix 3 - Awareness and Advertising Campaigns**Error! Bookmark not defined.**
Appendix 4 - Overview of Global Technical Regulation No. 9**Error! Bookmark not defined.**
Appendix 5 - Costs of Meeting Global Technical Regulation No. 9**Error! Bookmark not defined.**
Appendix 6 - Typical Costs for Regulation Compliance in Australia**Error! Bookmark not defined.**
Appendix 7 - Benefit-Cost Analysis – Methodology**Error! Bookmark not defined.**
Appendix 8 - Benefit-Cost Analysis – Details of Results**Error! Bookmark not defined.**
Appendix 9 - Benefit- Cost Analysis – Sensitivities**Error! Bookmark not defined.**
Appendix 10 - Benefit- Cost Analysis – Assumptions**Error! Bookmark not defined.**
Appendix 11 - Vehicle Front Protection Systems**Error! Bookmark not defined.**
Appendix 12 - Technical Liaison Group (TLG)**Error! Bookmark not defined.**
Appendix 13 - Acronyms.....**Error! Bookmark not defined.**

EXECUTIVE SUMMARY

Between 2000 and 2009, an average of 232 pedestrians and 31 cyclists were killed each year in Australia as a result of a collision with a vehicle. Serious injuries averaged at 2732 for pedestrians and approximately 960 for cyclists each year over the period 2000 to 2007.

There have been a number of approaches to reducing the cost to the community of these crashes. Most of these have aimed at preventing crashes from occurring through the use of education programs, punitive measures and infrastructure improvements. Although they have met with some success, the problem remains a long running one throughout the world.

Research has shown that modifying the design of the front structure of a vehicle could increase the chance of a vulnerable road user, such as a pedestrian or a cyclist, surviving a collision with a vehicle. Europe and Japan have introduced mandatory standards which specify a minimum level of performance in a series of pedestrian impact tests.

The current voluntary fitment rate of passive pedestrian safety measures in the Australian vehicle market was estimated at 26 per cent for passenger cars and Sports Utility Vehicles (SUVs) and zero per cent for Light Commercial Vehicles (LCVs). Although the Australian vehicle market has responded to the problem by developing some of these measures, it may be for the most part a response to the European and Japanese regulation. Vehicle manufacturers in Australia have indicated that they have no overall plan for improving pedestrian safety into the future.

An international standard, Global Technical Regulation (GTR) No. 9 Pedestrian Safety, GTR 9, was adopted by the United Nations in November 2008. Australia, along with other signatory countries under the *Agreement Concerning the Establishing of Global Technical Regulations for Wheeled Vehicles Equipment and Parts which can be Fitted and/or be Used on Wheeled Vehicles* of June 1998, is obliged to review the case for adopting GTR 9 under its domestic legislation.

Australia is considering applying GTR 9 to the Australian vehicle categories of MA (passenger cars), MB (passenger vans), MC (four-wheel drives or Sports Utility Vehicles) and NA (light commercial vehicles). These categories are a subset of the categories covered by GTR 9 and are the same as the corresponding United Nations Economic Commission for Europe (UNECE) regulation. In addition, and in line with GTR 9 and the UNECE regulation, it is not proposed to apply the requirements to “flat fronted” vehicles of category NA as well as “flat fronted” vehicles of category MA, MB and MC that are above 2,500 kg and which are derived from NA category vehicles.

Alternatives to mandating GTR 9 include: no action (business as usual), adopting a user information campaign, requiring government fleets to purchase GTR 9 compliant vehicles, introducing a voluntary or mandatory code of practice for vehicle suppliers, and mandating a standard under the Trade Practices Act. Of these options, business as usual, a user information campaign and a fleet purchasing requirement were considered feasible and examined in more detail.

The voluntary fitment rate for the business as usual case started at 26 per cent for passenger cars and SUVs and zero per cent for LCVs, reaching levels of 60 per cent and 39 per cent respectively by 2018. The expected effectiveness of the other options was: 45 per cent (for a user information campaign), 41 per cent (for fleet purchasing policies – cars and SUVs), 50 per cent (for fleet purchasing policies – LCVs) and 100 per cent (for mandating GTR 9).

A summary of the benefits, costs, Benefit-Cost Ratios and number of lives saved is shown below.

Summary of Net Benefits, Total Benefits, Costs, Benefit-Cost Ratios and Lives Saved under various scenarios

	Net Benefits ($m)			**Total Benefits ($m)**		
	Best Case	Likely Case	Worst Case	Best Case	Likely Case	Worst Case
Option 1 No intervention	-	-	-	-	-	-
Option 2 Information campaigns	33	18	3	81	81	81
Option 3 Fleet policies	202	155	107	262	262	262
Option 6 Regulation	248	185	122	347	347	347

	Costs ($m)			**Benefit-Cost Ratio**		
	Best Case	Likely Case	Worst Case	Best Case	Likely Case	Worst Case
Option 1 No intervention	-	-	-	-	-	-
Option 2 Information campaigns	49	64	78	1.7	1.4	1.0
Option 3 Fleet policies	60	108	155	4.4	3.0	1.7
Option 6 Regulation	99	162	225	3.5	2.5	1.5

	Lives Saved		
	Best Case	Likely Case	Worst Case
Option 1 No intervention	-	-	-
Option 2 Information campaigns	8	8	8
Option 3 Fleet policies	29	29	29
Option 6 Regulation	65	65	65

Best Case - minimum costs; Likely Case - average costs; Worst Case - maximum costs

Option 6: Mandating GTR 9 in Australia gave the highest net benefits and number of lives saved at $185m and 65 respectively, as well as over 3,000 serious injuries saved, over a forty six year period of analysis (assuming that the standard was active for fifteen years within this period). This was under the assumption that the final voluntary level of take-up of pedestrian safety measures by the vehicle manufacturers would otherwise reach 60 per cent for passenger cars and SUVs and 39 per cent for LCVs (for those vehicles required to meet pedestrian safety regulations by 2018).

A sensitivity analysis was undertaken for Option 6: Mandating GTR 9 in Australia and was conducted on three variables: the effectiveness of pedestrian safety measures; the voluntary take-up rate of pedestrian safety measures; and the discount rate. The net benefits from Option 6 remained positive under all but one of the scenarios tested. However, this scenario was highly unlikely and the net benefits were only slightly negative.

It is proposed to recommend that Global Technical Regulation (GTR) No. 9 Pedestrian Safety, as adopted by the UN through the United Nations Economic Commission for Europe (UNECE) regulations be mandated in Australia and applied to the Australian vehicle categories of MA (passenger cars), MB (passenger vans), MC (four-wheel drives or Sports Utility Vehicles) and NA (light commercial vehicles). In line with GTR 9 and the UNECE regulation, the requirements would not apply to "flat fronted" vehicles of category NA as well as "flat fronted" vehicles of category MA, MB and MC that are above 2,500 kg and which are derived from NA category vehicles.

For vehicles of category MA, MB and MC not exceeding 2,500 kg and vehicles of category NA derived from them, the requirements should apply to new vehicle models as of 24 February 2013 and all new vehicles as of 24 February 2018. A longer lead-time should be allowed for vehicles of category MA, MB and MC exceeding 2,500 kg and category NA other than those mentioned above. In this case, requirements should apply to new vehicles models from 24 February 2015 and all new vehicles from 24 August 2019. The timing chosen by the UNECE would accommodate the relatively long lead time needed to redesign the front structure of the current models, or to supersede the current models where necessary.

Compliance with pedestrian safety requirements would in all certainty be affected by the practice of fitting Vehicle Front Protection Systems (VFPS) (known as "bull bars") to vehicles. An analysis of this potential impact was discussed separately to the recommendation for the compliance of vehicles, as it mainly involved the fitting of aftermarket products which in turn come under state and territory legislation rather than Commonwealth legislation. The results generally showed that it is likely that there would still be net benefits gained by regulation of the base vehicles, regardless of whether compliance of VFPS to pedestrian safety requirements was also mandated.

Nevertheless, it is proposed that through the ADRs, the fitting of a VFPS could be considered in terms of whether the base vehicle has been designed for off-road operation and hence primarily rural/outback use. Adjustments for VFPS could be limited to vehicles purposely designed for off-road use (Sport Utility Vehicles (MC) and light commercial vehicles (NA) with four-wheel drive), with other vehicles (passenger cars (MA) and two-wheel drive light commercial vehicles (NA)) required to meet more stringent requirements, most likely achieved by owners fitting a deformable polymer VFPS or a nudge bar. These requirements would be similar to European Union (EU) Directive 2005/66/EC that directly addresses the pedestrian performance of VFPS and complements the requirements of the GTR. The adjustments to these requirements would involve adopting some or all parts of Australian Standard for VFPS (bull bars) AS 4876.1 2002. Motor Vehicle Frontal Protection Systems. Part 1: Road User Protection, Sections 1, 2 , 3.1 and 3.2. The implementation timing would be the same as that of the base vehicle, the intention being to maintain the pedestrian safety performance of the base vehicle, rather than set requirements for VFPS alone.

As part of the RIS process, the proposal will be circulated for 60 days public comment. The Department has already sought views, through the established ADR consultative forums, from the state and territory transport authorities regarding pedestrian protection and again separately regarding VFPS and any comment has been considered when writing this RIS. However, it is expected that a majority of the information and views will follow during the public comment period. A summary of public comment input and departmental responses will be included in the final RIS that is used for decision making.

1. STATEMENT OF THE PROBLEM

1.1. Introduction

The impact of road crashes on society is significant. Individuals injured in crashes must deal with pain and suffering, medical costs, wage loss, higher insurance premium rates, and vehicle repair costs. For society as a whole, road crashes result in enormous costs in terms of lost productivity and property damage. The cost to the Australian economy has been conservatively estimated to be at least $18 billion per annum (Australian Transport Council, 2008). This translates to an average of $805 for every person in Australia. The cost is borne widely by the general public, business, and government. It has a further impact on the wellbeing of families that is not possible to measure.

While the majority of pedestrian injuries in the road environment are not vehicle related (Frith and Thomas, 2010), around the world vulnerable road users such as pedestrians and cyclists make up between 13 and 45 per cent of all road related fatalities where a vehicle is involved. Within Australia, which has one of the lowest rates at around14 per cent, this still represents over 200 fatalities per year (Bosch, 2008).

There have been a number of approaches employed to reduce the cost to the community of crashes between vehicles and pedestrians. These have for the most part utilised initiatives to avoid the crashes from occurring, such as education programs, punitive measures and infrastructure improvements. These approaches have met with some success but the problem remains a long running one.

Over the past few decades research conducted in the area of vehicle safety and safety standards has been limited to improving the protection of vehicle occupants. More recently, it has now also started to consider the protection of vulnerable road users through changes to the design of vehicles. It has been shown that modifications to the design of vehicle fronts can increase the chance of a vulnerable road user such as a pedestrian or a cyclist surviving a collision with a vehicle. Some countries are now beginning to mandate a minimum level of pedestrian protection in new models of passenger vehicles. In Australia, there are currently no regulations dealing explicitly with vulnerable road user safety.

This Regulation Impact Statement (RIS) examines whether there is a need for Australian Government intervention, to be aimed at the new vehicle fleet, in order to reduce the number of fatalities and injuries sustained in collisions between vehicles and vulnerable road users such as pedestrians and cyclists.

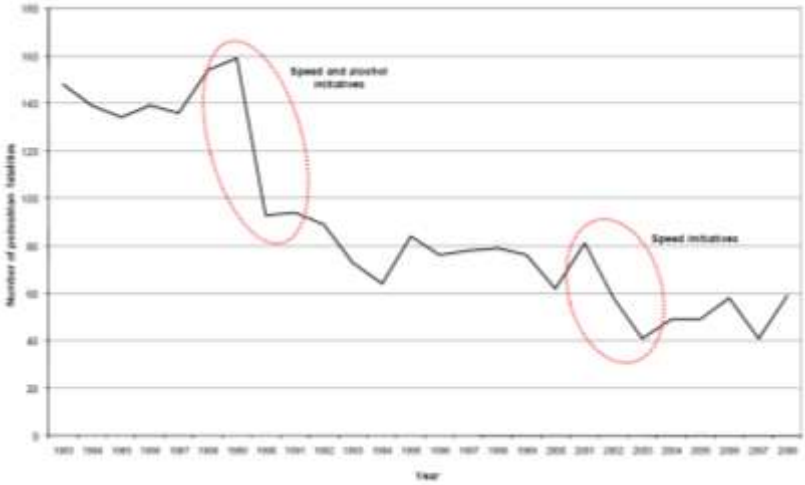
1.2. Background

Crashes that involve vulnerable road users such as pedestrians and cyclists represent a major road safety problem world-wide (Devlin et al, 2010). As already noted, between 13 and 48 per cent (14 per cent in Australia) of all road related fatalities in the world where a vehicle is involved impacts on this road user group. There is some evidence that vehicle drivers are largely to blame when collisions occur, at least with cyclists (Weston, 2010).

The most vulnerable subgroups of pedestrians continue to be: children, the elderly and the intoxicated, with the contributory risk factors varying between these three high risk pedestrian groups (Devlin et al, 2010).

In Australia, there have been some successes in reducing this number, for example the state of Victoria's two major speed (and alcohol) initiatives in 1990 and 2003 as shown in Figure 1. Educational, awareness and behaviour change programs are seen as vital to the success of improving pedestrian safe mobility, although very few programs have been developed for the purposes of educating adults about alcohol impairment and its effect on pedestrian safety (Devlin et al, 2010). Geometric countermeasures are also seen as important. This includes the separating where possible traffic and pedestrian flows.

Figure 1 Number of pedestrian fatalities from 1983 to 2008 in Victoria



Source: Devlin et al, 2010

However, it has been reported that the general trend for pedestrian deaths appears to be on the incline again in Victoria (Devlin et al, 2010) and this can also be seen in Figure 1. Given that walking, as an active transport mode, is being encouraged by both the Australian and New Zealand Governments as part of a push towards safe sustainable transport (Frith and Thomas, 2010) the problem is "likely to grow if initiatives that promote walking and public transport use are successful in increasing the amount of walking without concurrent improvements in road safety initiatives" (Devlin et al, 2010). It could therefore be expected that the problem will increase further, not only given the increase in the activity of vulnerable road users but also the increase in vehicle ownership predicted to occur over the coming years.

The National Road Safety Strategy sets out Australia's objectives, targets and priorities for road safety improvements. Using what is known as the Safe System approach, this "reflects international best practice as defined in the Organisation of Economic Cooperation and Development's landmark 2008 report *Towards Zero: Ambitious Road Safety Targets and the Safe System Approach*. This report was prepared with substantial involvement of Australian road safety officials and practitioners." (National Road Safety Council, 2010).

The Safe System approach was officially endorsed by the Australian Transport Council in 2004. It has guided the development of subsequent National Road Safety Action Plans and will underpin the development of the National Road Safety Strategy for 2011 to 2020

The approach is structured around four essential elements:

1. safe roads
2. safe vehicles
3. safe speeds
4. safe road users.

The Safe System approach is focused on making the road transport system more forgiving of human error. In designing and managing roads, vehicles and travel speeds, the aim is to reduce crash risk and ensure that road users can withstand the physical forces generated in crashes (National Road Safety Council, 2010). In a recent Austroads paper, it was argued that the approach of emphasizing behavioural interventions needs to be further complemented by the other factors (particularly vehicle and road countermeasures) and that " direct behavioural strategies, certainly relative to road improvement programs, have a more modest role to play in achieving further road toll reductions" (Langford, 2005).

When it comes to pedestrian safety and vehicle design, there are two primary means of improving the safety of a vehicle. The first involves the use of active safety systems, such as those for braking and lighting, which assist the driver in preventing a crash. The second involves the use of passive safety systems, such as seatbelts and supplemental restraints which provide protection should a crash occur.

The most common type of collision between a pedestrian and a vehicle involves the pedestrian being struck by the front of the vehicle. The first point of contact is generally between the vehicle bumper and the leg. This is usually followed by the hip striking the edge of the bonnet, and then the head and chest striking the vehicle bonnet or windscreen. Consequently, many injuries that result from collisions between vehicles and pedestrians are inflicted by the frontal structures of vehicles.

This RIS examines passive safety measures to reduce the injury potential of the frontal structures of vehicles such as bumpers and bonnets. By modifying these structures, the energy transmitted to a pedestrian upon impact may be able to be reduced, thereby reducing the level of injury.

Pedestrian safety of vehicles is already being regulated in some overseas markets. In November 2003, the European Council introduced Directive 2003/102/EC, requiring that, from 1 October 2005, all new types of passenger vehicles sold in Europe meet a specified level of performance in what are known as headform and legform impact tests. These tests utilise instrumented head and leg shapes to replicate the forces on the human body when colliding with a vehicle. In Japan, all new models of passenger vehicles introduced after 1 September 2005 must comply with pedestrian headform

impact performance requirements. However, there are currently no legform requirements.

Following the Directive, the United Nations Economic Commission for Europe (UNECE) established a new Global Technical Regulation (GTR) 9 on pedestrian safety in November 2008. This regulation is open for adoption by contracting parties (which includes Australia) under the international *Agreement Concerning the Establishing of Global Technical Regulations for Wheeled Vehicles Equipment and Parts which can be Fitted and/or be Used on Wheeled Vehicles* of June 1998 (the 1998 Agreement). In addition, as a contracting party to the 1998 Agreement, Australia is obliged to consider the case for adopting GTR 9 as its national standard for pedestrian safety.

