Australian Government

Department of Infrastructure, Transport, Regional Development and Local Government

Regulation Impact Statement

for

the Control of Vehicle Stability

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ABSTRACT

Electronic Stability Control (ESC) has a significant potential to save lives by reducing the number and severity of single motor vehicle crashes.

This Regulation Impact Statement (RIS) examined the case for Australian Government intervention in order to complement the current voluntary fitment rate of ESC to the new vehicle fleet in Australia.

The Australian market is responding well and without regulation. As at June 2008, 60 per cent of new passenger vehicles and Sports Utility Vehicles (SUVs) were supplied to the Australian market with ESC. Industry sources expect that there will be a 90-95 per cent fitment rate by 2012-2014.

The analysis concluded that, even given this high expected voluntary fitment rate, the adoption of a mandatory standard (regulation) under the *Motor Vehicle Standards Act 1989* (C'th) (MVSA) could be justified in terms of the benefits it would bring the community. As regulation is expected to generate the highest net benefits of the options examined, it is the recommended option. The final level of voluntary percentage take-up of ESC does not affect this conclusion. Regulation offered positive net benefits of $139m, a Benefit-Cost Ratio of 1.6 and a saving of 128 lives over a thirty year period if the final level of voluntary take-up were to reach and maintain a high of 95 per cent. It is also the only option with a guaranteed 100 per cent outcome both at the time of implementation and further into the future.

The recommended regulation is the *United Nations Global Technical Regulation (GTR) No. 8 Electronic Stability Control Systems*. It is recommended that GTR 8 be applied to vehicles up to 4.5 tonnes including passenger cars, passenger vans, off-road vehicles (SUVs), light and medium goods vehicles (utilities and lighter trucks) and light omnibuses (buses).

The RIS concluded that for the regulatory option, implementation timing before 2012-2014 (for new vehicle models and all vehicle models respectively) would not be possible without affecting the availability of vehicles that could be lawfully supplied to the market. This is because the rapid take-up of ESC has led to a world shortage of development and production resources and because some vehicle models that already utilise ESC technology would need to be modified to meet the requirements of the proposed regulation. For these reasons, the European Union (EU) has set a 2012-2014 timetable. Given the high volume of vehicles imported to Australia from the EU, the RIS proposes a similar timing for Australia. Any consideration of an earlier implementation date would require new costs to be sourced for the economic analysis, in order to take into account the limited development and production resources currently available.

User information campaigns and fleet purchasing policies were also considered worthwhile for increasing the voluntary take-up of ESC, pending a regulation coming into force.

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

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EXECUTIVE SUMMARY

Electronic Stability Control (ESC) is a motor vehicle driver assistance technology that aims to reduce the chance of a vehicle understeering ("plowout") or oversteering ("spinout"), thereby reducing crashes. It is linked to and complements Traction Control Systems (TCS) and Anti-lock Braking Systems (ABS). The technology is marketed under a number of proprietary names including Electronic Stability Program (ESP), Vehicle Dynamic Control (VDC), Vehicle Stability Assist (VSA), Vehicle Stability Control (VSC) and others.

Studies undertaken to date indicate that ESC has a significant potential to save lives by reducing the number and severity of single motor vehicle crashes (SVCs). These crashes account for almost 50 per cent of road crashes in Australia, costing in the order of 450 fatalities and $4 billion per year. It is possible that ESC could account for a real-world reduction in road trauma of around 30 per cent for passenger cars and up to 70 per cent for Sports Utility Vehicles (SUVs) and light commercial vehicles both in Australia and overseas.

ESC has been enthusiastically promoted by industry, government and consumer groups alike. The result has been an unprecedented voluntary take-up of the technology around the world. The highest rate of fitment of ESC is currently 96 per cent in Sweden, where difficult driving conditions and heavy promotion by the Swedish government is likely to have contributed. In Australia the voluntary fitment rate is currently at an average of 60 per cent, which is ahead of the United States (US) and the European average.

Regulation is also beginning to play a role. In the US, a new performance/prescriptive regulation for ESC for light passenger vehicles, FMVSS 126, will be fully in force by 2012. In addition, an international standard, Global Technical Regulation (GTR) No. 8 Electronic Stability Control Systems, GTR 8, has recently been adopted by the United Nations. GTR 8 is a standard based on FMVSS 126. Australia, along with other signatory countries under the *Agreement Concerning the Establishing of Global Technical Regulations for Wheeled Vehicles Equipment and Parts of June 1998*, is obliged to review the case for adopting GTR 8 under its domestic legislation. The United Nations intends to apply GTR 8 in 2012 with a phase in period to 2014. This will be done through the United Nations Economic Commission for Europe standard setting body, Working Party 29. There are currently no other similar regulations in Australia that cover ESC or dynamic vehicle stability generally.

This Regulation Impact Statement (RIS) examines the case for Australian Government intervention in order to complement the current voluntary fitment rate of ESC to the new vehicle fleet in Australia. It does not consider retro-fitting to vehicles that are in-service (i.e. that have already been registered for use on the road). It has been written in accordance with Council of Australian Governments (COAG) 'Principles and guidelines for national standards setting for ministerial councils'.

Any Australian Government intervention must be in accordance with its obligations under the World Trade Organisation (WTO), Asia-Pacific Economic Cooperation (APEC), Trans-Tasman Mutual Recognition Arrangement (TTMRA) and the United Nations Economic Commission for Europe (UNECE) 1958 and 1998 Agreements for motor vehicle regulations.

These generally require regulation to adopt internationally based standards where possible. With Australia producing just one per cent of the world's motor vehicles, these agreements make it possible for consumers to enjoy access to a large range of safe vehicles while positioning the local industry well for the export market.

In the case of ESC, the Australian market is responding well, having come from close to zero per cent fitment of ESC in 2000, to over 60 per cent by 2008. This trend is similar to other parts of the world. The Australian industry has indicated that it plans to have 90-95 per cent fitment by 2012-2014.

Six options are identified to address the underlying issue of SVCs due to loss of vehicular stability. Both non-regulatory and regulatory options were considered. Option 1: No intervention, Option 2: User information campaigns, Option 3: Fleet purchasing policies, Option 4: Codes of practice, Option 5: Mandatory standards under the *Trade Practices Act 1974* (C'th), and Option 6: Mandatory standards (Regulation) under the *Motor Vehicle Standards Act 1989* (C'th). Only Options 1, 2, 3 and 6 were considered feasible and a benefit-cost analysis was carried out for these. Costs were estimated based on advice from vehicle and ESC systems manufacturers as well as departmental information on regulatory processes.

The benefit-cost analysis found that there was a case for the provision of ESC for both passenger cars and Sports Utility Vehicles (SUVs) through government intervention. The final level of voluntary percentage take-up of ESC did not affect this finding. Option 6 Mandatory standards under the MVSA (Regulation) still offered positive net benefits of $139m, a Benefit-Cost Ratio of 1.7 and a saving of 128 lives over a thirty year period if the final level of voluntary take-up were to reach and maintain a high of 95 per cent. Further, there is a case even if the final level of take-up were to reach 100 per cent by 2015/16. This demonstrates the potential that ESC has to make a difference even over a short period of raised fitment rates.

Although Options 2 and 3 have been treated separately, in reality they are part of the No intervention option and have both contributed to the current level of take-up of ESC technology. Furthermore, they are not mutually exclusive and can continue in one form or another, regardless of what is recommended in this RIS. The rapid market response to date has involved effort and resources (information campaigns, direct discussion etc) from the federal and state governments, as well as other road safety groups, in working with the vehicle industry on the issue. Options 2 and 3 build on that success, but they assume to some extent that this current effort would be maintained. 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.

Summary of Net Benefits, Total Benefits, Costs and Benefit-Cost Ratios and Lives Saved- from the provision of ESC on new passenger cars and SUVs

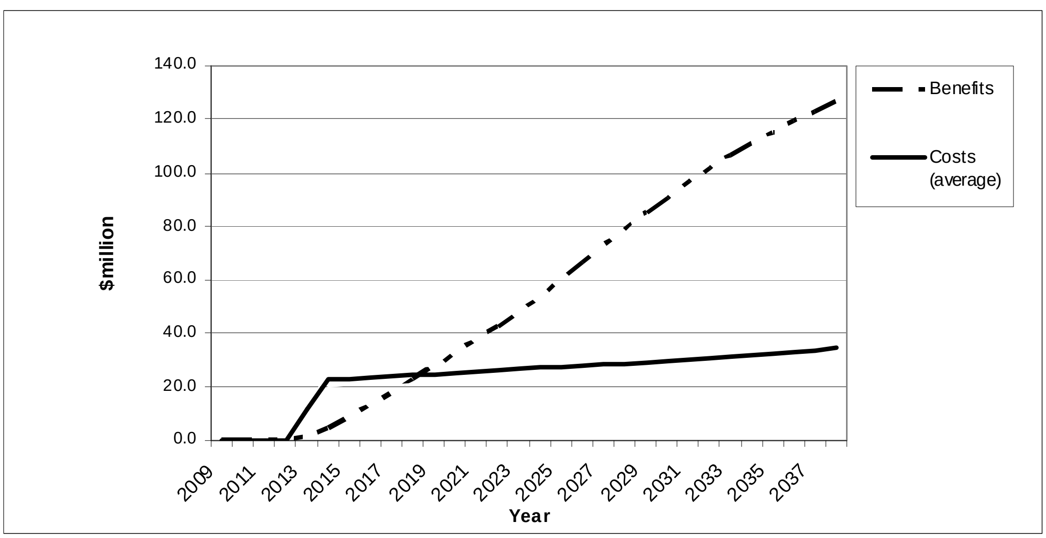
	Net Benefits ($m)			Total Benefits ($m)		
	Best Case	Likely Case	Worst Case	Best Case	Likely Case	Worst Case
Option 1 No intervention	-	-	-	-	-	-
Option 2 Information Campaign	-35 to 58	-51 to 19	-68 to -19	69-574	69-574	69-574
Option 3 Fleet policies	-30	-45	-60	56	56	56
Option 6 Regulation	162	139	115	376	376	376

	Costs ($m)			Benefit-Cost Ratio		
	Best Case	Likely Case	Worst Case	Best Case	Likely Case	Worst Case
Option 1 No intervention	-	-	-	-	-	-
Option 2 Information Campaign	104-516	121-555	137-593	0.7-1.1	0.6-1.0	0.5-1.0
Option 3 Fleet policies	87	101	116	0.6	0.6	0.5
Option 6 Regulation	214	238	261	1.8	1.6	1.4

	Lives Saved		
	Best Case	Likely Case	Worst Case
Option 1 No intervention	-	-	-
Option 2 Information Campaign	13-170	13-170	13-170
Option 3 Fleet policies	11	11	11
Option 6 Regulation	128	128	128

Notes:
Best Case - 25 year period, 7% discount rate, minimum costs
Likely Case - 25 year period, 7% discount rate, average costs
Worst Case - 25 year period, 7% discount rate, maximum costs

Option 6 Regulation: Undiscounted Benefits and Costs over time – passenger cars and SUVs



25 year vehicle life, $395 installation cost, $0.5m-$3m per model development cost, $65,000 per model certification cost, $50,000 per year regulation maintenance cost.

Option 6: Mandatory standards under the MVSA is the only option that would guarantee 100 per cent fitment within the implementation timeframe of the other major vehicle producing countries in the world (see later) and thereafter, to ensure on-going provision of ESC in new vehicles. There can be no guarantee that the other options would deliver an enduring result. Changing economic pressures, or the entry of new players into the market, could see a shift away from the current move to provide ESC equipped cars, particularly at the lower, more competitive end of the market. If the market changed such that regulation did have to be reconsidered at some future time, there would also be a long lead time (likely to be greater than two years due to the implementation, programming, development, testing and certification time necessary for taking ESC systems from first concept to on-the-road) needed to bring it in at that later time.

It is possible that, as the voluntary percentage take-up of ESC increases in the lead up to any implementation of regulatory intervention, the net benefits of Option 6 could dwindle. However, as part of the sensitivity analysis, the Benefit-Cost Analysis was also performed under the assumption that the take-up would reach 100 per cent by 2015/16. Even under these conditions, Option 6 showed that it could provide net benefits in nearly all cases and that these were higher than any other feasible option.

Therefore, Option 6: Mandatory standards under the *Motor Vehicle Standards Act 1989* (C’th) (MVSA) is the recommended option. Given the proven benefits of ESC and its potential to save lives even at reasonably high voluntary fitment rates (from 15 – 128 over thirty years depending on that rate) it still represents an effective option. It is also the only option with a guaranteed 100 per cent outcome both at the time of implementation and for the future.

From an international perspective and as a contracting party to the United Nations 1998 Agreement, Australia must subject the recently established Global Technical Regulation No. 8 for ESC to its domestic rulemaking process. This RIS is part of that process. While Australia is not obliged to regulate to mandate ESC (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 8. It is likely that much of the increase in ESC design and fitment throughout the world has at least partly been in anticipation of most economies doing so.

For those countries, including Australia, who are also party to the United Nations Economic Commission for Europe (UNECE) 1958 Agreement, UNECE Regulation No. 13-H (braking) is expected to be amended to incorporate the text of GTR 8. Regulation 13-H will include an implementation timing of 2012-2014. The European Union (EU) will adopt the 2012-2014 implementation timetable and this timetable is also proposed for Australia. Manufacturers, system suppliers and the authors of GTR 8 have advised that this timetable is necessary to allow for the existing world shortage of ESC development and production resources (due to its rapid take-up). This is significant to Australia as around 25 per cent of imported passenger cars are sourced from the EU, while only around 4 per cent are sourced from the United States (which has an earlier implementation timetable). If a timetable earlier than 2012-2014 was to be considered, new costs would have to be sourced for the economic analysis, in order to take into account the limited developmental and manufacturing resources currently available.

Therefore, if Option 6: Mandatory standards under the *Motor Vehicle Standards Act 1989* (C’th) (MVSA) is adopted, the recommended standard to be applied is the internationally accepted Global Technical Regulation (GTR) No. 8 Electronic Stability Control Systems.

In considering the scope of GTR 8, the benefit-cost results were applied to passenger cars and SUVs only, as light commercial vehicles have not been the focus of the Australian research and reliable data is not available. It should be noted that the GTR (being based on US regulation) extends to commercial based vehicles. In Australia it is proposed similarly to apply the regulation to vehicles up to 4.5 tonnes including passenger cars, passenger vans, off-road vehicles, light and medium goods vehicles and light omnibuses.

Regarding impacts of intervention, Option 6 would be the most difficult option for the vehicle manufacturing industry. It would affect local manufacturers the least, whereas manufacturers importing from the Asian markets would be affected the most. This is because their program of ESC fitment is less advanced as that of other regions. The vehicle and system manufacturers' international bodies predict a world supply shortage of ESC design, testing and manufacturing resources for at least the next few years.

In summary, it is recommended that the Australian Government should consider mandating the technical requirements of Global Technical Regulation (GTR) No. 8 Electronic Stability Control Systems under the *Motor Vehicle Standards Act 1989*, for vehicles up to 4.5 tonnes including Australian Design Rule (ADR) categories of MA (passenger car), MB (passenger van) and MC (Sports Utility Vehicle), NA (light goods vehicles), NB1 (medium goods vehicles), MD1, MD2 and MD3 (light omnibuses), effective 2012 for new models and 2014 for all models. If the Government chooses to proceed on such a basis after public comment, it will be supported by this analysis.

Options such as Option 2: User information campaigns and Option 3: Fleet purchasing policies are also considered worthwhile for increasing the voluntary take-up, pending the regulation coming into force.

As part of the RIS process, the proposal will be circulated for 60 days public comment. 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 approximately $18 billion per annum (Australian Transport Council: National Road Safety Action Plan 2007 and 2008). This translates to an average of $840 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.

Over the past fifteen or so years, an advanced type of anti-skid/anti-roll technology has been available on some passenger vehicles. Early research found that it had the potential to reduce single vehicle crashes substantially. With increased use of the technology and more sophisticated systems being developed, recent research appears to support this prediction in showing actual real-world benefits.

The technology is marketed under various proprietary names, but is most commonly known as Electronic Stability Control (ESC) or Electronic Stability Program (ESP). It was introduced in its modern form by Robert Bosch GmbH and Mercedes-Benz in 1993 and since then has been available as either standard or optional in an increasing number of passenger vehicles of all makes and models, most notably after 2005.

This Regulation Impact Statement (RIS) examines the case for Australian Government intervention to complement the current voluntary fitment rate of ESC/ESP to the new vehicle fleet in Australia. It does not consider retro-fitting to vehicles that are in-service (i.e. that have already been registered for use on the road).

For the purposes of this RIS, the term Electronic Stability Control, or ESC, will be used exclusively throughout the document. This term has widespread use and is one that has been adopted by the Society of Automotive Engineers for describing the technology.

1.2. Background

Electronic Stability Control (ESC) is a motor vehicle driver assistance technology that aims to reduce the chance of a vehicle understeering (“plowout”) or oversteering (“spinout”), thereby reducing crashes. It is linked to and complements Traction Control Systems (TCS) and Anti-lock Braking Systems (ABS). The technology is marketed under a number of proprietary names such as ESC, ESP, VDC, VSA, VSC and others.

ESC monitors the driver’s intended direction of the motor vehicle through the steering wheel and automatically acts on the engine and brake of one or more wheels if the vehicle begins to move off course. By applying uneven braking, directional forces can be generated on the vehicle to assist the steering system in bringing it back on course. The system responds to the difference between the intended (steering input) and actual path and rotational (yaw) rate of a vehicle, and acts to reduce the difference. A computer continuously evaluates the readings from side acceleration and yaw rate sensors and uses TCS and/or ABS to reduce power to or automatically brake individual wheels. ESC is discussed in more detail in Appendix 1 - Overview of Electronic Stability Control Systems.

ESC is a tool to help the driver maintain control of the vehicle using the available traction. While effective in many situations, it cannot override a vehicle's physical limits. If the driver pushes the vehicle beyond these limits, ESC will no longer be able to prevent a loss of control.

ESC is starting to be regulated in some overseas markets. In September 2006, the United States legislated through Federal Motor Vehicle Safety Standard (FMVSS) 126 that all manufacturers must start equipping 2009 models (ie September 2008 vehicles) with ESC and must fit all models with it by 2012. Canada intends to follow a similar path. Europe is presently taking a voluntary approach for light passenger vehicles, their target being consistent with the US at 100 per cent availability for the model year 2012. This approach includes using internet consultation to determine how the availability of ESC can be sped up and through a communication forum called eSafetyAware!

The United Nations Economic Commission for Europe (UNECE) finalised Global Technical Regulation (GTR) 8 for ESC on light passenger vehicles in June 2008. Based on FMVSS 126, 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 of June 1998* (ECE, 2002).