A second, more stringent phase of the Directive was due to be introduced in 2011. However, after the establishment of the GTR, Regulation EC 78/2009 was instead put in place. This regulation has been phased in from November 2009, repealing the original Directive 2003/102/EC and aligning the passive safety requirements with those of the GTR.

The UNECE is currently working towards adopting GTR 9 on pedestrian safety as a full UNECE regulation under the *Agreement concerning the Adoption of Uniform Conditions of Approval and Reciprocal Recognition of Approval for Motor Vehicle Equipment and Parts* of March 1958 (the 1958 Agreement). Australia is also contracting party to the 1958 agreement for developing UNECE regulations (separately to the 1998 Agreement for developing the GTRs). The (currently draft) UNECE regulation reflects most of the requirements of the GTR but has a narrower scope of vehicles that it applies to. It also adds implementation timing, something that the GTR does not contain in its role as template legislation.

Given the enduring problem of crashes between vehicles and vulnerable road users, despite the best efforts to date of governments around the world, there is still much to be achieved. The problem can only be expected to get worse as populations increase and there is a further push towards sustainable transport, leading to higher percentages of pedestrians interacting with vehicles. In not considering vehicle countermeasures such as GTR 9, the opportunity to reverse this trend could be lost.

As with any vehicle safety initiative in Australia, there are a number of options that need to be examined when considering Government intervention. These include both non-regulatory and/or regulatory means such as the use of market forces, manufacturers' commitments, codes of practice, public education campaigns, fleet purchasing policies and regulation through the Australian Design Rules (ADRs).

2. THE EXTENT OF THE PROBLEM

Over the past ten years, on average, 232 pedestrians were killed in collisions with vehicles each year (Department of Infrastructure, Transport, Regional Development and Local Government, 2009). During this same period, an average of 2732 pedestrians were seriously injured each year (Henley and Harrison, 2009). In 2009, pedestrian fatalities accounted for approximately 14 per cent of all fatalities on the roads. Table 1 shows the breakdown of vehicle types involved in fatal road crashes in Australia for the

period of 1999 to 2001. The percentages shown remain current to 2009. It can be seen that 78 per cent of fatal pedestrian crashes involve either passenger cars, Forward Control Vans (FCVs), four-wheel drives (4WDs or Sports Utility Vehicles (SUVs)), including some Light Commercial Vehicles (LCVs). Under the ADRs, these vehicles are classed as MA, MB, MC and NA categories. Refer to **Error! Reference source not found.** for details on ADR categories.

Table 1 Vehicles involved in fatal road crashes, by crash type: 1999 to 2001

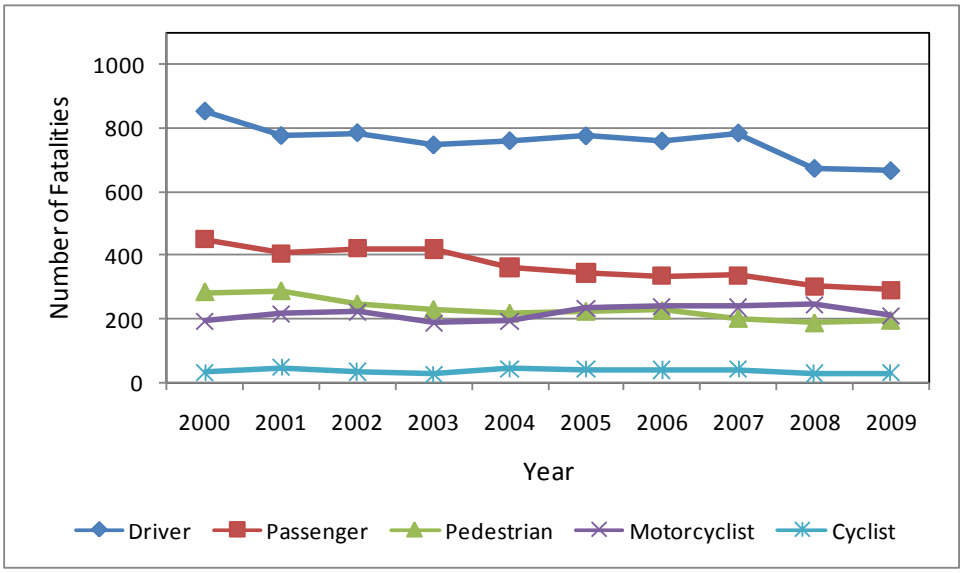
	Single Vehicle		**Multiple Vehicle**		**Pedestrian**	
Car	1122	71%	2021	62%	547	67%
4WD & FCV	273	17%	372	11%	89	11%
Bus	5	0%	45	1%	29	4%
Rigid truck	122	8%	475	15%	102	13%
Art. Truck	61	4%	354	11%	45	6%
Total	1583	100%	3267	100%	812	100%

Source: DITRDLG Australian Road Deaths Database

A review of fatal pedestrian crashes in South Australia reported that in 84 per cent of fatal pedestrian crashes the pedestrian was struck by the front of the vehicle (Anderson, 2008). Because passive pedestrian safety measures are targeted at vehicle fronts, 84 per cent of the above pedestrian crashes could therefore potentially be influenced by the implementation of passive pedestrian safety measures.

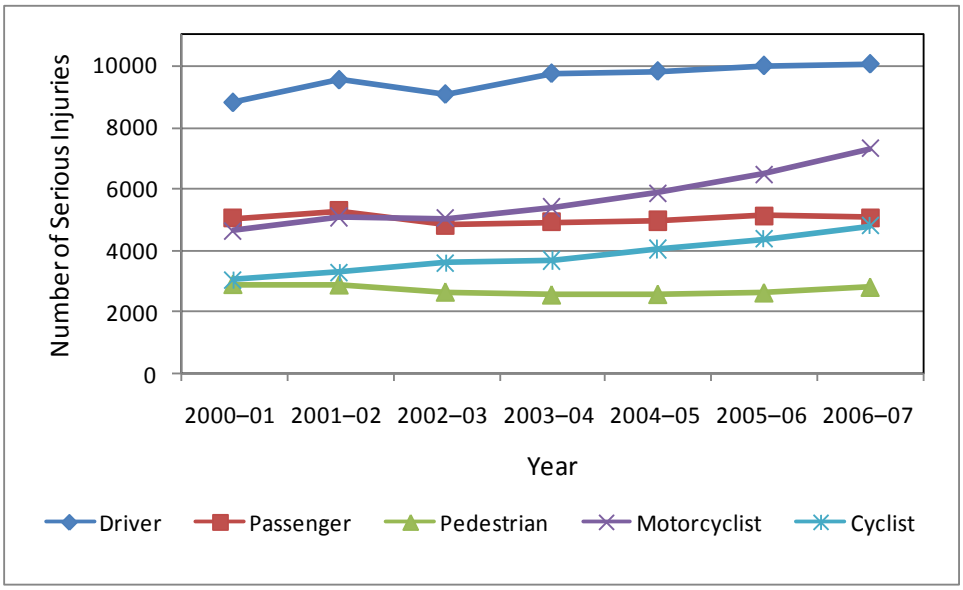
The number of pedestrian fatalities and serious injuries in Australia during the period of 1999 to 2009 are shown in Figure 2 and
Figure 3 respectively. The typical ratio of serious injuries to fatalities of pedestrians in crashes can be seen by comparing these two figures. There were approximately 11 serious injuries for each fatality.

Figure 2 Road deaths by road user, Australia: 2000 to 2009



Source: DITRDLG Australian Road Deaths Database

Figure 3 Serious injuries by road user, Australia: 2000 to 2006



Source: Henley and Harrison, 2009

National data could not be obtained for minor injuries. However, over a ten year period, the Victorian CrashStats database showed that pedestrian crashes in Victoria resulted in 529 fatalities, 6299 serious injuries, and 7640 minor injuries. This equates to 11.9 serious injuries and 14.4 minor injuries per fatality. Given that the ratio of serious injuries to fatalities matched the national data reasonably well, it was assumed that the Victorian statistics would be representative of the national case for minor injuries. It was also assumed that the rate of fatalities and injuries would be proportional to vehicle sales into the future and so, as highlighted in Section 1.2, would not be expected to decline naturally in the future at an acceptable rate, if at all. Notwithstanding this, to better account for these assumptions an injury rate equal to only half of the above reported statistics was adopted later during the analysis.

Although research into vulnerable road users and vehicle safety measures has focused predominantly on improving the protection of pedestrians, several effectiveness studies have concluded that pedestrian safety measures would also be beneficial for cyclists. In Australia, on average, 31 cyclists are killed each year in crashes involving vehicles (DITRDLG, 2009). In addition, on average, 3830 cyclists are seriously injured each year in transport related accidents, with approximately quarter of these serious injuries resulting from collisions with vehicles (Henley and Harrison, 2009). The Victorian CrashStats database showed that by including cyclist crashes along with pedestrian crashes, the ratio of injuries to fatalities would become 15.6 serious injuries and 23.8 minor injuries per fatality. It was again assumed that the Victorian statistics would be representative of the national case for injuries.

3. WHY GOVERNMENT INTERVENTION MAY BE NEEDED

Government intervention may be needed when the market fails to provide the most efficient and effective solution to a problem. In the case of pedestrian safety in vehicle

crashes, an externality exists that market forces may not be able to correct. This is because the individual who pays for the pedestrian protection does not receive the main benefit of it. The main benefit is received by the pedestrian, or other vulnerable road user, through the reduction of road trauma and not by the owner responsible for making the purchasing decision regarding the vehicle.

3.1. Market response

Research into pedestrian safety first began in the 1970s. Many of the early studies were aimed at reproducing the sequence of events observed in a collision between a vehicle and a pedestrian. This allowed for the identification of vehicle structures that most determine the injuries sustained by pedestrians and subsequently, the development of test methods to assess the level of pedestrian protection offered by a vehicle.

In addition to passive pedestrian safety (injury reduction once a collision has occurred), some manufacturers have been researching the use of active pedestrian safety systems. These systems act to prevent collisions in the first place. For example, Volvo has recently released the Collision Warning with Full Auto Brake and Pedestrian Detection system with its S60 model. This system detects pedestrians, warns the driver and applies the vehicle's brakes automatically if it determines that a collision is imminent.

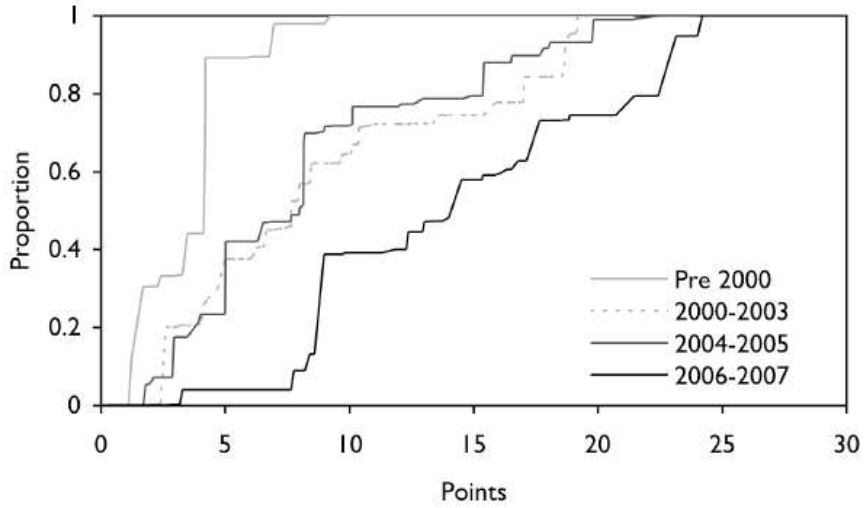
In 1992, the Australasian New Car Assessment Program (ANCAP) was established in Australia with the aim of providing consumers with information on the level of occupant protection provided by vehicles. Similarly, the European New Car Assessment Programme (EuroNCAP) commenced in 1997. Its test regime included a series of pedestrian impact tests and in 2000, ANCAP aligned itself with EuroNCAP by adding pedestrian safety to its own program. By providing consumers with information on the pedestrian safety of vehicles, these programs aim to increase consumer demand for pedestrian friendly vehicles. This provides vehicle manufacturers with an incentive to voluntarily produce vehicles to a higher level of pedestrian safety.

More recently, regulation was introduced in both Europe and Japan requiring that, as of late 2005, all new vehicle models manufactured in Europe and Japan comply with pedestrian safety standards.

New car assessment program ratings can provide a measure of the response of the market to these non-regulatory and regulatory actions. Based on the results of pedestrian impact tests under ANCAP/ EuroNCAP, a vehicle may be awarded a maximum of 36 points. In a recent study, Anderson et al (2008) of the Centre for Automotive Safety Research investigated whether there was a correlation between point scores under ANCAP/ EuroNCAP testing and the technical requirements of GTR 9. The authors estimated that a vehicle that would pass the GTR would score a minimum of 18 ANCAP/ EuroNCAP points.

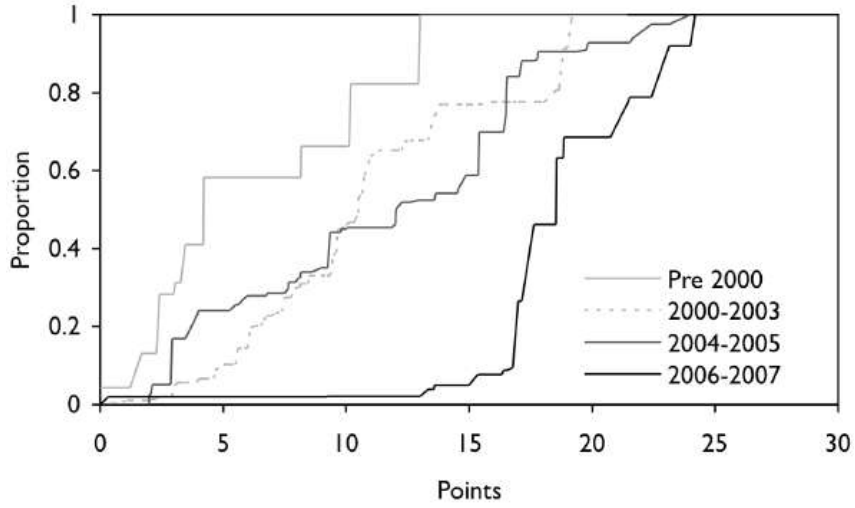
Anderson et al graphed the cumulative ANCAP/EuroNCAP performance of the Australian and European new car fleets by model release year, as shown in Figures 4 and 5 respectively. It can be seen that, in both jurisdictions, the ANCAP/EuroNCAP point score of vehicles released in more recent years is generally higher than that of vehicles released in earlier periods.

Figure 4 Cumulative Australian new car fleet performance by model release year



Source: Anderson et al, 2008

Figure 5 Cumulative European Union new car fleet performance by model release year



Source: Anderson et al, 2008

Using Anderson et al's correlation between ANCAP/EuroNCAP point scores and performance in GTR testing, the proportion of the new vehicle fleet both in Australia and Europe that would meet the GTR was estimated for various points in time. The results are summarised in Table 2.

Table 2 Percentage of new vehicle fleet estimated to pass the requirements of GTR 9

	Pre 2000 - No Intervention	**2004-2005 - Voluntary Programs**	**2006-2007 - EU Directive**
Australia	0%	8%	27%
Europe	0%	9%	54%

As seen in Table 2, of the vehicles released before the introduction of ANCAP pedestrian safety testing and overseas regulation, that is, before 2000, none scored the 18 points needed to pass the GTR. In fact, the majority of pre 2000 vehicles, approximately 90 per cent in Australia and 60 per cent in the EU, received a score of less than 5 points. During the period of 2000 to 2004, the new vehicle fleet performance, as measured by ANCAP/EuroNCAP ratings, improved considerably both in Australia and the EU. Approximately 8 per cent and 9 per cent of new vehicles released in 2004-2005 in Australia and the EU respectively were estimated to pass the GTR.

An even more notable improvement can be observed following the introduction of regulation in Europe and Japan. Of new vehicles released in 2006-2007 in the EU, 54 per cent were estimated to pass the GTR. During this same period, the pedestrian safety performance of the Australian new car fleet showed significant improvement in the absence of an Australian regulation on pedestrian safety. However, this was to a lesser extent than in the EU, with 27 per cent of new vehicles released in Australia in 2006-2007 estimated to pass the GTR. Furthermore, as a significant proportion of the Australian new car fleet is imported from Japan and Europe, it is possible that some of this improvement may have occurred as a result of the introduction of regulations in these countries. As more stringent requirements are due to be introduced in the EU in 2013 it is possible that, even without regulation in Australia, the pedestrian safety of the Australian fleet will improve in the future. However, there is no guarantee as to the extent of improvement that will be achieved without government intervention.

3.2. Objective of Government Intervention

A general objective of the Australian Government is to establish the most appropriate measure(s) for delivering safer vehicles to the Australian community. The specific objective of this RIS is to examine the case for government intervention to improve the pedestrian safety performance of the new vehicle fleet in Australia.

Where intervention involves the use of regulation, the Council of Australian Governments (COAG) has endorsed a set of Principles and Guidelines for Ministerial Councils and Standards Setting Bodies, for assessing new regulatory proposals or reviewing existing regulations (COAG, 2004). These Principles are shown in Box 1.

Box 1 Principles of good regulation

Principles of good regulation

- Minimising the impact of regulation
- Minimising the impact on competition
- Predictability of outcomes
- Adopt international standards and practices
- Regulations should not restrict international trade
- Regular review of regulation
- Flexibility of standards and regulations
- Standardise the exercise of bureaucratic discretion

Source: COAG, 2004

The Principles and Guidelines are available from:
<http://www.finance.gov.au/obpr/docs/COAG_best_practice_guide_2007.pdf>.

The Agreement on Technical Barriers to Trade, to which Australia is a signatory, requires contracting parties to adopt international standards where they are available or imminent.

4. EXISTING REGULATIONS

The Australian Government provides protection for new vehicle consumers through the *Trade Practices Act 1974* (C'th) (TPA) and the *Motor Vehicle Standards Act 1989* (C'th) (MVSA).

The TPA provides consumer protection and quality of supply of product. The MVSA provides mandatory vehicle safety, emission and anti-theft standards with which suppliers of new vehicles are required to comply. These are national standards and are known as the Australian Design Rules (ADRs).

There are currently no ADRs relating to the protection of pedestrians or other vulnerable road users in the event of a collision with a vehicle.

5. OPTIONS

The available options are listed below.

5.1. Non-Regulatory Options

Option 1: No intervention

Allow market forces to provide a solution (no intervention).

Option 2: User information campaigns

Inform consumers about the benefits of pedestrian friendly vehicles using information campaigns (suasion).

Option 3: Fleet purchasing policies

Only allow vehicles that provide a certain level of pedestrian safety for government purchases (economic approach).

5.2. Regulatory Options

Option 4: Codes of practice

Allow road vehicle supplier associations, with government assistance, to initiate and monitor a voluntary code of practice for pedestrian safety under the *Trade Practices Act 1974* (C'th) (TPA). Alternatively, mandate a code of practice under the TPA (regulatory – voluntary/mandatory).

Option 5: Mandatory standards under the TPA

Mandate standards for pedestrian safety under the *Trade Practices Act 1974* (C'th) (TPA) (regulatory – mandatory).

Option 6: Mandatory standards under the MVSA

Develop (where applicable) and mandate standards for pedestrian safety under the *Motor Vehicle Standards Act 1989* (C'th) (MVSA) based on the international standard adopted by the UNECE as GTR No. 9 (regulatory – mandatory).

6. DISCUSSION OF THE OPTIONS

6.1. Option 1: No intervention

Allow market forces to provide a solution (no intervention).

The current level of pedestrian safety has been achieved without regulation in Australia. However, as previously noted, there have been a number of actions, both in Australia and overseas, that have likely contributed to the current position. The current voluntary compliance of the Australian new vehicle fleet with GTR 9 on pedestrian safety was estimated in more detail than previously (see Table 2) from the results of a recent study conducted by Searson et al (2009). The aim of this study was to evaluate how many vehicles tested by ANCAP would be expected to pass the GTR. Of the 33 current vehicle models examined, 23 were passenger cars or Sports Utility Vehicles (SUVs) and 10 were Light Commercial Vehicles (LCVs). Six of the passenger cars and SUVs (26 per cent) were estimated to pass the requirements of the GTR. None of the ten LCVs were estimated to pass.

To determine the proportion of the Australian vehicle fleet expected to meet the GTR into the future, Australian manufacturers and importers were requested late in 2009 through the Federal Chamber of Automotive Industries (FCAI) to indicate their future plans. However, the FCAI were unable to provide any overall plan for compliance to the GTR.

Therefore, the final level of compliance expected to be achieved without any form of intervention was estimated from the proportion of vehicles imported from the EU and Japan. The European Union pedestrian safety regulation is already aligned with the GTR and it is expected that the Japanese standard will soon follow. Passenger vehicles imported from the EU and Japan represent approximately 72 per cent of total imports of passenger vehicles to Australia (Department of Foreign Affairs and Trade, 2009). Since around 84 per cent of Australia's vehicles are imported, it was estimated that 60 per cent (72% × 84% = 60%) of the Australian passenger vehicle fleet is likely to meet the GTR in the future without Australian Government intervention. In a similar way, it was also estimated that 39 per cent of LCVs are likely to meet the GTR in the future.

6.2. Option 2: User Information Campaigns

Inform consumers about the benefits of pedestrian friendly vehicles using information campaigns (suasion).

User information campaigns can be used to promote the benefits of safer vehicles and so encourage consumer demand. Campaigns may be carried out by the private sector, the public sector, or a combination of the two. They can be effective where the information being provided is simple to comprehend and unambiguous. They can be

targeted towards the single consumer or to those who make significant purchase decisions, such as private or government fleet owners.

Error! Reference source not found., details two real life examples of awareness campaigns; a broad high cost approach and a targeted low cost approach. The broad high cost approach cost $6m and provided a benefit-cost ratio of 5. The targeted low cost approach cost $1m and generated an awareness of 77 per cent. It was run over a period of four months.

In the case of pedestrian safety, a targeted approach would be most suitable, as the target market would consist solely of new vehicle buyers. However, it was recognised that the figures provided could be indicative only, as the campaigns do not relate to pedestrian safety or even to automotive related topics. Furthermore, it does not necessarily follow that increased awareness will translate directly into increased sales. This is particularly true in the case of pedestrian safety, where the target of the awareness campaign (the vehicle buyer) does not receive the main benefit (reduction in pedestrian injuries). In relation to this, in a consumer survey conducted by EuroNCAP (EuroNCAP, 2005), approximately 58 per cent of respondents said that the protection of pedestrians would influence their choice in purchasing a vehicle. Therefore, it was assumed that a campaign that generates an awareness of 77 per cent would at best result in a 45 per cent (58% × 77%) take-up of pedestrian friendly vehicles. It is likely that an awareness campaign would need to be run on a continuous basis to maintain its effectiveness.

Advertising campaigns were also considered as a means of increasing the uptake of pedestrian friendly vehicles. A typical cost for a three month campaign consisting of television, newspaper and magazine advertisements is $5m (*Average Advertising Costs* n.d.). Some research into advertising showed that for general goods, advertising campaigns can lead to an increase of around 8 per cent in sales (Radio Ad Lab, 2005). This is consistent with a recent result achieved by a Mitsubishi campaign promoting the safety feature of Active Stability Control. Although not directly related to pedestrian safety, this campaign is considered relevant as it focused on the promotion of a vehicle safety feature. Again, however, in the case of pedestrian safety (where the car buyer does not receive the primary benefit of the safety feature), it is likely that an advertising campaign would not be as effective. This is underscored by the current minimal promotion of passive pedestrian safety features in advertising by vehicle manufacturers. Because of this, and because of the high cost of advertising campaigns, it was decided that an awareness campaign would be the more feasible option that should be considered further. Table 3 provides a summary of the cost and effectiveness of various information campaigns.

Table 3 Estimated cost and effectiveness of various campaign types

Campaign	Estimated cost ($m)	Expected effectiveness
Awareness - broad	6	$5 benefit/$1 spent
Awareness – targeted *	1 per four month campaign, or 3 per year	Total of 77% awareness and 45% sales (but no greater than existing sales if already more than 45%)
Advertising	1.5 per month campaign,	8 % increase in existing sales

	or 18 per year

* Subsequently used towards a benefit-cost analysis

6.3. Option 3: Fleet purchasing policies

Only allow vehicles that provide a minimum level of pedestrian safety for government purchases (economic approach).

According to the Australasian Fleet Managers Association (AFMA), some 50 per cent of new car purchases in Australia are made through fleet purchase programs ("Fleet safety upgrade to flow on", 2008). This includes vehicles that are provided as part of remuneration packages as well as those used as part of general fleets. Therefore, fleet purchasers wield large market power and can influence manufacturers to make certain features as standard (Koppel, Charlton & Fildes, 2007). The specifications of Holden's fleet buyer models are defined by the fleet buyers (Gearin, 2006).

The government could intervene through fleet purchasing by favouring vehicle models that provide a certain level of pedestrian safety and by persuading manufacturers to improve vehicles currently not meeting this level.

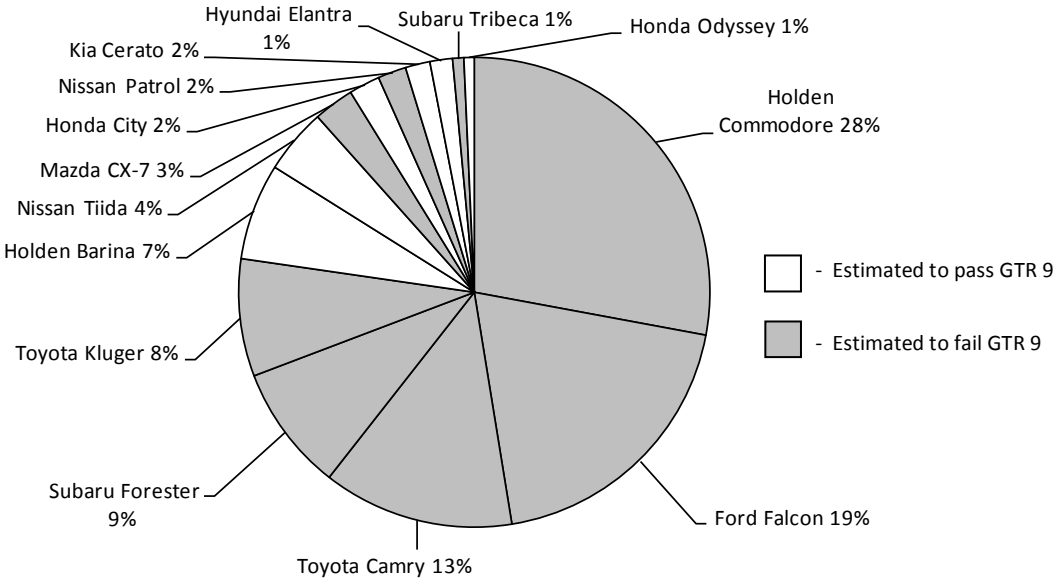
Further reasons for targeting fleet purchasing are:

- there is substantial evidence that fleet drivers have an increased crash risk compared to private registered vehicle drivers (Bibbings, 1997);
- ex-fleet vehicles are often sold after 2-3 years, giving the public the opportunity to buy a near new vehicle at a large discount (Nesbit & Sperling, 2001; Symmons & Haworth, 2005); and
- fleet vehicles are on average driven twice as far annually than household vehicles, thus maximising the use of any technology benefits (Nesbit & Sperling, 2001).

The National Road Safety Action Plan 2009 and 2010 (Australian Transport Council, 2008) lists fleet purchasing policies as one of its highest impact actions directed at accelerating the market penetration of advanced vehicle safety features. It specifies that these policies should have regard to high vehicle safety standards for both occupants and pedestrians. Currently, pedestrian safety is not a primary consideration in fleet purchasing policies. However, there are examples of governments, such as the South Australian government, listing a high pedestrian safety ANCAP rating as a desirable feature that should be given priority in the vehicle selection process.

The level of pedestrian safety offered by fleets can be estimated by considering the 33 current vehicle models assessed in the study discussed earlier by Searson et al (2009). Of the 23 passenger car and SUV models assessed, six were estimated to pass GTR 9 on pedestrian safety while eight were estimated to fail. The remaining nine models were considered likely to pass the GTR with little or no modification. Considering only those models assessed as a straight pass or fail, approximately 82 per cent by sales volume were estimated to fail the GTR. These are shown in Figure 6.

Figure 6 Estimated compliance of fourteen passenger car and SUV models with GTR 9, by sales volume



Source: Searson et al, 2009; FCAI, 2009

Given that 50 per cent of new car purchases are made through fleet purchase programs, it was assumed that fleet purchasing policies could potentially increase the number of passenger cars and SUVs expected to pass the GTR by 41 per cent (82% × 50%). Of the ten LCV models assessed by Searson et al, none were estimated to pass GTR 9. Therefore, it was assumed that fleet purchasing policies could potentially increase the number of LCVs expected to pass the GTR by 50 per cent (100% × 50%).

It is expected that vehicles purchased through fleet programs would flow through the vehicle fleet as ex-fleet vehicles are sold to the public. This would increase the resulting benefits. However, while 50 per cent of new vehicle purchases are made through fleet purchase programs, this includes both private and government fleets. Government fleet purchases alone account for only 7 per cent of new car purchases (Western Australian Office of Road Safety, 2009). Although the implementation of a government fleet purchasing policy may influence some private fleet purchasers to put in place similar policies, the extent of this influence is likely to be much reduced. Given this, it was decided that the initial estimate of a 41 per cent increase through fleet purchasing policies for passenger cars and SUVs and 50 per cent increase for LCVs would be a very generous value.

The cost of implementing a fleet purchasing policy would be minimal as it only involves a negotiated agreement with fleet managers to select only those vehicles that provide a certain level of pedestrian safety. The costs would be those relating to the negotiation processes (say $50,000 per year) plus any lost opportunity for the fleet in foregoing a vehicle model that may (other than for its pedestrian safety performance) be better placed to meet a particular fleet requirement (this latter aspect could not be estimated).

6.4. Option 4: Codes of practice

Allow road vehicle supplier associations, with government assistance, to initiate and monitor a voluntary code of practice for pedestrian under the *Trade Practices Act 1974* (C'th). Alternatively, mandate a code of practice under the *Trade Practices Act 1974* (C'th) (regulatory – voluntary/mandatory).

A code of practice can be either voluntary or mandatory as provided for under the *Trade Practices Act 1974* (C'th) (TPA). Part IVB – Industry Codes. There are remedies for those who suffer loss or damage due to a supplier contravening the code, including injunctions, damages, orders for corrective advertising and refusing enforcement of contractual terms.

Voluntary Code of Practice

Compared to legislated standards, voluntary codes of practice offer the opportunity for a high degree of industry involvement, as well as a greater responsiveness to change when needed. For them to succeed, the relationship between business, government and consumer representatives should be collaborative so that all parties have ownership of, and commitment to, the arrangements (Grey Letter Law, 1997)[1]. The Australian new vehicle industry is well placed to provide a collaborative voice on pedestrian safety. Of the manufacturers and importers involved with new passenger cars, the Federation of Automotive Product Manufacturers (FAPM) and the Federal Chamber of Automotive Industries (FCAI) represent 40 per cent and 99 per cent [2] respectively of the total.

Voluntary codes of practice work best when the industry itself gains from adhering to the code of practice. In the case of pedestrian safety, the main benefits would be received by the wider community and therefore there may be insufficient motivation for industry to participate. Furthermore, breaches would be difficult to detect and would usually only be revealed through failures in the field or by third party reporting. Therefore, any reduction in implementation costs over mandated intervention would need to be balanced against the consequences of these failures.

It would be difficult to separate this option from the no-intervention option and therefore it was not considered further.

Mandatory Code of Practice

Mandatory codes of practice can be an effective means of regulation in areas where government agencies do not have the expertise or resources to monitor compliance. However, in considering the options for regulating the design and construction of motor vehicles, the responsible government agency (Department of Infrastructure and Transport) has existing legislation, expertise, resources and well-established systems to

[1] Grey Letter Law, Report to the Commonwealth Interdepartmental Committee on Quasi Regulation, 1997

[2] Membership base of the FCAI includes vehicle manufacturers and the FAPM. It does not include sectors such as tyre manufacturing, vehicle distribution, transport logistics and after market supplies.

administer a compliance regime that would be more effective than a mandatory code of practice. This option was not considered further.

6.5. Option 5: Mandatory standards under the TPA

Mandate standards under the *Trade Practices Act 1974* (C'th) (regulatory – mandatory).

As with codes of practice, standards can be either voluntary or mandatory as provided for under the *Trade Practices Act 1974* (C'th) (TPA). Section 65C – Product safety standards and unsafe goods, allows the prescription of mandatory product safety standards. There are remedies for those who suffer loss or damage due to a product not meeting prescribed standards.

However, in the same way as a mandatory code of practice was considered in the more general case of regulating the design and construction of motor vehicles, the responsible government agency (Department of Infrastructure and Transport) has existing legislation, expertise and resources to administer a compliance regime that would be more effective than a mandatory standard administered through the TPA.

This option was not considered any further.

6.6. Option 6: Mandatory standards under the MVSA

Develop (where applicable) and mandate standards for pedestrian safety under the *Motor Vehicle Standards Act 1989* (C'th) (MVSA) based on the international standard adopted by the UNECE as GTR No. 9 (regulatory – mandatory).

In November 2008, the United Nations Economic Commission for Europe (UNECE) adopted Global Technical Regulation (GTR) No. 9 – Pedestrian Safety, under the *Agreement Concerning the Establishing of Global Technical Regulations for Wheeled Vehicles Equipment and Parts of June 1998* (the 1998 Agreement). GTR 9 is based largely on the work of the International Harmonised Research Activities (IHRA) Pedestrian Safety Working Group. As a contracting member to the 1998 Agreement, Australia must subject GTR 9 to its domestic rulemaking process and then advise the Secretary-General of the United Nations whether it has decided to adopt any or all of the requirements (ECE, 2002). For more details of GTR 9 refer to **Error! Reference source not found.**.

The UNECE is currently working towards adopting GTR 9 on pedestrian safety as a UNECE regulation under the *Agreement concerning the Adoption of Uniform Conditions of Approval and Reciprocal Recognition of Approval for Motor Vehicle Equipment and Parts* of March 1958 (the 1958 Agreement). Australia is also contracting party to the 1958 agreement for developing UNECE regulations (separately to the 1998 Agreement for developing the GTRs).