Within Europe, Sweden has the highest fitment rate of ESC at over 95 per cent. The technology has been heavily promoted by the government but is not mandated. This has led to community support and subsequently, inclusion by car-makers (Stanford, 2007). In some studies, large positive effects have been found on icy and snowy roads with smaller effects on dry roads (Erke, 2008). This is likely to be a factor in the rate of implementation in that country.

As with any vehicle safety initiative in Australia, there are a number of options that need to be examined. 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

Australian Transport Safety Bureau (ATSB) figures (ATSB, 2007) show that single vehicle crashes (SVCs) account for almost 50 per cent of fatalities on the roads. Passenger cars, Forward Control Vans (FCV) and four-wheel drives (4WDs or SUVs) account for 88 per cent of these. See Table 1. Under the ADRs, these vehicles are classed as MA, MB and MC category (Department of Infrastructure, Transport, Regional Development and Local Government, 2007). Refer to Appendix 2 - Vehicle Categories for more details on ADR categories.

Table 1 Motor 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: ATSB Fatal Road Crash Database[1]

Australian Transport Safety Bureau (ATSB) figures also show that in 2004 (latest data available) that there were 363 SVC fatalities involving passenger cars and 94 involving SUVs, these being the two most involved vehicle types (although Forward Control Vans – FCVs are included alongside SUVs, in reality there are very few of these vans available for passenger use). Refer to Appendix 3- Single and Multiple Vehicle Crashes and Ratio of Injuries.

Four per cent of the above SVCs were collisions with a) parked vehicles (1 per cent), b) trains (1 per cent) and c) cases where someone fell out of the vehicle (2 per cent) (ATSB, 2007). The remaining 96 per cent were crashes that could be most likely influenced by a countermeasure such as Electronic Stability Control (ESC). This is because the crashes are the type most likely to be as a result of the loss of control of the vehicle and where avoiding the loss, or regaining the control, may have averted the crash. Only these cases were included in the analysis of ESC.

It was determined from the data that around 20 per cent of off-path SVCs (where a vehicle leaves the carriageway) were on straight roads and were likely to have involved drivers who were substantially impaired by alcohol, drugs or fatigue. ESC would be of limited assistance in these cases. However, it is also possible that crash records substantially undercount cases where an unsealed road shoulder is a contributory factor. In-depth crash studies have found this problem to be very common (ATSB, 2007). Therefore, it was decided to include these cases in the analysis of ESC.

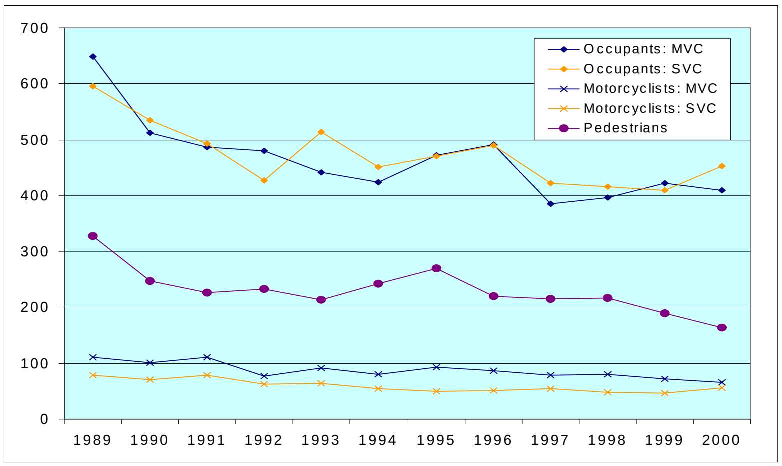
The typical ratio of serious injuries to fatalities for SVC can be seen by comparing Figure 1 and Figure 2 (ATSB, 2007). There were approximately 11 serious injuries for each fatality. The figures exclude New South Wales data but this would not be expected to affect the trend. Appendix 3- Single and Multiple Vehicle Crashes and Ratio of Injuries contains a more accurate calculation of the ratio (10.65) as well as two overseas studies for comparison that show similar trends. These indicate that serious injuries in road crashes are typically 7-11 times the fatalities. The other studies also

[1] Notes: *Car:* includes panel vans and car-based utilities, *4WD:* non-car-based 4WD vehicles, *FCV:* forward control van.

give general guidance for minor injuries in road crashes, suggesting that they are typically around 70 times the fatalities. However, a United Nations study of ESC benefits (Economic Commission for Europe, 2008) using American data found that SVC accounted for 15,007 fatalities and 500,000 injuries (ECE 2008), which could be equated to around 10 serious injuries and 35 minor injuries per fatality from this type of crash (as it was reported that a further 600,000 injuries from multiple vehicle crashes sensitive to ESC occurred, this would again bring the minor injuries ratio back up to 70). Because of this, the ratio of 1 fatality, 10.65 serious injuries and 70 minor injuries has been used.

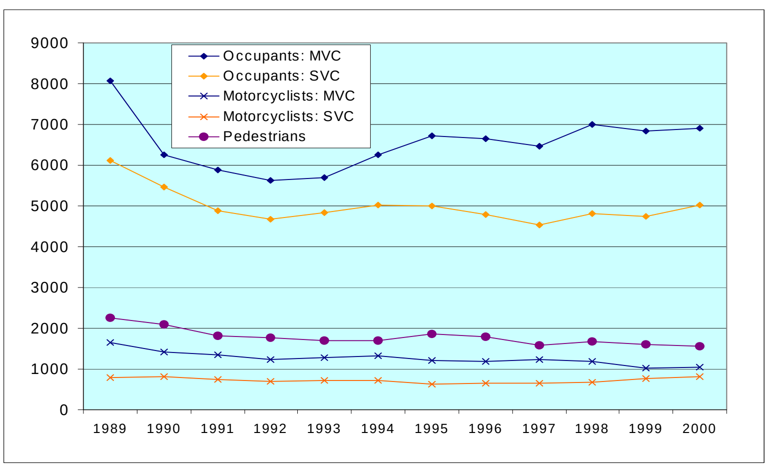
The total cost to the Australian community for these fatalities and serious injuries is in the order of $4 billion per year.

Figure 1 Road deaths by crash type and road user group Australia excluding NSW: 1989 to 2000



Source: ATSB Serious Injury Road Crash Database

Figure 2 Seriously Injured road users by crash type and road user group Australia excluding NSW: 1989 to 2000



Source: ATSB Serious Injury Road Crash Database

3. WHY GOVERNMENT INTERVENTION MAY BE NEEDED

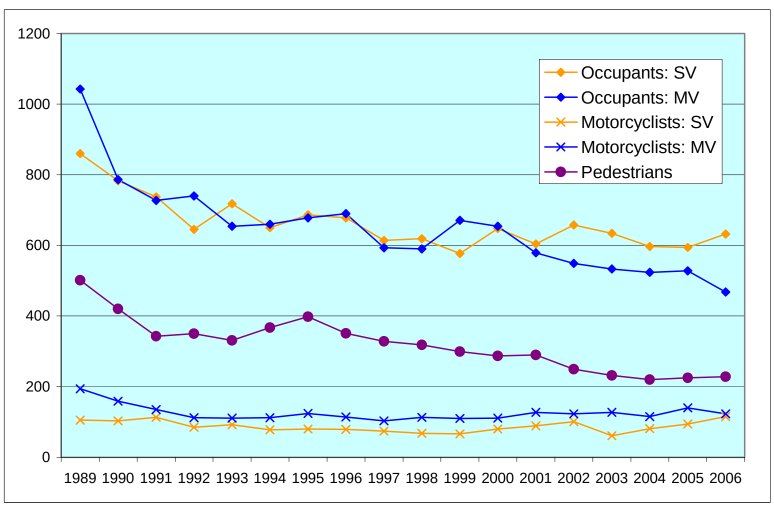
Government intervention may be needed when the market fails to provide the most efficient and effective solution to a problem. In the case of Electronic Stability Control (ESC) technology, Stanford (2007) suggests that if a rapid take-up is desired in the short term, government intervention is likely to be necessary.

3.1. Market response

Australian Transport Safety Bureau (ATSB) statistics show that deaths due to Single Vehicle Crashes (SVCs or SVs) have remained at a relatively significant level over a long period. Refer to Figure 3.

As detailed later (see Table 2, Table 3 and Figure 4 below and later), in Australia, the market response to ESC has been rapid. Therefore, the question is whether Government intervention would be cost-beneficial in extending the level of penetration and, if so, at what point. The National Road Safety Action Plan 2007 and 2008 (Australian Transport Council, 2006) noted the high incidence of fatal SVCs. It also noted that over the first half of the current decade there had been little reduction in the number of vehicle occupant deaths in SVCs. Over the same period deaths in other types of road crash had decreased substantially (ATSB, 2007).

Figure 3 Road deaths by road user group and crash type: 1989 to 2006



Source: ATSB Monthly Road Deaths Series

Australian research has shown that Electronic Stability Control (ESC) technology has the potential to reduce these statistics in Australia by in the order of 30 per cent. This is supported by various other studies around the world. Refer to Appendix 4- Effectiveness of Electronic Stability Control Systems.

The take-up of ESC has been monitored both in Australia and overseas through a number of studies. The approximate fitment rates of ESC around the world in 2007/8 are shown in Table 2 below[2].

[2] It should be noted that the rate for fitment of ESC is dynamic and so may only be correct at the time of writing.