A GTR functions as a global "template" regulation, and therefore does not contain any implementation timing. It is left to the contracting parties to determine their own timetable, including any phasing-in or delay in implementation. A UNECE regulation, on the other hand, is a working regulation that can give effect to GTR requirements at an international level, and includes implementation timing. Although the GTR does

specify a scope, it also states that a contracting party may restrict application of the requirements to a narrower group of vehicles if it decides that such restriction is appropriate. The (currently draft) UNECE regulation reflects most of the requirements of the GTR but has a narrower scope of vehicles that it applies to.

Timing of the regulations

The draft UNECE regulation on pedestrian safety contains the same implementation timetable as the European based regulation EC 78/2009. As the GTR does not contain implementation timing, the draft UNECE regulation contains the only internationally agreed timing available. European Regulation EC 78/2009 sets out a phase-in approach. For vehicles of category M1 not exceeding 2,500 kg GVM and category N1 derived from them, requirements in line with those of the GTR will apply to new vehicle types as of 24 February 2013 and all new vehicles as of 24 February 2018. A longer lead-time has been allowed for vehicles of category M1 exceeding 2,500 kg and category N1 other than those mentioned above. In this case, requirements will apply to new vehicles types from 24 February 2015 and all new vehicles from 24 August 2019.

Scope of the regulations

Currently, the GTR on pedestrian safety applies to vehicle categories (as defined in 1998 Global Agreement Special Resolution No. 1): 1-1 with a gross vehicle mass (GVM) exceeding 500 kg; 1-2 with a GVM exceeding 500 kg but not exceeding 4,500 kg; 2 with a GVM exceeding 500 kg but not exceeding 4,500 kg. Power driven vehicles of category 1-2 and category 2, where the distance, measured longitudinally on a horizontal plane, between the transverse centre line of the front axle and the R-point of the driver's seat is less than 1,000 mm, are exempt from the requirements of the GTR.

The vehicle categories subject to GTR 9 translate closest to the Australian categories of MA (passenger cars), MB (passenger vans), MC (four-wheel drives or Sports Utility Vehicles) greater than 500 kg; MD1, MD2 and MD3 greater than 500 kg and less than or equal to 4,500 kg (small and medium buses); as well as NA and NB1 greater than 500 kg and less than or equal to 4,500 kg (light and medium commercial vehicles) (refer **Error! Reference source not found.**). However, the development text for the GTR recognises that a contracting party may limit domestic regulation to a narrower group of vehicles as appropriate.

The lighter NA category consists of passenger car based utilities such as those based on the Holden Commodore or Ford Falcon, as well as light vans such as the Volkswagen Transporter and Hyundai iLoad. It also includes slightly heavier cab-chassis based utilities, such as the Holden Rodeo, Toyota Hilux and the Mitsubishi Triton, as well as various campervans, hearses and some ambulances.

The heavier NB category consists of larger vans such as the Mercedes Sprinter and Iveco Daily, as well as conventional truck chassis such as the Mitsubishi Canter, Hino 300 and Isuzu NH. It also includes some heavy trucks that would straddle the US 4,536 kg limit, such as the Isuzu NPR 400, and Iveco Daily and Mercedes Sprinter vans, as well as a number of motorhomes based on these or other chassis.

The light bus category MD1 includes the Toyota Landcruiser bus and a low volume limousine. The Toyota Hiace bus is the only vehicle in the MD2 category and the MD3 category includes the Ford Transit, Mercedes Sprinter and some low volume limousines.

The draft UNECE regulation, like the EU regulation, applies to a narrower group of vehicles than the GTR, namely, vehicles of category M1 and N1 (as defined in Annex 7 to the Consolidated Resolution on the Construction of vehicles (R.E.3)). This translates to Australian categories of MA (passenger cars), MB (passenger vans), MC (four-wheel drives or sports utility vehicles) and NA (light commercial vehicles).

Currently, the draft UNECE regulation does not apply to vehicles of category N1 and vehicles of category M1 above 2,500 kg maximum mass and which are derived from N1 category vehicles, where the driver's position "R-point" is either forward of the front axle or longitudinally rearwards of the front axle transverse centreline by a maximum of 1100 mm. This is to exempt flat fronted vehicles from pedestrian safety requirements. These types of vehicles would not have a front structure suitable for pedestrian safety measures to be included.

This exemption is slightly more generous than an otherwise similar provision in GTR 9. However, a later UN proposal to amend the scope of the GTR was recently adopted. The proposal effectively aligned the GTR more closely with the UNECE requirements.

There is also a further UN proposal to amend the draft UNECE regulation to make the exemption of M1 optional rather than automatic. This would align the draft regulation with further recent amendments to GTR 9.

There is no equivalent vehicle categorisation in the Australian system for vehicles "where the driver's position "R-point" is either forward of the front axle or longitudinally rearwards of the front axle transverse centreline by a maximum of 1100 mm" - although this is likely to cover some MB category passenger vans at least - and so this exemption would have to be determined through manufacturers' data for each particular model. Flat fronted light commercial vans such as the Toyota Hiace and Mitsubishi Express would be likely to fall under this exemption.

Performance Requirements

GTR 9 consists of two sets of performance requirements, head impact requirements and leg impact requirements. The head impact tests involve propelling child and adult headforms at the bonnet (within a specified region) at a velocity of 35 km/h. The angle at which the headform is propelled depends on the headform used. The Head Injury Criterion (HIC) must not exceed 1,000 over one half of a child headform test area and must not exceed 1,000 over two thirds of a combined child and adult headform test areas. The HIC for the remaining areas must not exceed 1,700 for both headforms.

The leg impact test involves propelling a legform at the vehicle bumper at a velocity of 40 km/h. The height of the lower bumper determines whether a lower legform

impactor or an upper legform impactor is used. In the lower legform to bumper test, vehicles must meet limits on lateral knee bending angle, knee shearing displacement, and lateral tibia acceleration. In the upper legform to bumper test, limits are placed on the instantaneous sum of the impact forces with respect to time and the bending moment on the test impactor.

Relationship to other legislated requirements

Where a standard has been mandated as an Australian Design Rule (ADR) under the *Motor Vehicle Standards Act 1989* (C'th) (MVSA), the ADR becomes applicable for new vehicles in accordance with its prescribed implementation scope and timing.

It was previously noted that there are currently no ADRs directly relating to the protection of pedestrians and other vulnerable road users in the event of a collision with a vehicle. Notwithstanding this, ADR 42/04 General Safety Requirements does specify design and construction requirements that prohibit any object fitted to a vehicle from increasing the risk of injury of any person. In the case of external protrusions at the front of the vehicle, this is a requirement that can affect pedestrian safety.

The relevant clauses are as follows:

> **11. EXTERNAL OR INTERNAL PROTRUSIONS**
>
> 11.1. No vehicle must be equipped with:
>
> 11.1.1. any object or fitting, not technically essential to such vehicle, which protrudes from any part of the vehicle so that it is likely to increase the risk of bodily injury to any person;
>
> 11.1.2. any object or fitting technically essential to such vehicle unless its design, construction and conditions and the manner in which it is affixed to the vehicle are such as to reduce to a minimum the risk of bodily injury to any person;
>
> 11.1.3. any object or fitting which, because it is pointed or has a sharp edge, is likely to increase the risk of bodily injury to any person; or
>
> 11.1.4. any bumper bar the end of which is not turned towards the body of the vehicle to a sufficient extent to avoid any risk of hooking or grazing.

Clauses 11.1.1 and 11.1.2 do not set a value for performance of a vehicle in terms of pedestrian safety. Instead, they only require that any additional "objects or fittings" must be technically essential and that the risk of injury in having them must be reduced as much as possible (in still allowing the objects to fulfil their function).

The fitting of extra equipment against this requirement is almost exclusively an aftermarket activity. Vehicle manufacturers rarely elect to certify such equipment during certification of the vehicle for supply to the market under the MVSA. Because of this, enforcement of the above clauses for the most part falls within state and territory vehicle standards requirements. These requirements are aligned to a greater or lesser degree with national in-service template regulations known as the Australian Vehicle Standards Rules (AVSRs). The AVSRs in turn require vehicles to continue to comply with the ADRs (that were in force when the vehicle was originally built) after they have been supplied to the market and used on the road. This is generally accepted as being from the point of registration onwards. The practical effect of this is that the

issue of fitting extra equipment lies substantially beyond the scope of this RIS, which is only able to examine proposals for changing Commonwealth legislation (the ADRs).

However, it is acknowledged that there is an aftermarket industry in Australia that provides such extra equipment for vehicles. The Australian Automotive Aftermarket Association (AAAA) advises that there are currently 1250 manufacturers, distributors, wholesalers, importers and retailers of automotive parts and accessories, tools and equipment in the aftermarket industry in Australia, with an aggregate gross annual turnover of $5 billion and employing 30,000 people (AAAA, 2010). In particular, there are around 190 companies, including the major manufacturers, which have an interest in four-wheel drive accessories such as Vehicle Front Protection Systems (VFPS). VFPS are structures, commonly known as a "bull-bars", which are fitted to the front of a vehicle. Their purpose is to provide a strong location point for recovery devices such as winches. They also provide a strengthening or energy absorbing capacity to minimise the damage to the front of a vehicle from animal strikes.

It is further acknowledged that due to the follow-on nature of ADRs and state and territory regulations (i.e. vehicles must continue to comply with the ADRs) aftermarket VFPS manufacturers could be affected by any changes to pedestrian safety requirements within the ADRs. While there are currently no VFPS certified in conjunction with a new vehicle, a number are available as dealer options and again as aftermarket products for vehicles that are already in use on the roads.

Therefore, VFPS were considered further as part of the analysis of impacts to business in Section 8.2 and also in Section 9.9.

7. ECONOMIC ASPECTS - BENEFIT-COST ANALYSIS

Benefit-cost analysis is a useful tool for evaluating the feasibility of implementing new technology, but it does not replace the decision process itself. The model used in this analysis is the Net Present Value (NPV) model. Using this model, the flow of benefits and costs are reduced to one specific moment in time. The time period that the benefits are assumed to be generated over is the life of the vehicle(s). Benefit-Cost Ratios (BCRs) are also calculated to show whether the returns (benefits) on a project outweigh the resources outlaid (cost) and indicate what this difference is.

In the case of adding particular safety features to vehicles, there will be an upfront cost (by the vehicle manufacturers) at the start, followed by a series of benefits spread throughout the life of the vehicles. This is then repeated in subsequent years as additional new vehicles are registered. There may also be other ongoing business and government costs through the years, depending on the option being considered.

In the case of pedestrian safety, the construction of a vehicle with pedestrian safety measures would be fundamentally the same as a vehicle without these measures, and so the performance and aesthetics of the vehicle would not be affected. Therefore, there would be no opportunity costs for consumers associated with the purchase of a pedestrian friendly vehicle. Additionally, it is not expected that the repair costs would be affected. In 2008, NRMA Insurance conducted testing to look at the repair costs of nine of Australia's top selling small vehicles (NRMA, 2008). The Toyota Corolla,

which performed well in the EURO NCAP pedestrian safety program, was the cheapest of the nine cars to repair. As noted by NRMA Insurance Head of Research Robert McDonald "this proves that manufacturers can design vehicles that can perform well in both pedestrian safety and vehicle protection".

Calculations were started at the current estimated voluntary compliance rate of 26 per cent for passenger cars and SUVs and 0 per cent for LCVs. The results of each option were compared to what would happen if there was no government intervention, i.e. Option 1, the Business As Usual (BAU) case. Under the BAU case it was expected that the voluntary compliance rate would reach 60 per cent for passenger cars and SUVs and 39 per cent for LCVs by 2018.

The analysis model that was used had the capacity to calculate over a 46 year period of analysis. All options were given a starting point of 2010, but for Option 6 Regulation, which in reality would have a staggered introduction of the regulation between 2013 and 2018 for some types of vehicles and 2015 to 2019 for others (see Section 6.6), the starting point was set conservatively as 2015 to 2019 for all vehicles. By then running the analysis model such that the regulation option remained in force for 15 years (i.e. after 15 years from the first phase-in date of 2015) the regulation would be withdrawn or replaced), this took the analysis to 2030. All options were then set to have this same end date of implementation. There then followed a 26 year period for the full set of benefits from each option to be realised over the life of a cohort of vehicles. As the options other than the regulation option were able to be implemented straightaway from 2010, their period of effectiveness added to a total of 21 years. It was necessary to run the analysis over such a long period because in the general case, road safety benefits from improving the performance of vehicles are realised gradually as the fleet is first replaced and then the vehicles age and crash over a crash period of about 26 years for each vehicle. This is discussed further below.

The calculations used a method that accounted for variations in both crash likelihood and vehicle registrations over a possible 26 year vehicle crash life, as originally developed by Fildes (2002). Thus, the benefits were controlled for the risk that a crash would occur during a particular year of a vehicle's life. The crash likelihoods represented historical crash rates and as such were a good approximation of the crash profile of an average vehicle. The average crash age of a vehicle under this model was around 10-15 years. It should be made clear that the average crash age of a vehicle is not the same as the average age of a vehicle. By way of example, a cohort of vehicles in the fleet crashes very little in the first few years of its life and, due to scrappage and/or reduced use, decreasingly in the last fifteen years of its life. Under this model, it was not necessary to determine the average age of a vehicle.

The benefits were calculated using established monetary values representing fatalities, serious injuries and minor injuries as well as associated vehicle repair and administration costs. It was assumed that these injuries would remain proportional to the expanding human population and vehicular population in Australia over the coming years, as discussed earlier in Section 2. These values represented an average cost of crashes. However, it was recognised that the crash rate used was based on Victorian data rather than the whole of Australia and that other efforts to reduce pedestrian fatalities (speed and alcohol initiatives, road design, education, etc) are expected to continue into the future. Given this, it is possible that the national trend of falling fatalities shown earlier in Figure 2, could continue (although the same could not be said of serious injury levels as shown in

Figure 3). Therefore, to be very conservative, the crash rate used for the analysis was

halved for all injury levels.

Vehicle repair costs were correlated to injury severity rather than crash type. Although there may have been an argument that vulnerable road users that are involved in crashes would be expected to result in less vehicle damage than if the crash had occurred with another vehicle, this was not shown to be true, due to evidence found of a generally high degree of post-crash towing where injuries were more severe, regardless of the crash type. Post-crash towing in turn was associated through insurance data with higher levels of vehicle damage and so vehicle repair costs (Bureau of Transport Economics, 2000). Notwithstanding the above, vehicle repair costs have been determined to be in the order of one quarter of the total cost of an average crash. This value in turn would be reduced by about two thirds if it was assumed that all tow-away crash damage became drive-away damage instead. This equates to around 15 per cent of the total crash costs (Bureau of Transport Economics, 2000). A very conservative position was again taken in the analysis by reducing the benefits by this 15 per cent.

A detailed explanation of the method can be found in **Error! Reference source not found.**.

Vehicle fleet

In the Australian new vehicle market there are a number of vehicles registered each year that fall under an Australian Design Rule (ADR) vehicle category relevant to this analysis. These are detailed in Table 4 below.

Table 4 Details of the new vehicle fleet

ADR Category	Description	Number of Makes	Number of Models	Number of Vehicles
MA	Passenger car	61	246	540,562
MB	Passenger van			
MC	SUV		61	188,153
NA	Light goods van/ute/SUV	44	81	181,058

Source: FCAI, 2009; Dept of Infrastructure, Transport, Regional Development and Local Government, 2009

There is a model changeover approximately every five years. In assuming a five year model life, it was determined that there were an average of 49.2 new passenger car models, 12.2 new SUV models and 16.2 new LCV models per year.

Costs

For the non-regulatory options, the costs were discussed earlier in the RIS and summarised in Table 3 Estimated cost and effectiveness of various campaign types. These costs represented the non regulatory intervention methods (awareness campaigns, advertising campaigns etc). The actual fitment, development and (as relevant) regulatory costs are discussed in the following sections.

Source of the Costs

Obtaining costs associated with vehicles meeting the performance requirements of the GTR on pedestrian safety is generally difficult as they are a source of competitive advantage. However, the Transport Research Laboratory (TRL) in the United Kingdom conducted detailed research into these costs (Lawrence, 2006). This was done as part of a feasibility study into regulating pedestrian safety within the European Union (EU). TRL noted that accurate costs were not readily available as manufacturers were concentrating on meeting the (then) current requirements for pedestrian protection in the EU, which at the time were not the same as the GTR.

To estimate the costs, TRL estimated the modifications that would need to be carried out for vehicles within different market segments to meet the GTR, and then quantified them with the help of two detailed case studies involving a Landrover Freelander and a Ford Mondeo. These models were chosen as two common vehicles in the EU that between them could represent the typical range of modifications needed, under the assumption that manufacturers would meet any requirements with an additional twenty per cent tolerance. These modifications would satisfy the three design concepts needed for pedestrian protection, that is; 1) having sufficient crush depth, 2) having the appropriate deformation stiffness and 3) having the appropriate force distribution.

By adding detailed costs for modified parts and tooling to general development costs for pedestrian safety technology, TRL estimated an overall cost associated with meeting the GTR for both the Landrover and the Ford. They then tailored this cost to each vehicle market segment as shown in Table 5. In their analysis, TRL identified that, due to their streamlined styling, executive cars and sports cars may be unable to utilise conventional passive safety measures to meet pedestrian requirements. Therefore, the costs for these segments were based on the assumption that these vehicles would be fitted with pop-up bonnets or similar and so would include costs associated with these systems.

Table 5 Cost of vehicle modifications required to meet the GTR

Vehicle Style	**Cost per vehicle (€ 2006)**
Super Mini	45.98
Small Family Car	27.76
Large Family Car	36.93
Executive Car	129.55
Sports Car	397.40
Small MPV	30.80
Large MPV	34.53
Large Off-Roader	47.41

Source: Lawrence et al, 2006

As the costs were to be used for analysis of the Australian market, Australian manufacturers and importers were requested in late 2009 through the Federal Chamber of Automotive Industries (FCAI) for information towards confirming or otherwise the above costs of design, certification and production to GTR 9.

However, Australian manufacturers and importers were unable to directly allocate costs to meeting GTR 9. The FCAI contended that pedestrian protection is not an add-on feature or set of components that can simply be adapted to a vehicle. Design for it is very much integral and fundamental of the basic concept, style, structure and layout of the vehicle. It is impossible to isolate pedestrian protection from base vehicle development with respect to packaging, styling, structural integrity, endurance, durability, manufacturability, occupant protection, crashworthiness - all the fundamentals of auto design/development.

Because of this, the European costs shown in Table 5 have been used as a best estimate to determine costs for the Australian case. While it is not expected that the fundamental values of these costs would differ significantly between Europe and Australia, this has been discussed further below in terms of imported vehicles versus locally produced vehicles.

Magnitude of the Costs

The costs in Table 5 were averaged (according to the Australian sales volumes for each vehicle segment) to give a cost of $78 per vehicle. This was subsequently used in the benefit-cost analysis as the maximum cost to modify a vehicle to meet the GTR. It is important to note that this cost applies more to vehicles in Europe. To determine the (possibly reduced) costs that may be more relevant to the Australian market, the detailed costs for the Ford Mondeo were taken as a starting point. The required modifications for compliance were grouped into three categories (refer to **Error! Reference source not found.**).

Firstly, those modifications which would be part of the normal design process for the front of the vehicle were identified. These modifications could be achieved through attention to the vehicle configuration and would require little in the way of additional components to be fitted. Modifications of this type include providing appropriate clearances around the front bumper/grill area and under the bonnet for crush depth, as well as designing these structures to provide more evenly spread deformation resistance. Modifications of this kind were uncosted.

Secondly, those modifications which, although additional to the normal design process and involving specialised design solutions, would still be integral to the vehicle and not easily removed were identified. Modifications of this type include the addition of crush cans and crush beams within the structure. It is likely that vehicles designed and certified in Europe to meet the GTR by way of the EU requirements would also be supplied to other world markets with these features intact, regardless of whether pedestrian safety requirements applied in that country as well. Similarly, other countries that manufacture vehicles would build them to meet the GTR by way of being able to also supply them to the EU. Therefore, vehicles imported to Australia would be expected to already have the basic pedestrian safety structure and so would not require any modifications that relate to the integral structure of the vehicle. Modifications of this kind would only need to be costed for locally manufactured vehicles, which represent approximately 16 per cent of the Australian vehicle market.

Thirdly, those modifications which are additional to the normal design process, involve specialised design solutions and which would not be integral to the vehicle were identified. These features could easily be left out or substituted during production for supply to a market that did not require pedestrian safety features. Modifications of this type include deformable headlamps and frangible mountings, dedicated bonnet latches and hinges as well as crushable mounts for underbonnet equipment. Modifications of this kind would need to be costed for both locally manufactured vehicles and imported vehicles.
The resulting adjusted costs are shown in Table 6 for each vehicle segment. **Error! Reference source not found.** contains a detailed calculation of these costs.

Table 6 Cost of vehicle modifications required to meet the GTR – modified for the Australian market

Vehicle Style	Cost per vehicle (€ 2006)
Super Mini	17.61
Small Family Car	10.63
Large Family Car	14.15
Executive Car	49.62
Sports Car	152.22
Small MPV	11.80
Large MPV	13.23
Large Off-Roader	19.60

The adjusted costs for the individual market segments were combined to give a sales weighted average cost of $30 per vehicle. This was used in the benefit-cost analysis as the minimum cost to modify a vehicle to meet the GTR.

A test facility estimated a cost of $35,000 to test a vehicle model to a pedestrian safety regulation. This is commensurate with other test costs shown in **Error! Reference source not found.** and so was assumed.

Certification costs (costs to meet a regulation) were based on previous FCAI estimates and Department of Infrastructure and Transport experience. A cost of $15,000 was assumed for the type approval costs of pedestrian safety for a vehicle model as discussed in **Error! Reference source not found.**.

Finally, an annual cost of $50,000 was assumed for the implementation and maintenance of a regulation based on Department of Infrastructure and Transport experience. This is also discussed further in **Error! Reference source not found.**.

Table 7 provides a summary of the costs for various aspects of modifying vehicles to meet pedestrian safety requirements. It also includes the costs of the non-regulatory options from Table 3.

Table 7 Estimation of the costs of pedestrian safety

Type of cost	Estimated cost ($)	Notes

Pedestrian safety modifications (min)	30	per vehicle
Pedestrian safety modifications (max)	78	per vehicle
Information campaigns	3m	per year
Fleet purchasing policies	50,000	per year
Pedestrian safety testing	35,000	per model
Type approval	15,000	per model
Implement and maintain regulation	50,000	per year

Particular Costs for each Option

For Option 1: No intervention, there were no costs associated with this as it was the base or Business As Usual (BAU) case.

For the remaining options, there was a basic design and fitment cost associated with the number of vehicles that would need to be modified to meet pedestrian safety requirements due to the particular intervention method (option) used, above and beyond those that already comply voluntarily. For example, say that 60 per cent of newly registered vehicles already comply with pedestrian safety requirements, and an intervention method (option) was expected to raise this to 80 per cent. Then there would be a basic design and fitment cost associated with 80 – 60 = 20 per cent of these newly registered vehicles.

This basic design and fitment cost was added to any other costs related to the intervention method (e.g. cost of awareness campaigns).

For Option 2: User information campaigns, there was a basic design and fitment cost as well as a minimum cost of $3m per year ongoing for an awareness campaign. This was discussed earlier in the RIS.

For Option 3: Fleet purchasing policies, there was a basic design and fitment cost as well as a cost (as discussed earlier in the RIS) of $50,000 per year for the negotiation process.

For Option 6: Mandatory standards under the MVSA, there was a basic design and fitment cost as well as costs for the testing and for the submission and processing of the results. The testing costs were estimated at $35,000 per model, while type-approval submissions and processing costs (including other costs surrounding the use of the regulation) were estimated at $15,000 per model. There was also an estimated cost of $50,000 per year to governments to create, implement and maintain the regulation, as discussed above.

By their nature, regulations would be applied to all of the relevant models in the new passenger fleet (regardless of whether they already met pedestrian safety requirements when any regulation was first applied) and so regulation costs would be independent of the voluntary level of pedestrian safety in the current fleet. These costs represent designing, testing and proving compliance of a vehicle against regulated requirements.

These costs would apply to every vehicle model under the scope of the regulation and would be above and beyond the design and testing associated with normal product development.

Error! Reference source not found. shows the particular costs for each option, including those for basic design and fitment.

7.1. Benefits and Costs of the Remaining Options

Four scenarios were prepared for estimating the benefits from pedestrian safety. These represented the four remaining options, Options 1, 2, 3 and 6. The four scenarios were based on the difference between the current voluntary fitment rate of passive pedestrian safety measures, and the final expected fitment rate under each particular option. The current voluntary fitment rate had been estimated at 26 per cent for passenger cars and SUVs and zero per cent for Light Commercial Vehicles (LCVs).

For Option 1: No intervention, there were no associated benefits or costs as this was the base or Business as Usual (BAU) case.

For Option 2: User information campaigns, there was an estimated increase from the Option 1 current fitment rate to a total of 45 per cent fitment rate (based on an awareness of 77 per cent generating a 45 per cent take-up of pedestrian friendly vehicles) for an ongoing targeted awareness campaign. The campaign would be stopped once the voluntary rate would have otherwise (through the BAU case) reached 45 per cent.

For Option 3: Fleet purchasing policies, there was an added flat 41 per cent increase for passenger cars and SUVs and 50 per cent for LCVs on top of the Option 1 voluntary fitment rate. This was capped at 100 per cent total.

For Option 6: Mandatory standards under the MVSA, there was an increase from the current fitment rate to a total of 100 per cent, with a pro-rata transition within the 2015-2019 period of implementing the regulation.

Effectiveness of Pedestrian Safety

Lawrence et al (2006) investigated the effectiveness of GTR 9 in reducing road trauma (Refer to **Error! Reference source not found.** for further details). The reductions in the number of pedestrian fatalities and serious injuries sustained in pedestrian crashes were estimated to be around 4 per cent and 12 per cent respectively. The authors assumed that minor injuries would not be reduced. Lawrence et al also examined the effectiveness of the GTR in reducing cyclist fatalities and injuries. A summary of the effectiveness estimates is shown in Table 8.

Table 8 Effectiveness of GTR 9 in reducing vulnerable road user casualties

	Pedestrian	**Cyclist**
Fatal injury	3.9%	1.4%

Serious injury	12.0%	4.8%
Minor injury	0%	0%

Source: Lawrence et al, 2006

The estimates shown in Table 8 were derived using national statistics of the United Kingdom (UK) and so better reflect the characteristics of vulnerable road user crashes in the UK. Table 9 shows a comparison of the characteristics of vulnerable road user crashes between Australia and the UK.

Table 9 Proportions of pedestrians and cyclists hit by fronts of vehicles subject to regulation

		Fatal injury	**Serious injury**	**Minor injury**
Australia	Pedestrians	0.69	0.76	0.78
	Cyclists	0.52	0.77	0.79
The UK	Pedestrians	0.60	0.56	0.50
	Cyclists	0.44	0.45	0.44

Source: Lawrence et al, 2006; VicRoads CrashStats, 2010; Anderson, 2008

It can be seen that the proportion of crashes that involve the vulnerable road user being hit by the front of a vehicle subject to regulation is higher in Australia than in the UK. This means that regulation in Australia could potentially affect a slightly higher proportion of accidents than in the UK. For example, in the UK, 60 per cent of fatal pedestrian crashes involved the pedestrian being hit by the front of a vehicle subject to regulation. In comparison, 69 per cent of fatal pedestrian crashes in Australia were in this category. Therefore, the proportions in Table 8 were used to adjust the effectiveness estimates in Table 9 for the Australian context (e.g. 3.9% × 0.69/0.6 = 4.5%). The adjusted effectiveness estimates are shown in Table 10.

Table 10 Effectiveness of GTR 9 in reducing vulnerable road user casualties – adjusted for Australian case

	Pedestrian	**Cyclist**
Fatal injury	4.5%	1.7%
Serious injury	16.4%	8.2%
Minor injury	0%	0%

However, as noted by Lawrence et al, it may not be realistic to assume that what would have been a fatality could be converted to no injury or even a minor injury. It is more likely that a fatality would be converted to a serious injury. As such, the percentage reductions in Table 10 were adjusted using the ratio of injuries to fatalities (1 fatality, 11.9 serious injuries and 14.4 minor injuries for pedestrian crashes and 1 fatality, 40.7 serious injuries and 88.1 minor injuries for cyclist crashes) to account for the conversion of casualties from fatal to serious and serious to minor (e.g. 16.4% - 4.5% ×1/11.9 = 16.0%). The negative values in Table 11 indicate an increase in minor injuries for both pedestrians and cyclists.

Table 11 Effectiveness of GTR 9 in reducing vulnerable road user casualties – adjusted for Australian case and conversion of injuries

	Pedestrian	**Cyclist**

Fatal injury	4.5%	1.7%
Serious injury	16%	8.2%
Minor injury	-13.5%	-3.8%

The pedestrian and cyclist effectiveness estimates were then averaged, according to the proportions of casualties resulting from pedestrian and cyclist crashes, shown in Table 12, to produce a combined effectiveness of 4.1 per cent for a fatal injury, 13.4 per cent for a serious injury, and -8.9 per cent for a minor injury (e.g. 4.5% × 0.87 + 1.7% × 0.13 = 4.1 %).

Table 12 Casualties resulting from pedestrian and cyclist crashes as a percentage of the total

	Pedestrian crash	**Cyclist crash**
Fatal injury	87%	13%
Serious injury	67%	33%
Minor injury	53%	47%

This can be summarised as an effectiveness that reduces fatalities and serious injuries, being particularly successful against the latter, but that has little effect on reducing minor injuries (the apparent increase in minor injuries being due to the reduction of serious injuries that then become minor injuries).

For the purposes of calculating the number of lives saved from any introduction of pedestrian safety, the effectiveness of 4.1 per cent as calculated above for a fatal injury was used. However, for the purposes of calculating the monetary value of benefits from the introduction of pedestrian safety, the monetary saving from a reduction of 4.1 per cent for a fatal injury, 13.4 per cent for a serious injury, and -8.9 per cent (an increase) for a minor injury were combined by considering the reduction in the cost of an "average" crash (refer **Error! Reference source not found.** for details). This can be seen in Table 13.

Table 13 Monetary saving of an "average" crash resulting from pedestrian safety measures (rounded values)

	Average cost	**Reduction**
Fatal injury	$99,294	$4,090 (**4.1%)**
Serious injury	$191,812	$25,728 **(13.4%**)
Minor injury	$9,881	-$884 **(-8.9%)**
Total	$300,986	$28,934 (**9.6%)**

Therefore, an effectiveness of 4.1 per cent was used for the calculation of lives saved while an effectiveness of 9.6 per cent was used for monetary savings.

7.2. Results

Error! Reference source not found. shows the calculations for the benefit-cost analysis. These include the Best Case, Likely Case and Worst Case for each option.

The outputs were constructed by using the minimum cost of $30 for the Best Case and the maximum cost of $78 for the Worst Case. The Likely Case was an average within this range. All scenarios used a 7 per cent discount rate.

An overview of the total Net Benefits, the total Costs, the average Benefit-Cost Ratios (BCRs) and the total number of Lives Saved over the period of analysis is given in Table 14 for each option. The distribution of the (undiscounted) benefits and costs, and the BCR, is shown over time in Figure 7. The effect of each option on the BAU is shown over time in Figure 8.

Table 14 Summary of Net Benefits, Total Benefits, Costs, Benefit-Cost Ratios and Lives Saved from the improved pedestrian safety of new passenger cars, SUVs and LCVs

	Net Benefits ($m)			**Total Benefits ($m)**		
	Best Case	Likely Case	Worst Case	Best Case	Likely Case	Worst Case
Option 1 No intervention	-	-	-	-	-	-
Option 2 Information campaigns	33	18	3	81	81	81
Option 3 Fleet policies	202	155	107	262	262	262
Option 6 Regulation	248	185	122	347	347	347

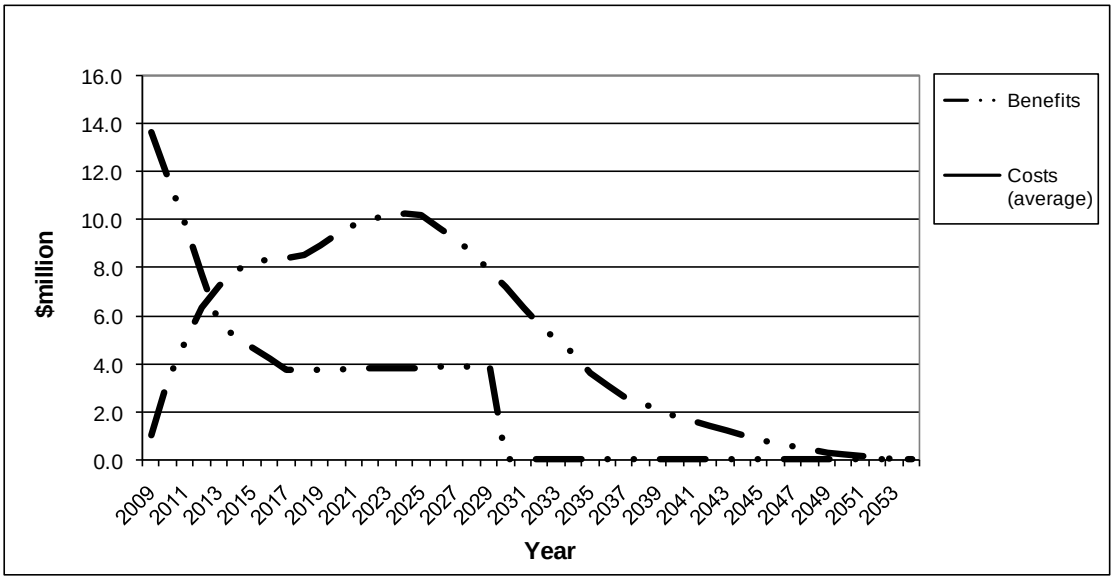
	Costs ($m)			**Benefit-Cost Ratio**		
	Best Case	Likely Case	Worst Case	Best Case	Likely Case	Worst Case
Option 1 No intervention	-	-	-	-	-	-
Option 2 Information campaigns	49	64	78	1.7	1.4	1.0
Option 3 Fleet policies	60	108	155	4.4	3.0	1.7
Option 6 Regulation	99	162	225	3.5	2.5	1.5

	Lives Saved		
	Best Case	Likely Case	Worst Case
Option 1 No intervention	-	-	-
Option 2 Information campaigns	8	8	8
Option 3 Fleet policies	29	29	29
Option 6 Regulation	65	65	65

Best Case - 7% discount rate, minimum costs
Likely Case - 7% discount rate, average costs
Worst Case - 7% discount rate, maximum costs