Table 2 Rate of ESC fitment around the world – 2007/8

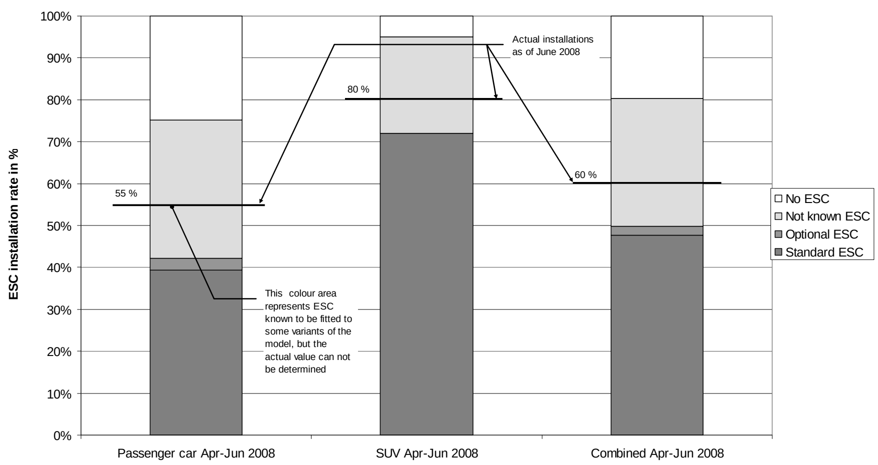
Country/region	***%***
United States	46
Europe	50
Australia	60 (April-June 2008)
Korea	26
Japan	25
China	5

Source: Bosch (2007); Federal Chamber of Automotive Industries

The fitment of ESC has been growing rapidly over the past few years. By October 2007, the fitment rate in Australia had reached 48 per cent (43.7 for passenger cars and 61.7 for SUV vehicles, giving a weighted average of 48.2).

Figure 4 shows that for April-June 2008, at least 47.8 per cent of new passenger vehicles sold in Australia were available with ESC as standard, with the possibility that another 30.5 per cent also had ESC as standard, while 2.1 per cent were available with ESC as an option. The actual fitments reported by the vehicle manufacturers are also shown[3]. These are 55 per cent for passenger cars, 80 per cent for Sports Utility Vehicles (SUVs) and 60 per cent combined. The average for the world has also increased and at the time of writing was at 31 per cent.

Figure 4 Type of ESC fitment in Australia: April - June 2008 - optional and standard equipment



Source: Data taken from Vfacts Index (2008), manufacturers' websites and the Federal Chamber of Automotive Industries

[3] The reason that there are a number of vehicles shown as "possibly" fitted with ESC as standard is because these estimates of availability (as compared with actual fitment) are based on the known sales volume of each model, along with the availability of ESC for the particular model. In some cases, standard fitment varies within the model (for example, it may be fitted to the GLX variant, but not the GL). The sales volume of specific variants within a model has not been able to be determined).

Since 2006 there has been some intervention by Australian and state and territory governments, in partnership with vehicle manufacturers, in raising public awareness of the technology. Although penetration is increasing with time, there is no guarantee that the penetration rate will reach 100 per cent without mandatory targets.

There is also no guarantee, in the absence of an appropriate standard, that all ESC systems will have a minimum level of performance.

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 increase the current voluntary fitment rate of ESC to 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 Electronic Stability Control technology.

5. OPTIONS

The available options are listed below.

Non-Regulatory Options

Option 1: No intervention
Allow market forces to provide a solution (no intervention).

Option 2: User information campaigns
Inform consumers about any benefits of Electronic Stability Control (ESC) technology using education campaigns (Suasion).

Option 3: Fleet purchasing policies
Only allow vehicles fitted with ESC for government purchases. (Economic approach).

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 ESC and its fitment 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).

Option 5: Mandatory standards under the TPA
Mandate standards for ESC 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 ESC under the *Motor Vehicle Standards Act 1989* (C'th) (MVSA) based on the international standard adopted by the UNECE as GTR No 8.

6. DISCUSSION OF THE OPTIONS

6.1. Option 1: No intervention, Option 2: User information campaigns

No Intervention

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

As noted, the current level of penetration of ESC equipped cars has been achieved without regulation. The net effect has been that industry appears to have assessed the demand and acted with a reasonably rapid response. However, there have also been a number of user information campaigns and other initiatives run and it is likely that these have contributed to this result.

The change in fitment rates in Australia between 2000 and April 2008 is indicative of likely future trends. The rates have been determined by Scully & Newstead (2007), based partly on sales monitoring data collected over the period 2000-2005. This start of the period is when ESC first began to appear in vehicles. These are shown in Table 3 below.

Table 3 Historical rate of ESC fitment in Australia

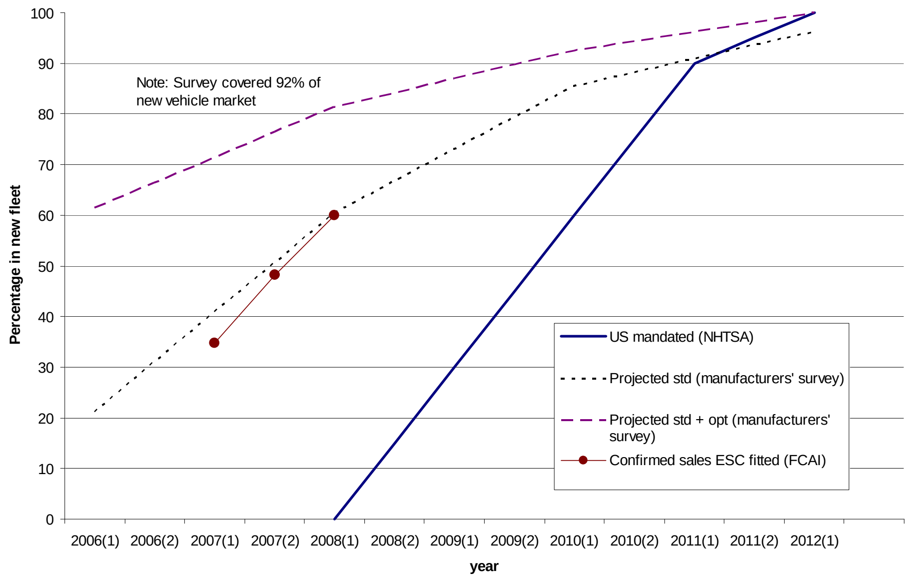
Year	*Fitment (%)*
2000	-
2003	5
2004	10
2006	15
2007	25
Present (April-June 2008)	60[4]

The final expected fitment rate of ESC is as advised in motor vehicle manufacturers' future plans. Manufacturers representing over 90 per cent of the passenger car and Sports Utility Vehicles (SUVs) Australian market were contacted by the Department of Infrastructure, Transport, Regional Development and Local Government through the Federal Chamber of Automotive Industries (FCAI) to provide this information for MA, MB and MC category vehicles. The manufacturers' responses were collated and have been graphed in aggregate form in Figure 5 overleaf.

[4] See Figure 4.

[5] See text for some revisions to these figures.

Figure 5 Future rate of ESC fitment in Australia – manufacturers' plans[5]



Source: Data taken from Vfacts Index (2008), manufacturers' websites and the Federal Chamber of Automotive Industries

Figure 5 shows that manufacturers plan to fit ESC technology to all MA, MB and MC category Australian supplied vehicles as standard or optional by 2012. The known sales of ESC as shown earlier in Figure 4 have been added to the graph, and confirm that the plans are realistic.

However, the FCAI is unable to commit at this time to a 100 per cent fitment rate by 2012-2014. The expected rate may be closer to 90 per cent for MA category and 95 per cent for MC category by 2012 (this would equate to a combined rate of 91 per cent given the relative sales volumes); and 95 for both MA and MC category by 2014. The reason for looking at plans to 2012 is that the United States (US) has recently regulated to require all US light vehicles to be fitted with ESC by 2012. There is a phase in approach and this has been marked on the graph for reference. Details of the US rule are discussed later in this RIS in section 6.5.

In the Australian context, ESC adoption has been limited by some major makes not offering ESC as standard or optional (as of January 2008). This is most notable in the case of Toyota which currently does not offer ESC on its Corolla and Yaris models (7.8 per cent and 4.9 per cent of Australian passenger car sales in January 2008, the highest selling and fourth highest selling models respectively). However, in the case of the Corolla, this is understood to be because the specifications for the 2008 model were determined in 2005, and ESC was not considered at that point in time. As a result it expected to be introduced into the Corolla range in late 2008 (Stanford, 2007).

The take-up has also been limited by some makes varying ESC implementation within model variants. The Subaru Forrester for example offers ESC as optional on its XT Luxury Wagon but does not offer it on the four other variants. The Forrester was the second highest selling SUV in January 2008, at 8.0 per cent of SUV sales. The Toyota Prado, the third highest selling SUV in January 2008, has ESC as standard on two of eight available variants, optional on three of the eight available variants and not at all on the remaining three variants. If these manufacturers had installed ESC as standard the installation rate would have jumped from 41 per cent of all vehicles offering ESC as standard to 54.3 per cent at the end of January 2008.

Complete market adoption of ESC appears to be the goal, with a representative from the Federal Chamber of Automotive Industries stating that car makers are working toward “100 per cent use of the electronic stability program” (Gardiner, 2008). This statement seems to be supported by a senior executive of Toyota Australia’s stating “Buyers are risk averse and are expecting technology such as VSC and TRC to be included as standard equipment on an increasing number of models” (Stanford, 2007). This implies that market demand is pushing suppliers into increasing the fitment of safety features.

Sweden has high voluntary fitment rates (over 90 per cent), yet these may not be easily replicated in Australia in the short term. The vast majority of Swedish cars are produced in Europe, which in some areas has higher demand for ESC due to the driving conditions. In comparison, the vast majority of Australia’s cars are imported from Japan and South Korea, which have ESC fitment rates of 25 per cent and 26 per cent respectively (Stanford, 2007). Because of the influence of the local market, there is not a strong incentive to demand the extra feature.