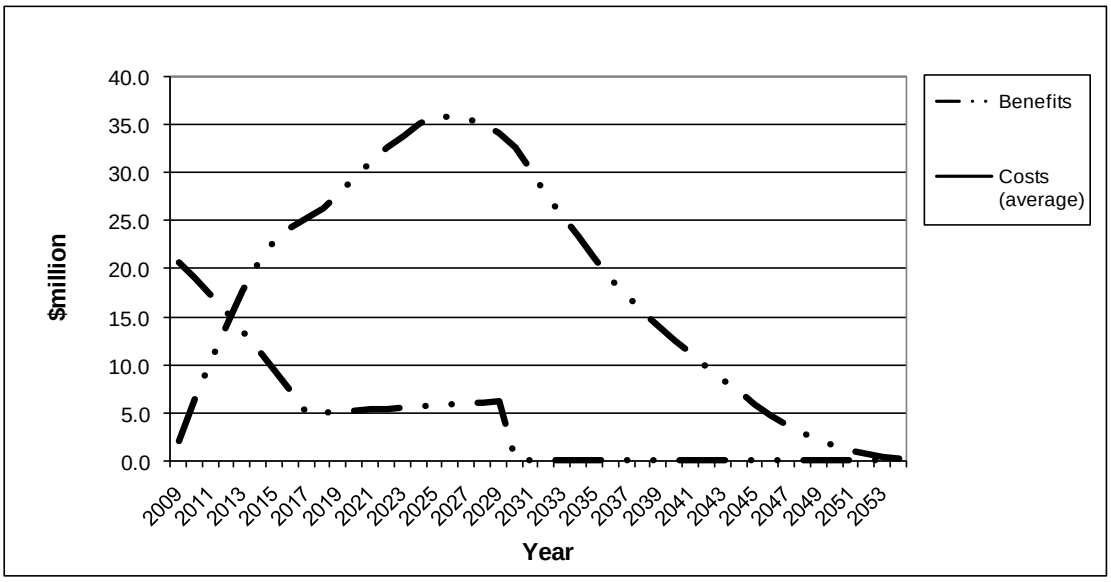
Figure 7 Undiscounted Benefits and Costs of various options over time

Option 2: User information campaigns – Awareness



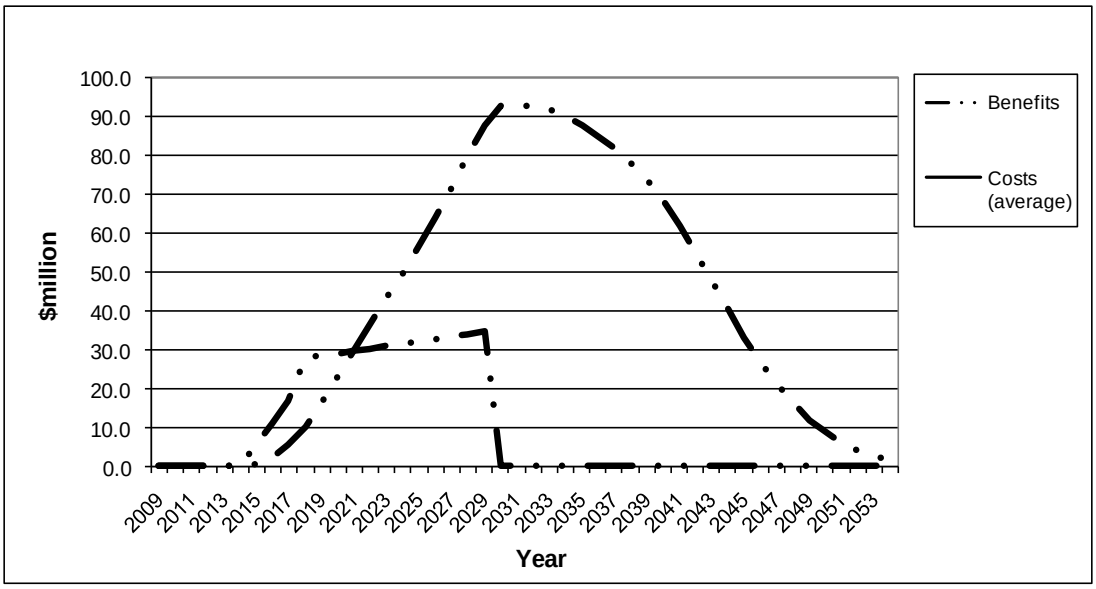
$30-$78 per vehicle cost for pedestrian safety modifications and $3m per year campaign cost.

Option 3: Fleet purchasing policies



$30-$78 per vehicle cost for pedestrian safety modifications and $50,000 per year negotiation cost.

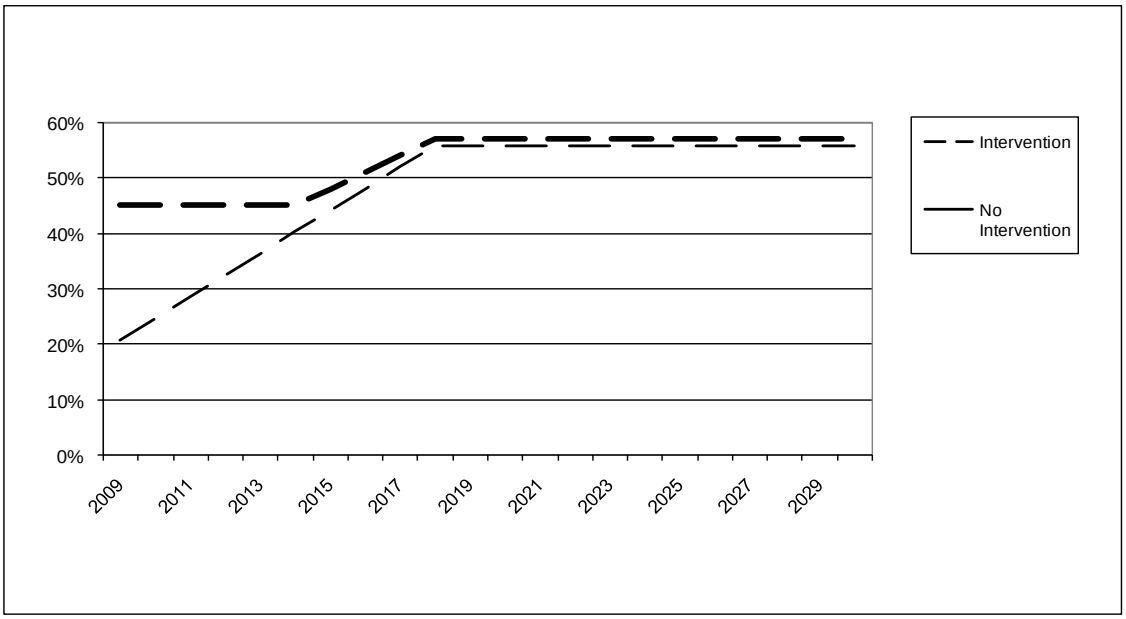
Option 6: Mandatory standards under the MVSA



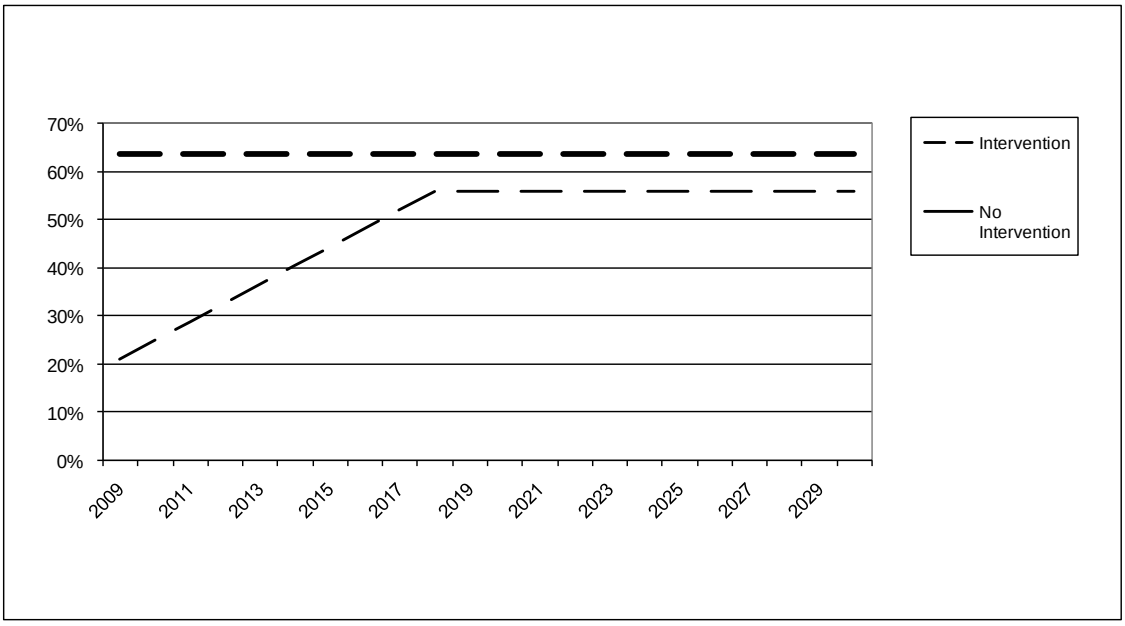
$30-$78 per vehicle cost for pedestrian safety modifications, $50,000 per model certification cost, and $50,000 per year regulation maintenance cost.

Figure 8 Comparison of the expected fitment rate of No intervention (Option 1) to Intervention (Options 2, 3 and 6) over time

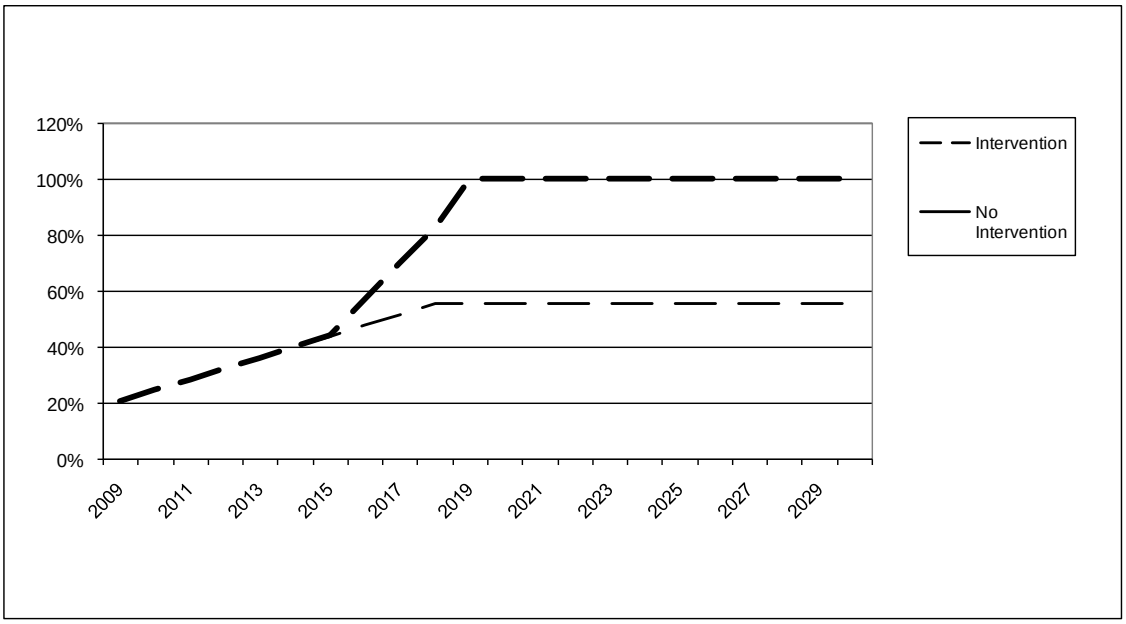
Option 2: User information campaigns – Awareness



Option 3: Fleet purchasing policies



Option 6: Mandatory standards under the MVSA



7.3. Summary of the Results

Option 2: User information campaigns, Option 3: Fleet purchasing policies, and Option 6: Mandatory standards under the MVSA, all gave positive net benefits for the Best, Likely and Worst cases. Option 6 gave the highest net benefits, followed by Option 3. The net benefits for Option 2 were significantly lower than for Options 3 and 6.

The Benefit-Cost Ratios (BCRs) were above one for all three options analysed, ranging from 1.4 to 3.0 for the Likely case. This means that each option will provide more benefits through reduced road trauma than it will cost to implement. The Option 3 BCR of 3.0 was the highest, followed by the Option 6 and Option 2 BCRs of 2.5 and

1.4 respectively.

In terms of costs over the assumed 15 year life of regulation, Option 6, the regulation option, was the most expensive to implement. The estimated cost to implement Option 6 was $162m (including costs to business and government). Option 3, the fleet purchasing policies option was next at $108m, while Option 2, the user information campaigns option was the cheapest at $64m.

In terms of the number of lives saved, Option 6: Mandatory standards under the MVSA was the highest by a considerable margin, at 65 lives saved over the assumed 15 year life of regulation. Option 2: User information campaigns and Option 3: Fleet purchasing policies saved 8 and 29 lives respectively.

Each option affected the Option 1 No intervention (or Business As Usual (BAU)) case in a different way, as discussed below.

Option 1: No intervention was the base case and so had no allocated benefits or costs associated with it. It was assumed that the voluntary fitment rate would reach 60 per cent for passenger cars and SUVs and 39 per cent for LCVs by 2018. This was based on the proportion of vehicles imported to Australia from Europe and Japan, where new vehicles will be required to meet pedestrian safety regulations by 2018. After that it was assumed that the rate would stay constant for the foreseeable future. This trend can be observed in the No intervention series within the graphs presented in Figure 8.

In Option 2: User information campaigns it was assumed that an ongoing awareness campaign, costing $3m per year, would bring the fitment rate up to 45 per cent, but do no more than maintain this level in the long term. Figure 8 shows that for the first five years the fitment rate is raised to 45 per cent. After five years, the passenger cars and SUV rate has gone beyond 45 per cent in the BAU scenario, while the LCV rate is still well below this level. In fact, the LCV rate remains below 45 per cent for the entire period of analysis and so the awareness campaign continues indefinitely. The benefits will continue to accrue as long as the LCV rate under the BAU case would have otherwise have remained at below 45 per cent.

In Option 3: Fleet purchasing policies a flat increase approach was used. Here it was assumed that initial fleet negotiations would increase the initial fitment rate by 41 per cent for passenger cars and SUVs and 50 per cent for LCVs. This reflects the potential gains identified earlier in the RIS. Because the BAU remains below this level for the entire period of analysis, fleet negotiations continue. The benefits will continue to accrue as long as the BAU rates would have otherwise have remained at below the level achieved through fleet purchasing policies.

In Option 6: Mandatory standards under the MVSA there is a pro-rata transition phase from the BAU fitment rate to 100 per cent between 2015 and 2019. As the final BAU fitment rate was assumed to be 56 per cent (the combined rate for passenger cars, SUVs, and LCVs), regulation is ongoing and forces compliance to 100 per cent. This can be seen in Figure 8. It can also be seen in Figure 7 that the costs begin with the introduction of the regulation in 2015 and steady at the end of the transition phase in 2019, followed by a gradual rise in line with the increasing overall fleet size expected

for Australia. As with Options 2 and 3, the benefits will continue to accrue as long as the BAU level would have otherwise have remained below the level achieved through intervention, in this case 100 per cent.

7.4. Sensitivity Analysis

A sensitivity analysis was carried out to determine the effect on the outcome of some of the less certain inputs to the benefit-cost analysis. Only Option 6 was tested as this was the option that gave the highest net benefits.

The possible range of costs for pedestrian safety modifications had already been considered in the main benefit-cost analysis through the Best, Likely and Worst case scenarios. The remaining uncertainties that could adversely affect the options were the effectiveness, the final expected voluntary fitment rate under the BAU (Option 1 No intervention) case and the discount rate of the benefits and costs. A sensitivity analysis was undertaken on each of these variables as presented below for the Likely case (i.e. average costs). Detailed results of the sensitivity tests can be found at **Error! Reference source not found.**.

Effectiveness

The effectiveness of passive pedestrian safety measures was considered to be reasonably accurate, as it was taken from a comprehensive study and subsequently tailored to the Australian context. However, to account for any uncertainty, the effectiveness of 9.6% was varied by ±20%. As seen in Table 15, the net benefits are positive even when the effectiveness is reduced by 20%.

Table 15 Impacts of changes to effectiveness

Scenario	Net Benefits ($m)	Benefit-Cost Ratio
Low effectiveness (7.7%)	115	2.0
Base case effectiveness (9.6%)	185	2.5
High effectiveness (11.5%)	254	3.0

Business As Usual (BAU) voluntary fitment rate

As noted earlier in the RIS, the estimate for the future voluntary fitment rate was based on the proportion of vehicles imported to Australia from Europe and Japan, where new vehicles will be required to meet pedestrian safety regulations by 2018. After that it was assumed that the rate would stay constant for the foreseeable future. A sensitivity test was conducted with the final BAU fitment rate reaching 95 per cent. Although it is considered highly unlikely that the final BAU would reach 95 per cent, this was chosen as an extreme scenario. As shown in Table 16, there is a small net cost of $0.1m under this unlikely scenario.

Table 16 Impacts of changes to the BAU voluntary fitment rate

Scenario	Net Benefits ($m)	Benefit-Cost Ratio
Base case BAU fitment rate (60% passenger cars and SUVs, 39% LCVs)	185	2.5
High BAU fitment rate (95% passenger cars and SUVs, 95% LCVs)	-0.1	1.0

Discount rate

A sensitivity test was conducted using discount rates of 3 and 11 per cent. Table 17 shows that the net benefits are positive under all three discount rates.

Table 17 Impacts of changes to the discount rate

Scenario	Net Benefits ($m)	Benefit-Cost Ratio
Low discount rate (3%)	574	3.5
Base case discount rate (7%)	185	2.5
High discount rate (11%)	59	1.9

Assumptions

A number of assumptions were made in the benefit-cost analysis. Details of these can be found at **Error! Reference source not found.**.

8. ECONOMIC ASPECTS - IMPACT ANALYSIS

Impact analysis considers the magnitude and distribution of the benefits and costs that have been calculated. It also looks at the impact of each option on the affected parties.

8.1. Identification of Affected Parties

In the case of pedestrian safety, the parties affected by the options are:

Business/Consumers

- vehicle manufacturers or importers;
- vehicle owners;
- vehicle operators;
- aftermarket product suppliers; and

Governments

- Australian/state & territory governments and their represented communities.

The Business/Consumers parties are represented by several interest groups. Those relevant to the topic of this RIS include the:

- Federal Chamber of Automotive Industries (FCAI), that represents the automotive sector and includes vehicle manufacturers, vehicle importers and component manufacturers/importers;
- Federation of Automotive Product Manufacturers (FAPM) that represents the automotive component manufacturers/importers;

- Australian Automobile Association (AAA) that represents vehicle owners and operators (passenger cars and derivatives) through the various automobile clubs around Australia (RAC, RACV, NRMA etc); and
- Australian Automobile Aftermarket Association (AAAA) that represents the after-market industry.

8.2. Impacts of the Remaining Options

There were four options that were considered feasible: 1) No intervention, 2) User information campaigns, 3) Fleet purchasing policies and 6) Mandatory standards (internationally based) under the MVSA. This section looks at the impact of each of the options in terms of quantifying the expected benefits and costs, and identifies how these would be distributed within the community. This is discussed below and summarised in Table 18 on page 48.

Option 1: No intervention

Allow market forces to provide a solution.

As this option is the base case (Business As Usual case), there are no benefits or costs allocated. All other options are calculated relative to this base case option.

Option 2: User information campaigns

Inform consumers about the benefits of pedestrian friendly vehicles using information campaigns (suasion).

As this option involves intervention only to influence consumer desire in the market place, the benefits and costs are those that are expected to occur on a voluntary basis, over and above those in the no intervention option (Option 1 above). The fitment of pedestrian safety measures would remain a commercial decision within this changed environment.

Benefits

Business

There would be no direct benefit to business (over and above that of Option 1) as a result of a reduction in road trauma caused by vehicles that are sold with pedestrian safety measures due to the user information campaign.

Consumers

There would be a direct benefit to consumers and the wider community (over and above that of Option 1), as a result of a reduction in road trauma for those who drive a vehicle with pedestrian safety measures due to the information campaign, and who avoid or minimise the effects of a crash due to the action of these measures.

Governments

There would be an indirect benefit to governments (over and above that of Option 1) as a result of a reduction in road trauma for those who drive a vehicle with pedestrian safety measures due to the user information campaign, and who avoid or minimise the effects of a crash due to the action of these measures.

This option would add approximately $81m over and above Option 1. This benefit would be shared with governments and so the community.

Costs

Business/Consumers

There would be a direct cost to business/consumers (over and above that of Option 1) as a result of additional design, fitment and testing costs for vehicles that are sold with pedestrian safety measures due to the user information campaign. This would add between $18m and $48m over and above Option 1.

Governments

There would be a cost to governments for funding or running user information campaigns that inform the consumer of the benefits of pedestrian safety measures. This is estimated at $30m.

Option 3: Fleet purchasing policies

Only allow vehicles that provide a certain level of pedestrian safety for government purchases (economic approach).

As this option involves direct intervention to change demand in the market place, the benefits and costs are those that would occur on a voluntary basis, over and above those determined in the no intervention option (Option 1 above). The fitment of pedestrian safety measures would remain a commercial decision within this changed environment.

Benefits

Business

There would be no direct benefit to business (over and above that of Option 1) as a result of a reduction in road trauma caused by vehicles that are sold with pedestrian safety measures due to fleet purchasing policies.

Consumers

There would be a direct benefit to fleet owners and the wider community (over and above that of Option 1), as a result of a reduction in road trauma for those who drive a fleet vehicle with pedestrian safety measures due to fleet purchasing policies, and who avoid or minimise the effects of a crash due to the action of these measures.

Governments

There would be an indirect benefit to governments (over and above that of Option 1) as a result of a reduction in road trauma for those who drive a vehicle with pedestrian safety measures due to fleet purchasing policies, and who avoid or minimise the effects

of a crash due to the action of these measures.

This option would add $262m over and above Option 1. This benefit would be shared with governments and so the community.

Costs

Business/Consumers

There would be a direct cost to business/fleet owners (over and above that of Option 1) as a result of additional design, fitment and testing costs for vehicles that are sold with pedestrian safety measures due to fleet purchasing policies. This would add between $60m and $155m over and above Option 1. This cost would be passed on to the consumer.

Governments

There would be a cost to governments for administering fleet purchasing policies that require the purchase of vehicles with pedestrian safety measures. This is estimated at $0.51m.

Option 6: Mandatory standards under the MVSA

Mandate standards for pedestrian safety under the *Motor Vehicle Standards Act 1989* (C'th) (MVSA) based on international standards from the United Nations Economic Commission for Europe (UNECE) (regulatory – mandatory).

As this option involves direct intervention to change the specification of the product supplied to the market place, the benefits and costs are those that would occur on a mandatory basis, over and above those determined in the no intervention option (Option 1 above). The fitment of pedestrian safety measures would no longer be a commercial decision within this changed environment.

Benefits

Business

There would be no direct benefit to business (over and above that of Option 1) as a result of a reduction in road trauma on vehicles that are sold fitted with pedestrian safety measures due to the Australian Government mandating standards.

Consumers

There would be a direct benefit to vehicle owners and the wider community (over and above that of Option 1), as a result of a reduction in road trauma for those who drive a vehicle with pedestrian safety measures due to the Australian Government mandating standards, and who avoid or minimise the effects of a crash due to the action of these measures.

Governments

There would be an indirect benefit to governments (over and above that of Option 1) as

a result of a reduction in road trauma for those who drive a vehicle with pedestrian safety measures due to the Australian Government mandating standards, and who avoid or minimise the effects of a crash due to the action of these measures.

This would add $347m over and above Option 1. This benefit would be shared with governments and so the community.

Costs

Business/Consumers

There would be a direct cost to business/fleet owners (over and above that of Option 1) as a result of additional design, fitment and testing costs for vehicles that are sold with pedestrian safety measures due to the Australian Government mandating standards. This would add between $99m and $225m over and above Option 1. This cost would be passed on to the consumer.

As discussed in Section 6.6, there may be a further direct cost to vehicle manufacturers - but more likely an indirect cost to aftermarket suppliers - where a Vehicle Front Protection System (VFPS) has been fitted to a vehicle. The fitting of a VFPS to a vehicle subject to GTR 9 through the Australian Design Rules (ADRs) would at least require re-testing of each vehicle model, as the performance characteristics of the front structure of the vehicle would be significantly altered with regards to pedestrian protection. This would be true whether the VFPS is fitted as original equipment or as an aftermarket item, given that state and territory regulations apply to in-service vehicles and generally require continued compliance to the ADRs.

For each vehicle model there would be a cost per matched VFPS model. In terms of the main types of vehicles that would be fitted with a VFPS, this would be the case for all models of vehicles in the MC category (four-wheel drives or sports utility vehicles) and the NA category (light commercial vehicles) for complete coverage of all vehicles. As there are currently 142 models of these vehicles (see Table 4), these testing costs could be significant. However, these costs were not used towards the main benefit-cost analysis as alternative solutions to the issue of VFPS have been explored further as part of the discussion in Section 9.9.

Governments

There would be a cost to governments for developing, implementing and administering regulations (standards) that require vehicles to meet a minimum level of pedestrian safety. This is estimated at $0.51m.

Table 18 Summary of the benefits and costs of pedestrian safety measures over a forty six year period of analysis

Affected Parties	**Option 1 No intervention**		**Option 2 User information campaigns**		**Option 3 Fleet purchasing policies**		**Option 6 Mandatory standards under the MVSA**	
	BENEFITS	**COSTS**	**BENEFITS**	**COSTS**	**BENEFITS**	**COSTS**	**BENEFITS**	**COSTS**
Business	-	-	None	Increased costs of vehicles $18m - $48m	None	Increased costs of vehicles $60m - $155m	None	Increased costs of vehicles and regulation compliance costs. $99m - $225m
Consumers	-		Reduced road trauma $81m		Reduced road trauma $262m		Reduced road trauma $347m	
Government		-		Cost of funding and running campaigns $30m		Cost of administering fleet purchasing policies $0.51m		Cost of implementing and administering regulations, does not include state and territory govts follow-on costs for in-service regulation $0.51m
Lives Saved	-		8		29		65	
Benefit/Cost Ratio	-		1.0-1.7		1.7-4.4		1.5-3.5	

Note: Total benefits are shown. The Summary in **Error! Reference source not found.** shows the split between Business/Consumers and Government costs.

9. DISCUSSION

The four scenarios that were prepared for estimating the benefits and costs from pedestrian safety represented the four options that were considered feasible:

- Option 1: No intervention;
- Option 2: User information campaigns;
- Option 3: Fleet purchasing policies; and
- Option 6: Mandatory standards under the *Motor Vehicle Standards Act 1989* (C'th) (MVSA) (Regulation).

9.1. Net Benefits

Option 6: Mandatory standards under the MVSA had the highest net benefits at a Likely value of $185m resulting from the assumed 15 year life of regulation. These benefits would be spread over a period that goes beyond the 15 years that the intervention was in place. Option 2: User information campaigns and Option 3: Fleet purchasing policies also had positive Net Benefits of $18m and $155m respectively for the Likely case.

9.2. Benefit-Cost Ratios

Option 3: Fleet purchasing policies had the highest Benefit-Cost Ratio (BCR) at a Likely value of 3.0. Option 6: Mandatory standards under the MVSA had the next highest BCR at a Likely value of 2.5, followed by Option 2: User information campaigns with a BCR of 1.4 for the Likely case. The high BCR of Option 3 reflects the relatively low cost needed to negotiate a fleet purchasing agreement.

9.3. Lives Saved

Option 6: Mandatory standards under the MVSA had the highest number of lives saved at 65 over the assumed 15 year life of regulation. This was more than twice the number lives saved under Option 3: Fleet purchasing policies. Option 2: User information campaigns saved the lowest number of lives at 8.

9.4. The Case for Intervention

This Regulation Impact Statement (RIS) has identified a current road safety problem for Australia. Over 200 fatalities and many additional injuries occur each year due to collisions of vehicles with pedestrians and other vulnerable road users. Research has shown that by modifying the construction of the front of vehicles, these fatalities and injuries could be reduced by between 4 and 13 per cent – provided certain performance requirements are met. It has been argued that there is an externality with regards to pedestrian safety and vehicle crashes that market forces may not be able to correct. This is because the individual who pays for pedestrian safety does not receive the main benefit of it. The main benefit is received by the pedestrian, or other vulnerable road user, through the reduction of road trauma. It is not received by the owner responsible for making the purchasing decision regarding the vehicle. Because of this, there is little incentive for the owner to demand pedestrian friendly designs from the vehicle manufacturer.

The pedestrian safety measures currently in Australian vehicles may be for the most part a response to regulation within the major vehicle producing economies of Europe and Japan. Although some active pedestrian safety systems are being developed and marketed (e.g. the Volvo S60), manufacturers in Australia have indicated that there is no defined program for improving pedestrian safety apart from through these regulations. The estimated voluntary rate of compliance reflects this, as does the negligible promotion of passive pedestrian safety features in vehicle advertising. Given the above, there is a case for intervention in order to reduce the fatalities and injuries associated with collisions of vehicles with pedestrians and other vulnerable road users.

There are advantages to intervention by regulation as compared to other non-regulatory means, especially in an environment of lower rates of voluntary take-up. Option 6: Mandatory standards under the MVSA (Regulation) was the only option that could guarantee 100 per cent fitment of pedestrian safety measures, both within the implementation timeframe (discussed in section 9.7), and thereafter. There would be no guarantee that non-regulatory options would deliver an enduring result. Furthermore, changing economic pressures could significantly impact the merits of these options. Monitoring the market would bring in added complications such as defining what is meant by a pedestrian friendly vehicle (in the absence of a mandatory standard), setting the lower limit at which point intervention would have to be reconsidered, and determining what minor digressions, if any, would be tolerated. If regulation did need to be reconsidered, there would also be a long lead time needed to bring it in at a later time. Therefore, if 100 per cent penetration with high confidence is the desired outcome, Option 6 is the only option that can deliver this.

Option 6 Regulation has the potential to offer positive net benefits of $185m and a saving of at 65 lives over a forty six year period of analysis (assuming that the standard was active for fifteen years within this period) if the final level of voluntary take-up were to reach the expected 60 per cent for passenger cars and SUVs and 39 per cent for LCVs by 2018, in line with the proportion of vehicles being imported to Australia from Europe and Japan (where they will be required to meet pedestrian safety regulations by 2018). These savings would be higher than any of the other options that were considered feasible. In addition to the lives saved it should be highlighted that the pedestrian safety measures under the regulation option would be particularly effective at reducing serious injuries, by some three times that of fatalities (refer Table 13 where fatalities are expected to be reduced by 4.1 per cent and serious injuries by 13.4 per cent). Given that there are 15.6 serious injuries for each vulnerable road user fatality (refer page 13), this means that a saving of 65 lives over the period of analysis will also result in a saving of well over 3,000 serious injuries (65 x [13.4% / 4.1%] x 15.6 / 1) as well. In terms of annual figures, **Error! Reference source not found.** show that lives saved will peak at around 3 per year. This would correspond to a saving of 150 serious injuries per year as well.

It is of course possible that the voluntary percentage take-up of pedestrian friendly vehicles could increase in anticipation of any regulatory intervention, both in Australia and overseas, resulting in a decrease in the net benefits of Option 6. However, as part of the sensitivity analysis, the Benefit-Cost Analysis was performed under the hypothetical scenario of a take-up rate reaching 95 per cent by 2018. Even under this extremely unlikely scenario, Option 6 is able to provide positive net benefits under all but one of the scenarios tested. However, this scenario was highly unlikely and the net benefits were only slightly negative. This demonstrates the potential that pedestrian safety measures have to make a difference.

Although Options 2 and 3 have been treated separately, they are not mutually exclusive and can continue in one form or another regardless of the recommendation of this RIS. In fact, it is possible that measures such as those proposed in Options 2 and 3 have already contributed to the current level of take-up of pedestrian friendly vehicles. However, it is important to note that the benefits of Options 2 and 3 are less assured than the benefits of Option 6 and so would lie somewhere between the base (business as usual) case and their calculated values. This would be similar for the costs. This reflects the fact that the response to these options relies on two factors; firstly that consumers will receive the message favourably and secondly that manufacturers will perceive any increased demand and act accordingly.

From an international perspective, and as a contracting party to the United Nations 1998 Agreement (see section 6.6), Australia must subject Global Technical Regulation No. 9 for Pedestrian Safety to its domestic rulemaking process. This RIS is part of that process. While Australia is not obliged to mandate pedestrian safety (even though it voted for the GTR to be established), if a regulatory option is chosen it is obliged to adopt the accepted international standard, in this case GTR 9.

Therefore, Option 6: Mandatory standards under the *Motor Vehicle Standards Act 1989* (C'th) (MVSA) represents an effective and robust option. It is also the only option with a guaranteed 100 per cent outcome both at the time of implementation and in the future.

9.5. Recommendation

Option 6: Mandatory standards under the *Motor Vehicle Standards Act 1989* (C'th) (MVSA) is the recommended option. Given the readily available benefits of pedestrian safety measures and their potential to save lives, even if there were reasonably high voluntary fitment rates, it represents an effective and robust option. It is also the only option with a guaranteed 100 per cent outcome both at the time of implementation and in the future.

9.6. Impacts

Business/Consumers

The four options considered would have varying degrees of impact on consumers, business and the government. The costs to business would be passed on to the consumers, as the vehicle industry is driven by margins. The benefits would flow to the community (due to the negative externalities of road vehicle crashes) and the consumers. Governments would absorb much of the cost of the intervention (such as information programs, regulation etc).
Option 6: Mandatory standards under the MVSA would be the most difficult option for the vehicle manufacturing industry. This is because it involves regulation based development and testing with forced compliance of all applicable models. Manufacturers or those importing from the European Union or Japan would have the least difficulty. Vehicles imported from these markets represent around 60 per cent of Australia's passenger vehicles.

There may be a further direct cost to vehicle manufacturers - but more likely an indirect cost to aftermarket suppliers - where a Vehicle Front Protection System (VFPS) has been fitted to a vehicle. The implications of this were first raised in Section 6.6 and are discussed later in the RIS.

Governments

The Australian Government operates and maintains the vehicle certification system, which is used to ensure that vehicles first supplied to the market comply with the Australian Design Rules (ADRs). There are costs incurred in operating this service. A cost recovery model is used and so these costs are recovered from business.