User Information Campaigns

User information campaigns can be used to promote the benefits of new technology 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.

Appendix 6 – Awareness Campaign - Effectiveness, 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 was run over a period of four months. It provided an effectiveness of 77 per cent. However, it is recognised that these figures are indicative only as the campaigns do not relate to ESC or even automotive related topics. It is likely that a campaign would have to be run on a continuous basis to maintain its effectiveness.

Appendix 7 – Information Campaigns, details three notable advertising campaigns for Hyundai, Mitsubishi and Volkswagen. The cost of such campaigns is not made public. However, a typical cost would be $5m for television, newspaper and magazine advertisements for a three month campaign (*Average Advertising Costs* n.d.). Some recent research showed that for general goods, advertising campaigns can lead to an around 8 per cent increase in sales (Radio Ad Lab, 2005). This was similar to the result achieved by the Mitsubishi campaign. The campaign was highly relevant as it focussed solely on ESC. It is likely that a campaign would have to be run on a continuous basis to maintain its effectiveness. Appendix 7 – Information Campaigns, also outlines other government and private sector campaigns for ESC. While some costs were available, the effectiveness of the campaigns was not able to be determined. Table 4 provides a summary of the costs and known effectiveness of the various information campaigns.

Table 4 Estimation of campaign costs and effectiveness

Campaigns	*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 so sales (but no greater than existing sales if already more than 77%)
Advertising*	1.5 per month campaign, or 18 per year	8 % increase in existing sales.
Fleet	0.15	-
Other	0.2-0.3	-

* These were subsequently used towards a benefit-cost analysis

6.2. Option 3: Fleet purchasing policies

Only allow vehicles fitted with Electronic Stability Control (ESC) 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", 2008). This includes vehicles that are provided as part of remuneration packages as well as vehicles that are 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).

ESC is currently available as either standard or optional on many new passenger cars and Sports Utility Vehicles (SUVs) in Australia. The government could intervene through fleet purchasing by taking up the ESC option either by favouring those models fitted with ESC, or by persuading manufacturers to fit ESC to vehicles currently not fitted with it. Other 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).
- 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 Australian Government acknowledges the significant safety benefit of ESC and requires agencies to consider it during any general fleet selection exercise. The Victorian and Queensland governments have also announced programs that will require ESC to be included in fleet purchases. Fleet management programs are also under development by the Western Australian Government but the outcome is not known.

The availability of ESC in fleets can be approximated by looking at the twenty most popular passenger car and SUV models in Australia generally. These are shown in Figure 6 and Figure 7.

Figure 6 Type of ESC fitment in Australia: April 2008 –the twenty most popular passenger car models

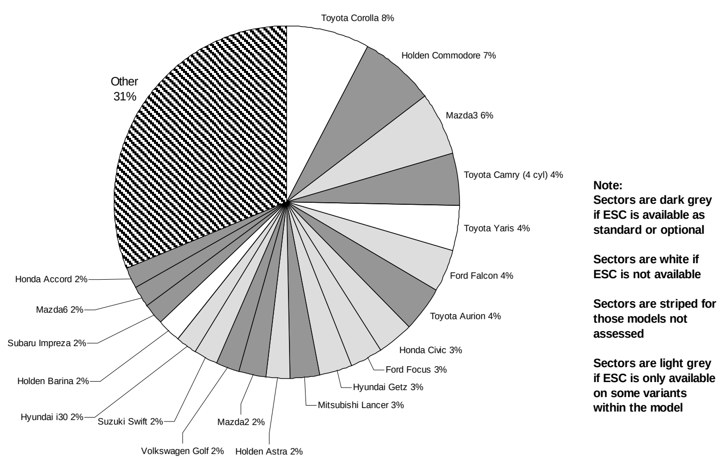
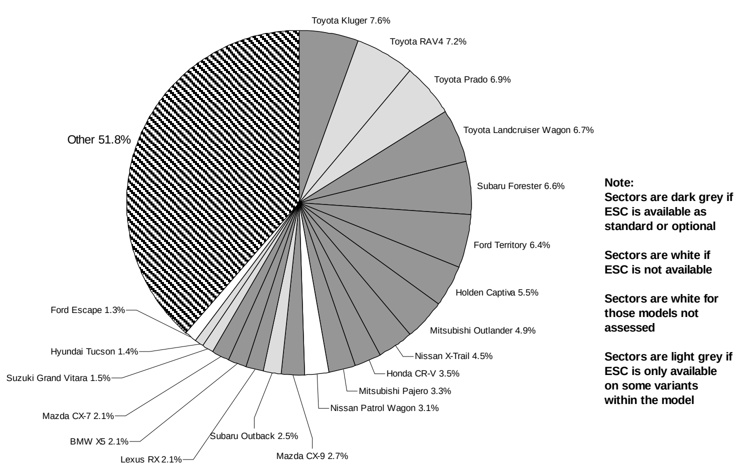


Figure 7 Type of ESC fitment in Australia: April 2008 –the twenty most popular SUV models



Source for Figure 6 and Figure 7: Data taken from Vfacts Index (2008), manufacturers' websites and the Federal Chamber of Automotive Industries

The majority of the twenty models have ESC available as standard or optional, including lower priced passenger car models such as the Ford Focus and Hyundai Getz. This means that most of the vehicles in the Australian Government fleet, and likely in other fleets, are now available with ESC. Toyota has announced that the Camry, representing around 3 per cent of the market, will now have ESC as standard fitment. However, the Toyota Corolla and Yaris, which together make up around 10 per cent of the market, are behind. Overall, there is room for a further 22 per cent increase of ESC in the market within these top twenty passenger car models (mainly through four cylinder vehicles). Of the models outside the top twenty (including Toyota, Honda, Volkswagen, Mitsubishi, Subaru, Kia, Holden) around half are available with ESC as standard or optional.

There is pressure for fleet managers to propose greater use of four cylinder vehicles for environmental policy reasons. Pressure on manufacturers to supply four cylinder vehicles with ESC could accelerate the introduction of ESC in this segment. If all the popular four cylinder passenger cars in the top twenty had ESC as standard, the current penetration rate would increase by at least 20 per cent.

There is not the same potential for increasing ESC in the SUV models, as only around 4.5 per cent in the top twenty models are not available with ESC as either standard or optional. It is not known whether the 4.5 per cent available within the top twenty SUVs could be similarly influenced through fleet sales. However, it was assumed for the purposes of this RIS that it could.

The cost of such a campaign would be minimal as it only involves negotiated agreement with fleet managers to select ESC equipped vehicles only. 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 not having ESC) be better placed to meet a particular fleet requirement (this latter aspect could not be estimated).

6.3. Option 4: Codes of practice

Allow road vehicle supplier associations, with government assistance, to initiate and monitor a voluntary code of practice for Electronic Stability Control (ESC) technology and its fitment 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)[5]. The new vehicle industry is well placed to provide a collaborative voice in the case of ESC. Of the manufacturers and importers involved with new passenger cars (these are the vehicles that would be affected by the introduction of ESC), the Federation of Automotive Product Manufacturers (FAPM) and the Federal Chamber of Automotive Industries (FCAI) represent 40 per cent and 99 per cent [6] respectively of the total.

However, any breaches 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.

In the case of ESC, the technology is fairly well established and so a voluntary code of practice would not be detailed. It would be reduced to simply an agreement by industry to fit ESC to all nominated vehicle types by a certain date or to publish and promote information on ESC. However, it would be difficult to separate this option from the no-intervention option and therefore 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, Transport, Development and Local Government) has existing legislation, expertise, resources and well-established systems to administer a compliance regime that would be more effective than a mandatory code of practice.

This option was not considered further.

6.4. 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.

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

[6] 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.

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, Transport, Development and Local Government) 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.

6.5. Option 6: Mandatory standards under the MVSA

In June 2008, the United Nations Economic Commission for Europe (UNECE) adopted Global Technical Regulation (GTR) No. 8 - Electronic Stability Control Systems, under the *Agreement Concerning the Establishing of Global Technical Regulations for Wheeled Vehicles Equipment and Parts of June 1998* (the 1998 Agreement). GTR 8 has been based on the new United States (US) rule Federal Motor Vehicle Safety Standard (FMVSS) No. 126. As a contracting member to the 1998 Agreement, Australia must subject GTR 8 to its domestic rulemaking process and must 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 8 refer Appendix 8- Overview of Global Technical Regulation No. 8 .

Timing of the regulations

FMVSS 126 has a phase in period that requires 30 per cent fleet fitment from September 2008 to 100 per cent from September 2011 as follows[7]:

- Sept. 1, 2008 30 per cent of the light vehicle fleet -with carryover credit
- Sept. 1, 2009 60 per cent
- Sept. 1, 2010 90 per cent
- Sept. 1, 2011 100 per cent

GTR 8 does not contain any implementation timing, as it is left to the contracting parties to determine their own timetable, including any phasing-in or delay in implementation. However, those countries who are also party to 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) and have already adopted UNECE Regulation No. 13-H (braking), are expected to vote in November 2008 on amendments to R 13-H to incorporate the text of GTR 8. The timing in the draft amendments is November 2011 for any new approvals and November 2013 for any newly registered vehicles (effectively 2012 for new model vehicles and 2014 for all remaining new vehicles). The European Union has indicated that it will be voting for the amendments.

[7] Multi-stage vehicle manufacturers and modifiers may instead fully comply with the standard by September 1, 2012.