State and territory governments need to review in-service regulations and the effect that a pedestrian safety regulation would have on allowable vehicle modifications, given the principle of continued compliance to the ADRs. With reference to VFPS in particular, this is discussed later in the RIS.

9.7. Timing of the Preferred Option

If Option 6: Mandatory standards under the *Motor Vehicle Standards Act 1989* (C'th) (MVSA) was to be adopted, it was concluded earlier that the recommended standard to be applied is the internationally accepted Global Technical Regulation (GTR) No. 9 Pedestrian Safety. However, as mentioned earlier in the RIS, the GTR does not prescribe a timetable for implementing the regulation.

The draft UNECE regulation on pedestrian safety, which incorporates the requirements of the GTR, does contain implementation timing. It sets out a phase-in approach as follows:

- For vehicles of category M1 not exceeding 2,500 kg GVM, and vehicles of category N1 derived from them, the regulation will apply to:
  - new vehicle types as from 24 February 2013, and
  - all new vehicles as from 24 February 2018.

- For vehicles of category M1 exceeding 2,500 kg GVM, as well as vehicles of category N1 other than those mentioned above, the regulation will apply to:
  - new vehicle types as from 24 February 2015, and
  - all new vehicles as from 24 August 2019.

As a contracting party to the 1958 Agreement, it is Australia's policy to harmonise the ADRs with the international regulations adopted by the UNECE under the 1958 Agreement, except where it is necessary to take account of unique Australian conditions. It is also important to align with internationally agreed timing under the UNECE 1958 Agreement. This is because the Australian market represents only 1 per cent of the global market and so the model range available to the consumer in Australia is sensitive to any unique Australian requirements. Around 84 per cent of vehicles are imported, with only 16 per cent locally manufactured. These two figures have reversed during the past twenty or so years. Europe represents around 25 per cent of Australia's imported passenger cars while the US only represents around 5 per cent. Therefore, an ADR should be internationally harmonised as much as possible. For this reason, the timetable set out in the draft UNECE regulation on pedestrian safety would be the most feasible timetable.

9.8. Scope of the Preferred Option

GTR 9 applies to vehicles of category 1-1, 1-2 and 2 (as defined in 1998 Global Agreement Special Resolution No. 1) with a gross vehicle mass exceeding 500 kg but not exceeding 4,500 kg. This translates to the UNECE categories of M1, M2 and N of 4,500 kg or less and the Australian categories of MA (passenger cars), MB (passenger vans), MC (four-wheel drives or Sports Utility Vehicles), MD1, MD2 and MD3 (small and medium buses), as well as NA and NB1 (light and medium commercial vehicles) (refer **Error! Reference source not found.**). However, the GTR states that contracting parties may restrict application of the requirements to a narrower group of vehicles if they decide that such restriction is appropriate.

In line with this, the draft UNECE regulation applies to a narrower group of vehicles, that is, vehicles of category M1 and N1 only. This translates to Australian categories of MA (passenger cars), MB (passenger vans), MC (four-wheel drives or Sports Utility Vehicles) and NA (light commercial vehicles). It is important to highlight that the technical requirements are the same for all of the applicable categories. It is the implementation date that has been brought forward for lighter MA, MB and MC vehicles and any NA vehicles where their design has been derived from the lighter MA, MB or MC vehicles (see Section 9.7 above).

There is also an exemption that is in both the GTR and draft UNECE regulation. The requirements do not apply to vehicles of category N1 and (optionally as decided by the Contracting Parties) to vehicles of category M1 above 2,500 kg maximum mass and which are derived from N1 category vehicles, where the driver's position "R-point" is either forward of the front axle or longitudinally rearwards of the front axle transverse centreline by a maximum of 1100 mm.

It is recommended that the UNECE regulation is adopted for the scope of any Australian regulation.

9.9. Vehicle Front Protection Systems

As discussed in Sections 6.6 and 8.2, the fitting of a Vehicle Front Protection System (VFPS) such as a "bull bar" or "nudge bar" to a vehicle subject to GTR 9 through the Australian Design Rules (ADRs) would require re-testing of the vehicle, as the performance characteristics of the front structure of the vehicle would be likely to be altered in relation to pedestrian protection.

The analysis of this potential impact has been discussed separately to the recommendation for the compliance of vehicles (see Section 9.7 above), as it almost exclusively involves the fitting of aftermarket equipment. The requirements for aftermarket equipment for vehicles come under state and territory control and hence under its legislation. As this Regulation Impact Statement (RIS) was examining the possibility of intervention by the Australian Government, it was only able to consider the option of Commonwealth regulation. Therefore, the analysis has been presented in terms of how the fitting of aftermarket VFPS could affect the outcome of any intervention by the Australian Government on the issue of pedestrian safety.

However, it was also recognised that at some point a vehicle manufacturer may wish to supply a VFPS in conjunction with a new vehicle, in which case Commonwealth requirements would apply. Further, if the Commonwealth and the state or territory legislation

were not aligned in their respective requirements, a manufacturer may choose the least stringent path to certify a VFPS, whether it was by supplying the VFPS as an ADR certified item with a new vehicle purchase or as an aftermarket (post-registration) option.
It also became clear that this RIS offered the opportunity to propose an ADR based solution as to how Commonwealth and state and territory regulation could together best balance pedestrian protection with any genuine need for a VFPS.

An overview of the issue is presented below. A more comprehensive discussion of VFPS is also provided in **Error! Reference source not found.** and this should be referred to for further detail.

VFPS are currently fitted to a number of vehicles in Australia. Their primary purpose is for use in a rural environment, to protect against animal strikes, to provide strong points for vehicle recovery and to provide mounting points for additional equipment such as winches, lights and aerials. However some VFPS, particularly those in used exclusively in an urban environment, are fitted for aesthetic reasons only, or to protect bodywork from minor parking accidents etc.

The majority of VFPS are fitted as aftermarket equipment. The Commonwealth controls the performance standards of vehicles through the Australian Design Rules (ADRs) for new vehicles only (apart from some concessional schemes). There are few if any VFPS certified in conjunction with a new model vehicle. This means that the control of VFPS primarily comes under state and territory legislation as aftermarket equipment rather than under Commonwealth legislation as original equipment.

The Commonwealth has examined the case for requiring the Australian categories of MA (passenger cars), MB (passenger vans), MC (four-wheel drives or sports utility vehicles) and NA (light commercial vehicles) to meet pedestrian safety performance requirements in the form of an Australian Design Rule (ADR). An ADR for pedestrian protection would indirectly impact on the fitting of aftermarket VFPS. This is because state and territory legislation generally requires continued compliance to the ADRs once a vehicle is registered and an aftermarket VFPS would alter the performance of the front of a vehicle in a collision with a pedestrian. It is also possible that a vehicle manufacturer would want to include a VFPS as part of certifying a new vehicle model. Therefore, this RIS needed to consider the impact of VFPS on the proposed pedestrian safety ADR.

The VFPS market is reported to be worth around $285m per year and is dominated by VFPS made of steel or aluminium alloy, although there is a growing proportion of deformable polymer type VFPS. These latter types currently represent only around 2 per cent of the market. However, they are increasingly being purchased for government fleets due to their improved performance in terms of pedestrian protection and their use is expected to increase in the future.

Analysis of the benefits and costs of adopting pedestrian safety requirements in an ADR revealed that it is likely that there would still be net benefits available, regardless of whether VFPS were made to continue to comply with the ADR or exempted from any further requirements, beyond compliance of the original base vehicle. However, in the first case the benefits had the potential to become a negative Net Benefit (although this was highly speculative) if the VFPS industry was unable to meet the full ADR requirements as they

stood. In the second case the net benefits in road trauma reduction would be seriously eroded if some otherwise complying base vehicles were fitted with noncomplying VFPS. It was thought that the second case was the more feasible one, but that there should be adjustments rather than full exemptions and that these should only be for vehicles where a VFPS was providing an essential function.

An ADR for pedestrian safety would be based on the international standard Global Technical Regulation (GTR) 9. This regulation itself makes no reference to VFPS and so evaluating the compliance of a vehicle fitted with a VFPS would be problematic. However, there is a European Union (EU) Directive 2005/66/EC that directly addresses the pedestrian performance of VFPS and complements the requirements of the GTR. If this EU directive were also to be adopted it would still be difficult for current types of steel and aluminium alloy VFPS to comply, although it is known that there are currently complying steel nudge bars and full height (but not full width) polymer VFPS available in the United Kingdom at a similar cost to comparable types in Australia.

ADR 42/04 General Safety Requirements currently specifies design and construction requirements such that a) any additional "objects or fittings" must be technically essential and b) the risk of injury in having them must be reduced as much as possible in still allowing the objects to fulfil their function.

Whether VFPS are fitted for technically essential reasons depends mostly on where the vehicle is being used. In an urban environment, they are less essential; in a rural environment they are more essential. However, an ADR can only mandate requirements to apply to all vehicles, no matter where they are used in Australia. There has been some success by the states and territories in working with the community and industry to minimise the use of pedestrian unfriendly VFPS in urban environments. However, there is still room to improve and the addition of a new ADR for pedestrian safety would make this all the more pressing.

It is proposed that through the ADRs, the fitting of a VFPS could be considered in terms of whether the base vehicle has been designed for off-road operation and hence primarily rural/outback use. Adjustments for VFPS could be limited to vehicles purposely designed for off-road use (Sport Utility Vehicles (MC) and light commercial vehicles (NA) with four-wheel drive), with other vehicles (passenger cars (MA) and two-wheel drive light commercial vehicles (NA)) required to meet more stringent requirements, most likely achieved by owners fitting a deformable polymer VFPS or a nudge bar.

The adjustments mentioned above for VFPS would be in terms of at least meeting Australian Standard for VFPS (bull bars) AS 4876.1 2002. Motor Vehicle Frontal Protection Systems. Part 1: Road User Protection, Sections 1, 2, 3.1 and if possible the impact testing of Section 3.2, in lieu of the full ADR requirements. The Standard is a compromise of achievable pedestrian protection within the current capability of the VFPS industry and a number of peak bodies representing owners, pedestrians, academia, industry and government comprised the committee that developed it. The full proposal is shown in Table 19.

Table 19 Proposed pedestrian safety performance options for VFPS by vehicle type - subject to consultation (Note: this does not represent compliance options for the vehicle itself)

Pedestrian Safety Requirements for VFPS	**MA, MB (passenger cars/vans)**	**NA (2WD light commercial)**	**MC (4WD /SUV)**	**NA (4WD light commercial)**
(i) No requirements	N/A	N/A	N/A	N/A
(ii) AS 4876.1 2002 Sections 1, 2 and 3.1	N/A	N/A	N/A*/ Must Comply	N/A*/ Must Comply
(iii) AS 4876.1 2002 Sections 1, 2, 3.1 and 3.2.	N/A	N/A	Must Comply*/ May Comply	Must Comply*/ May Comply
(iv) EU Directive 2005/66/EC	Must Comply	Must Comply	May Comply	May Comply

*Preferred position.

Comment is sought during the public consultation process on this table and where the best balance of vehicle and occupant protection and pedestrian performance should be set. This is particularly so for the state and territory transport authorities as in 2008 the adoption of AS 4876.1 2002 was rejected in a separate vote on amendments to the Australian Vehicle Standards Rules.

10. CONSULTATION

10.1. General

Development of the Australian Design Rules (ADRs) under the *Motor Vehicle Standards Act 1989* (C'th) (MVSA) is the responsibility of the Vehicle Safety Standards Branch of the Department of Infrastructure and Transport. It is conducted in consultation with representatives of the Australian Government, the National Transport Commission, state and territory governments, manufacturing and operating industries, road user groups and experts in the field of road safety.

The Department undertakes public consultation on behalf of the Federal Minister for Infrastructure and Transport. Under Part 2, section 8 of the MVSA the Minister may consult with state and territory agencies responsible for road safety, organizations and persons involved in the road vehicle industry and organisations representing road vehicle users before determining a design rule.

The Department has already sought views both formally and informally through the established ADR consultative forums, from the state and territory transport authorities regarding pedestrian safety requirements and again separately regarding Vehicle Front Protection Systems. Any comments have been considered when writing this Regulation Impact Statement (RIS). However, little was received at this stage and so it is expected that a majority of the information and views will follow during the public comment period.

10.2. Public Comment

The publication of an exposure draft of the proposal for public comment is an integral part of the consultation process. This provides an opportunity for business and road user communities, as well as all other interested parties, to respond to the proposal by writing or

otherwise submitting their comments to the department. Providing proposals with a RIS assists all stakeholders to identify the impacts of the proposals more precisely and enables more informed debate on the issues.

It is intended that the proposal be circulated for 60 days public comment. At this time, notification will also be sent to the World Trade Organisation as part of Australia's obligations under the Technical Barriers to Trade agreement.

A summary of public comment input and departmental responses will be included in the final RIS that is used for decision making.

11. CONCLUSION AND RECOMMENDED OPTION

Studies have shown that pedestrian safety measures have a significant potential to save lives, by reducing the problem of the severity of injuries during collisions between vehicles and pedestrians or other vulnerable road users by up to 13 per cent. These collisions account for over 200 fatalities and many additional injuries that occur each year in Australia.

The market response has been limited, due to the nature of pedestrian safety in that the individual who pays for the vehicle and hence for the pedestrian safety features does not receive the main benefit of them. The main benefit is received by the pedestrian, or other vulnerable road user, through the reduction of road trauma. Because of this, there is little incentive for the owner to demand pedestrian friendly designs from the vehicle manufacturer.

The Australian market is responding for the most part to existing or impending regulations for passive pedestrian safety measures within the major vehicle producing economies of Europe and Japan. The current compliance of the fleet was estimated at 26 per cent for passenger cars and Sports Utility Vehicles (SUVs), with no Light Commercial Vehicles (LCVs) estimated to pass.

A benefit-cost analysis found that there was a case for the provision of pedestrian safety measures for passenger cars, SUVs and LCVs through government intervention. The level of voluntary percentage take-up of these measures did not alter this finding.

Option 6 Regulation has the potential to offer positive net benefits of $185m and a saving of at 65 lives, as well as over 3,000 serious injuries, over a forty six year period of analysis (assuming that the standard was active for fifteen years within this period) if the final level of voluntary take-up were to reach the expected 60 per cent for passenger cars and SUVs and 39 per cent for LCVs by 2018, in line with the proportion of vehicles being imported to Australia from Europe and Japan (where they will be required to meet pedestrian safety regulations by 2018). These savings would be higher than any of the other options that were considered feasible.

Given the strong potential for pedestrian safety measures to reduce road trauma, preference was also given to Option 6 because it could assure the highest level of compliance. Option 6: Regulation was the only option that would guarantee 100 per cent fitment within the implementation timeframe of other major vehicle producing countries in the world and thereafter. There can be no guarantee that the other options would deliver an enduring result.

Therefore, the adoption of mandatory standards (Regulation) under the *Motor Vehicle Standards Act 1989* (C'th) (MVSA) was the recommended option. The recommended standard to be applied was the internationally accepted Global Technical Regulation (GTR) No. 9 Pedestrian Safety, as adopted by the UN through the UNECE regulations.

It was recommended that the standard be applied to the Australian categories of MA (passenger cars), MB (passenger vans), MC (four-wheel drives or Sports Utility Vehicles) and NA (light commercial vehicles) (refer **Error! Reference source not found.**). In line with the GTR and the corresponding UNECE regulation, the requirements would not apply to "flat

fronted" vehicles of category NA and vehicles of category MA, MB and MC that are above 2,500 kg and which are derived from NA vehicles.

The recommended implementation timetable was as for the European Union's (and other countries under the United Nations Economic Commission for Europe (UNECE) 1958 Agreement) implementation timetable of 2013-2019 (depending on the vehicle mass). This would accommodate the relatively long lead time needed to redesign the front structure of the current models, or to supersede the current models where necessary.

Compliance to pedestrian safety requirements would be affected by the practice of fitting Vehicle Front Protection Systems (VFPS) (known as "bull bars") to vehicles. An analysis of this potential impact was discussed separately to the recommendation for the compliance of vehicles, as it mainly involved the fitting of aftermarket products which in turn come under state and territory legislation rather than Commonwealth legislation. The results generally showed that it is likely that there would still be net benefits, regardless of whether compliance of VFPS to pedestrian safety requirements was mandated.

Input on VFPS during the public comment period will form part of the final decision making. This may include whether there should be awareness campaigns run in conjunction with the aftermarket industry, about balancing any genuine need for VFPS for vehicle/vehicle occupant protection with the genuine need for vehicles to provide better pedestrian protection. The Department has already sought views, through the established ADR consultative forums, from the state and territory transport authorities regarding pedestrian protection and again separately regarding VFPS and any comment has been considered when writing this RIS. However, it is expected that a majority of the information and views will follow during the public comment period.

12. IMPLEMENTATION AND REVIEW

An ADR for pedestrian safety would be given force in law in Australia by determining it as a vehicle standard under the *Motor Vehicle Standards Act 1989*. It would be implemented under the type approval arrangements for new vehicles administered by the Vehicle Safety Standards branch of the Department of Infrastructure and Transport.

The arrangements in place for the on-going development of the ADRs are the same as those for initial development. This is the responsibility of the Vehicle Safety Standards branch of the department and is carried out in consultation with representatives of Australian Government, state and territory governments, manufacturing and operating industries, road user groups and experts in the field of road safety.

Where the stringency of a standard is increased or there is a change in applicable categories, a suitable lead-time would be negotiated with industry. This is typically 18 months for new models and 24 months for all other models, but may extend beyond this in the case of major redesigning of vehicle systems.

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