Although Australia is a party to the 1958 agreement, it has not directly adopted (applied) R 13-H. However, the equivalent Australian Design Rule, ADR 31/01, is fully harmonised with R 13-H).

The issue of timing is discussed in more detail in section 9.6.

Scope of the regulations

The US rule FMVSS 126 requires ESC systems to be fitted to passenger cars, multipurpose vehicles, light trucks and buses with a gross vehicle weight rating of 4,536 kg (10,000 pounds) or less. Light trucks are extremely popular as passenger vehicles in the US, representing around 50 per cent of the passenger “car” fleet.

The GTR has been based on and applies to the same vehicle types as the US rule; UNECE categories 1-1 (M1), 1-2 (M2) and 2 (N) of 4,536 kg or less. This translates closest to the Australian categories of MA (passenger cars), MB (passenger vans), MC (four-wheel drives or sports utility vehicles), MD1, MD2 and MD3 of 4,500 kg or less (small and medium buses), as well as NA and NB1 of 4,500 kg or less (light and medium commercial vehicles) (refer Appendix 2 - Vehicle Categories). 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 available Australian research into ESC has focussed on the lighter vehicles under the MA, MB and MC categories. The US light truck category (Class 1 and Class 2) equivalent in Australia would be the NA (light goods vehicle) and NB (medium goods vehicle) category and these vehicles would be included in the scope of the GTR. Light buses in the MD1, MD2 and MD3 categories would also be included in the scope of the GTR. While the GTR applies to vehicles under 4,536 kg (the metric conversion of 10,000 lbs), in Australia, the cut-off between light and heavy vehicles has long been drawn at 4,500 kg and this corresponds to the upper mass limit of NB1 and MD3.

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 Toyota Hiace and Mitsubishi Express. 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.

Performance Requirements

The FMVSS and GTR contain both prescriptive and performance requirements. Although the preference was to only have performance requirements, the GTR working party identified that it was not possible to devise a reliable single test that could cover all scenarios of instability in a vehicle. To keep the testing burden as low as possible, a single test was formulated, and then supplemented with prescriptive requirements.

The performance requirements have their origins in the US New Car Assessment Program "fishhook test"; a test that has been used in the past to evaluate resistance to rollover. It consists of a lane changing manoeuvre at 50 mph (80 kmh). The lane change contains a precisely specified steering wheel movement (in the shape of a half sine wave performed by machine) from the straight ahead position first in one direction, then a pause, and finally a return to the straight ahead position. Within around two seconds of achieving the final position, the rate of rotation, or yaw, of the vehicle must be sufficiently diminished. There is a minimum sideways movement that must be achieved in the first second or so of the manoeuvre, the purpose of which is to defeat the use of steering systems that respond slowly to steering input.

The prescriptive requirements are slightly modified from but otherwise consistent with the definition of ESC as contained in a voluntary consensus standard, the Society of Automotive Engineers (SAE) Surface Vehicle Information Report J2564 (rev. June 2004), which require an ESC system to have:

- Individual braking to correct yaw.
- Computer closed loop control.
- Detection of yaw rate and sideslip.
- Monitoring of steering input.
- Operation on full range of vehicle use except slow speed.

The FMVSS and GTR reflect a performance capability equal to the current crop of ESC equipped vehicles.

7. ECONOMIC ASPECTS - BENEFIT-COST ANALYSIS

General

Benefit-cost analysis is a useful tool for evaluating the feasibility of implementing new technology, but it does not replace the decision process itself. Benefit-Cost Ratios (BCRs) show whether the returns (benefits) on a project outweigh the resources outlaid (cost) and indicates what this difference is.

The model used in this analysis was the Net Present Value (NPV) model. Using this model, the flow of benefits and costs are reduced to one specific moment in time. This moment is the point at which the initial investment is made and the same starting point is used for all options. The time period that the benefits are assumed to be generated over is the life of the vehicle(s). In the case of fitting a safety device to a group of vehicles, there is an upfront cost (by the vehicle manufacturers) at the starting point, followed by a series of benefits spread throughout the life of the group of 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.

The only ongoing costs directly associated with the technology of Electronic Stability Control (ESC) would be as part of the overall maintenance of the vehicles. As this would be minimal, it is not necessary to include it in the model. Calculations were started at the current voluntary fitment rate of 55 percent for passenger cars and 80 percent for Sports Utility Vehicles (SUVs). The results of each option were compared to what would happen if there was no government intervention, ie Option 1, the Business As Usual (BAU) case. Under the BAU case industry expects the voluntary fitment rate to reach 90 per cent for passenger cars and 95 per cent for SUVs by 2012, with both segments then expected to reach 95 per cent by 2014 (refer page19). A final "what if?" of the BAU case of voluntary fitment was carried out under the possibility that the rate would transition from 95 per cent in 2014 to reach 100 per cent by 2015/16.

The calculations were done using a method that considered the crash likelihood and variation of vehicle registrations over a 25 year vehicle life, as originally developed in Fildes (2002). A thirty year analysis period was chosen. This allowed for a lead time for the regulation option to begin at 2012 (see the later discussion of lead time in Section 9.6), and then a 25 year period for the full set of benefits over the life of a vehicle to be realised.

A more detailed explanation of the method can be found in Appendix 11 - Benefit-Cost Analysis – Methodology.

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 below in Table 5.

Table 5 Details of the New Vehicle Fleet

ADR Category	*Description*	*Number of Makes*	*Number of Models*	*Number of Vehicles*
MA	Passenger car	44	178	637,019
MB	Passenger van			
MC	SUV		52	198,176
NA	Light goods van/ute/SUV	16	82	177,556
NB1	Goods van/SUV		73	
MD1	Light bus		2	
MD2	Light bus		1	
MD3	Light bus		7	

Source: FCAI (2007, Passenger); FCAI (2007, SUV); FCAI (2007, Light Commercial); Dept of Infrastructure, Transport, Regional Development and Local Government (2008)

Around two thirds of vehicles are imported, while one quarter of Australian production is exported. 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 10.4 new SUV models per year and 35.6 new passenger car models per year.

Costs

For the non-regulatory options, the costs were discussed earlier in the RIS and the results summarised in Table 4 Estimation of campaign costs and effectiveness. These costs represented the non regulatory intervention methods (awareness campaigns, advertising campaigns etc). The actual fitment, development and (as relevant) regulatory costs are discussed below.

Source of the Costs

Obtaining data on the manufacturing costs of ESC is generally difficult as these costs are a source of competitive advantage. Research in the United States (US) towards the US regulation FMVSS 126 showed that the cost of installing ESC was US$368 for the Antilock Braking Systems (ABS) part of the system, and US$111 for the ESC part of the system, giving a total of US$479. The cost for ABS was not considered where ABS was already fitted to the vehicle. These costs were the total cost to meet the US regulations (NHTSA, 2006). An overall average cost for passenger cars and light trucks was separately determined by taking into account the percentage of the US fleet that already had ABS fitted and then those that already had ESC fitted. The total cost of fitting ESC under the current US legislative program was reported as being US$985.2m (Murray, 2007).

However, these costs represent a new vehicle fleet in the US, which is approximately ten times that of the Australian fleet, and so economies of scale would have a significant effect. Also, the US regulation compliance system is one of self-certification and there are no government related costs on industry in confirming the initial compliance of the vehicles (although there are downstream costs to affirm and enforce compliance). This would reduce the up-front costs in the US of adopting ESC on a regulatory basis. As the costs were to be used for analysis of the Australian market, Australian costs were sourced instead.

In March 2008, Australian manufacturers and importers were requested through the Federal Chamber of Automotive Industries for information on the costs related to the design, testing and installation of ESC. As part of this, they were also asked to separately identify those costs that would be incurred solely in meeting a regulatory requirement. The results have been reported at Appendix 9 – Costs for Fitting Electronic Stability Control.

In addition, a leading ESC systems designer and manufacturer was contacted and gave general guidance on design, testing and fitment costs for ESC systems, again including those related to regulation. This was combined with internal departmental data representing costs of regulation development, maintenance and approval processing. These results have also been reported at Appendix 9 – Costs for Fitting Electronic Stability Control.

Magnitude of the Costs

The costs from the various sources were comparable, although the FCAI's development costs were high. FCAI cautioned that the development costs for ESC alone are hard to separate from the overall vehicle development costs. Therefore, it was decided to use the ESC system designer's upper costs for development as a maximum value.

For the purposes of the benefit-cost analysis, an Australian figure for the fitment of ESC to a vehicle of $395 was adopted. This figure represents a composite value of a lower fitment cost of $350 for models were an Antilock Braking System (ABS) is already available, to an upper cost of $800 for models were ABS is not already available. The composite value was based on the known proportion of the most popular new models available with or without ABS. These costs are discussed in more detail in Appendix 9 – Costs for Fitting Electronic Stability Control

An Australian figure for development cost for a vehicle model ($3m maximum and $0.5m minimum) was also adopted as discussed in Appendix 9 – Costs for Fitting Electronic Stability Control.

Advice on test track availability and suitability was also sought from vehicle and component/systems manufacturers who confirmed that at least one independently operated test track is available and the leading ESC component/system manufacturer's test track is also suitable. Therefore, the benefit-cost analysis does not factor in additional costs for establishing new test tracks. However, a cost of $50,000 would be a reasonable assumption for the testing of ESC to a regulation for a vehicle model as discussed in Appendix 9 – Costs for Fitting Electronic Stability Control.

Certification costs (costs to meet a regulation) were based on FCAI estimates and Department of Infrastructure, Transport, Regional Development and Local Government experience. A cost of $15,000 was assumed for the type approval costs of ESC for a vehicle model as discussed in Appendix 9 – Costs for Fitting Electronic Stability Control.

Finally, a yearly cost of $50,000 was assumed for the implementation and maintenance of a regulation based on Department of Infrastructure, Transport, Regional Development and Local Government experience. This was discussed further in Appendix 9 – Costs for Fitting Electronic Stability Control.

The cost in fuel consumption was not calculated as part of the benefit-cost analysis. Individual components of an ESC system would add around 4 kilograms to the mass of a vehicle. According to Transport Canada (2007), this will result in increased fuel consumption of 0.1per cent or 1 additional litre every 10,000 km (assuming an average fuel consumption of 10L/100 km). If the vehicle is already equipped with an antilock braking system, the addition to the mass is 1kg. This would give an increased fuel consumption of 1 additional litre for each 40,000 km travelled. As a result, the environmental impact will be minimal and so does not need to be factored in to the analysis.

Table 6 provides a summary of the costs for various aspects of fitting ESC to a vehicle. It includes the non-regulatory options from Table 4.

Table 6 Estimation of the costs of ESC

Type of cost	*Estimated cost ($)*	*Notes*
Fitment of ESC system	395	per vehicle
Development of ESC system	0.5m - 3m	per model
Information campaigns	3m - 18m	per year
Fleet purchasing policies	50,000	per year
Testing of ESC system to a regulation	50,000	per model
Type approval costs	15,000	per model
Implement and maintain regulation	50,000	per year

Particular costs

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 be fitted with ESC due to the particular intervention method (option) used, above and beyond those already fitted voluntarily. For example, say that 60 per cent of newly registered vehicles already have ESC fitted voluntarily, 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 (eg cost of advertising campaigns).
For Option 2: User information campaigns, there was a basic design and fitment cost as well as a minimum cost of $3m dollars per year ongoing for a awareness campaign (Option 2(a)) or a maximum cost of $18m per year ongoing for an advertising campaign (Option 2(b)). These have been discussed earlier in the RIS.

For Option 3: Fleet purchasing policies, there was a basic design and fitment cost as well as a cost (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 as detailed on page 81 at $50,000 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 and are also detailed on page 81.

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 had ESC when any regulation was first applied) and so regulation costs would be independent of the voluntary take-up of ESC. These costs represent designing, testing and proving compliance of an ESC system against regulated requirements. These costs would apply to every vehicle model under the scope of the regulation and are above and beyond the design and testing associated with normal product development.

Appendix 12 –Benefit-Cost Analysis – Details of Results shows all the particular costs for each option, including those for basic design and fitment.

7.1. Benefits and Costs from installing ESC under a variety of scenarios

Four scenarios were prepared for estimating the benefits from ESC. These represented the four remaining options, Options 1, 2, 3 and 6. The four scenarios were based on the difference between the current voluntary percentage take-up of ESC, and the final take-up expected for each particular option in 2014. The current voluntary percentage take-up of ESC is 55 per cent for passenger cars and 80 per cent for Sports Utility Vehicles (SUVs). Refer Figure 4 on page 15. The benefits and costs for Option 6 were then calculated again, this time based on the possibility of the voluntary percentage take-up of ESC reaching 100 per cent by 2015/16. This last scenario is a hypothetical best case only as it is not based on industry advice. It should also be noted that while these results are likely to reflect a true picture of the market at the time an option may be implemented, they rely exclusively on industry advice about future intentions. This is in no way guaranteed.

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

For Option 2: User information campaigns, there was an estimated increase from the Option 1 current take-up (55 per cent for passenger cars and 80 per cent for SUVs) to a total of 77 per cent take-up (based on a 77 per cent awareness) for an ongoing targeted awareness campaign (Option 2(a)), or alternatively an 8 per cent increase on Option 1 through ongoing advertising campaigns (Option 2(b)). Note that as the voluntary take-up for SUVs was already 80 per cent, the targeted awareness campaign had no effect on SUVs. The campaign also stopped once the passenger car voluntary rate would have otherwise (through the BAU case) reached 77 per cent. The advertising campaign added 8 per cent of the current rate at the time to the Option 1 voluntary fitment rate. This was of course capped at 100 per cent total.

For Option 3: Fleet purchasing policies, there was an added a flat 20 per cent increase for passenger cars and 4.5 per cent for SUVs on Option 1 voluntary fitment rate (55 per cent for passenger cars and 80 per cent for SUVs). Again this was capped at 100 per cent total.

For Option 6: Mandatory standards under the MVSA, there was an increase from a current take-up (55 per cent for passenger cars and 80 per cent for SUVs) to a total of 100 per cent, with a pro-rata transition within the 2012-2014 period of implementing the regulation.

Effectiveness of Electronic Stability Control

The effectiveness of ESC in reducing road trauma was estimated at 27 per cent for passenger cars and 68 per cent for SUVs, using research by Scully and Newstead (2007) on crashes in Australia that involved any kind of injury. These estimates have the greatest relevance as they represent real-world statistics for Australian conditions. Refer to Appendix 4- Effectiveness of Electronic Stability Control Systems for further details. The estimate of effectiveness is shown in Table 7 below.

Table 7 ESC effectiveness rates

Crash Type	***Effectiveness (%)***
Passenger cars	
Fatal injury	27
Serious injury	27
Minor injury	27
SUVs	
Fatal injury	68
Serious injury	68
Minor injury	68

Results

Appendix 12 –Benefit-Cost Analysis – Details of Results 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 lowest costs for the Best Case, and highest costs for the Worst Case. The Likely Case was an average within this range. All scenarios used a 25 vehicle life and a 30 year analysis period, with a 7 per cent discount rate. The assumed final rate of the BAU case was 95 per cent for both passenger cars and SUVs from 2014 onwards.

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 the analysis is given in Table 8 for each option. The distribution of the (undiscounted) benefits and costs, and the BCR, is shown over time in Figure 8. The effect on the BAU of each option is shown over time in Figure 9.

Table 8 Summary of Net Benefits, Total Benefits, Costs and Benefit-Cost Ratios and Lives Saved- from the provision of ESC on new passenger cars and SUVs

	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 Campaign	-35 to 58	-51 to 19	-68 to -19	69-574	69-574	69-574
Option 3 Fleet policies	-30	-45	-60	56	56	56
Option 6 Regulation	162	139	115	376	376	376

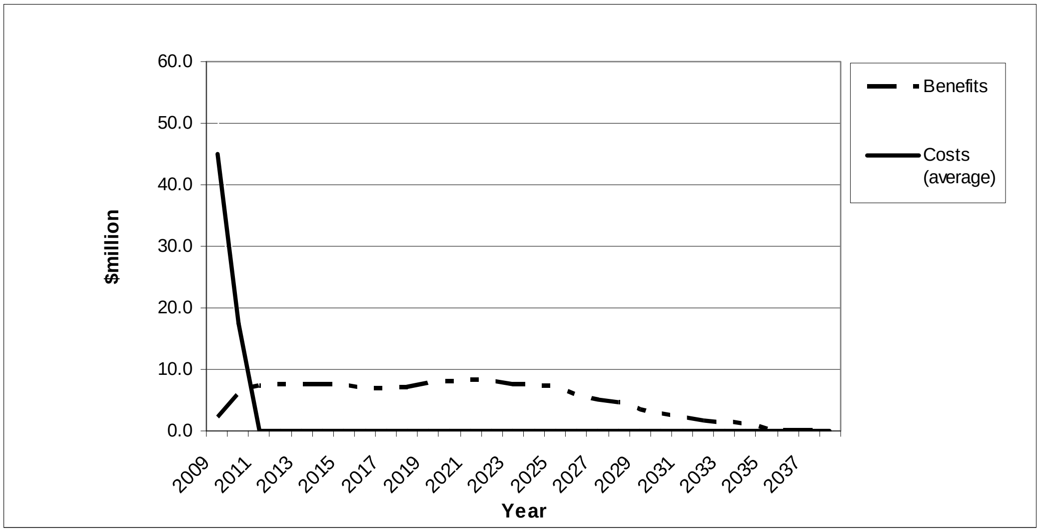
	Costs ($m)			Benefit-Cost Ratio		
	Best Case	Likely Case	Worst Case	Best Case	Likely Case	Worst Case
Option 1 No intervention	-	-	-	-	-	-
Option 2 Information Campaign	104-516	121-555	137-593	0.7-1.1	0.6-1.0	0.5-1.0
Option 3 Fleet policies	87	101	116	0.6	0.6	0.5
Option 6 Regulation	214	238	261	1.8	1.6	1.4

	Lives Saved		
	Best Case	Likely Case	Worst Case
Option 1 No intervention	-	-	-
Option 2 Information Campaign	13-170	13-170	13-170
Option 3 Fleet policies	11	11	11
Option 6 Regulation	128	128	128

Notes:
Best Case - 25 year period, 7% discount rate, minimum costs
Likely Case - 25 year period, 7% discount rate, average costs
Worst Case - 25 year period, 7% discount rate, maximum costs

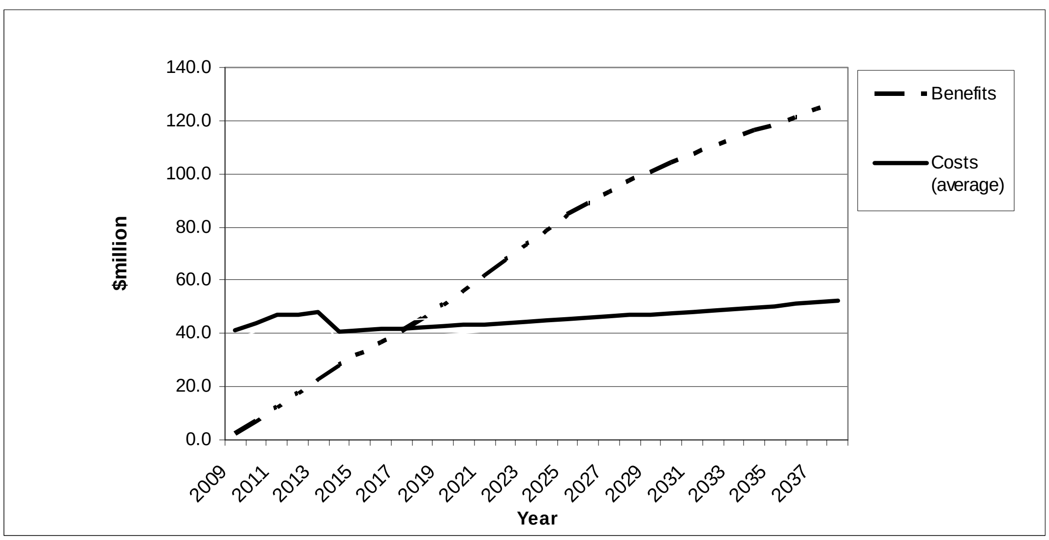
Figure 8 Option Undiscounted Benefits and Costs over time – passenger cars and SUVs

Option 2(a): User information campaign – Awareness



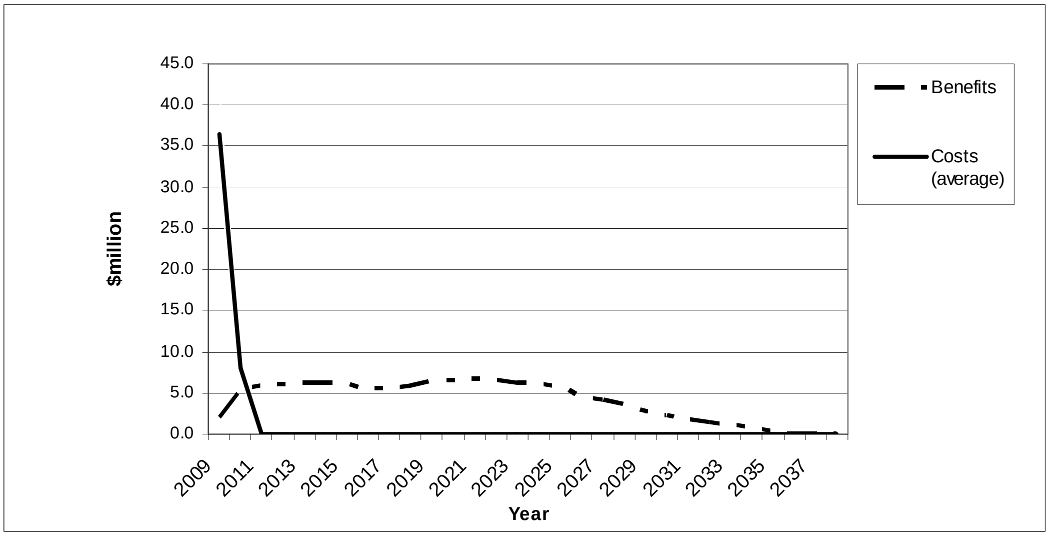
25 year vehicle life, $395 installation cost, $0.5m-$3m per model development cost.

Option 2(b): User information campaign – Advertising



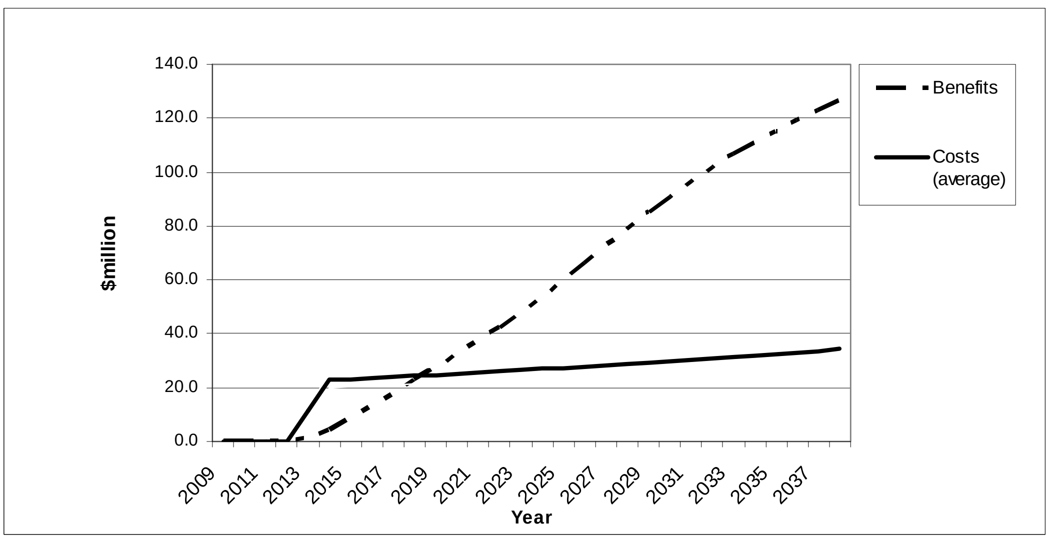
25 year vehicle life, $395 installation cost, $0.5m-$3m per model development cost.

Option 3: Fleet purchasing policies



25 year vehicle life, $395 installation cost, $0.5m-$3m per model development cost.

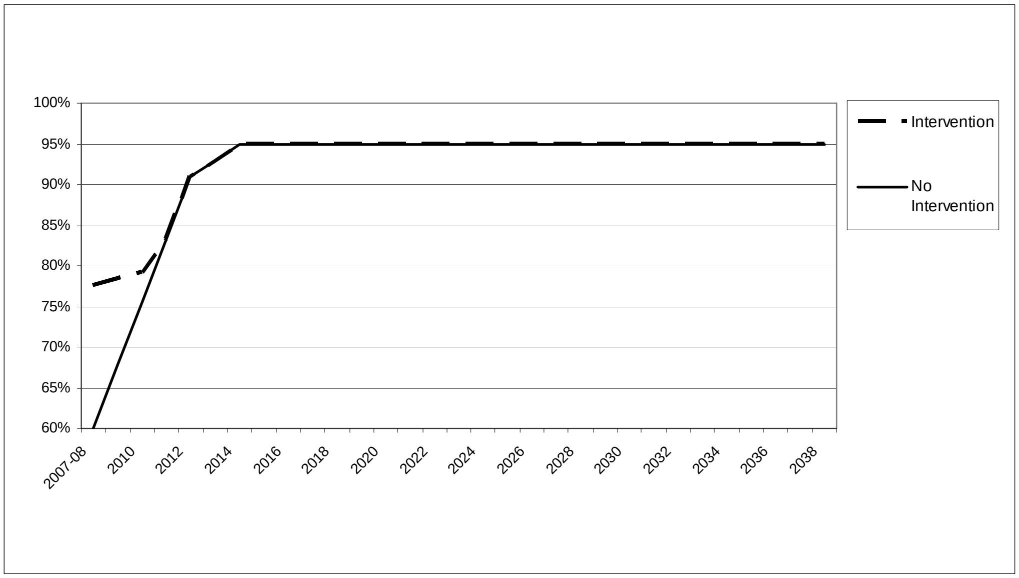
Option 6: Mandatory standards under the MVSA



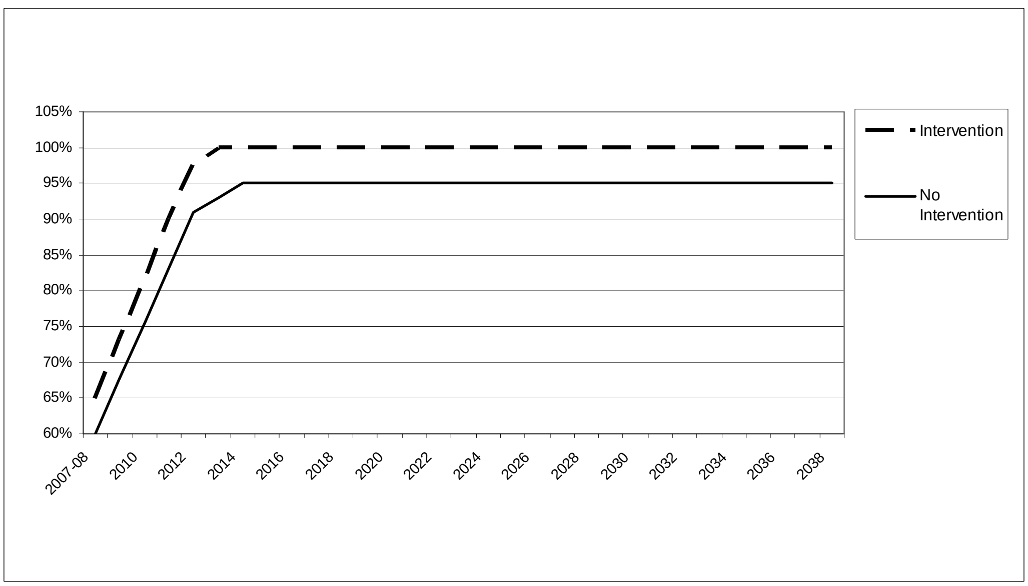
25 year vehicle life, $395 installation cost, $0.5m-$3m per model development cost, $65,000 per model certification cost, $50,000 per year regulation maintenance cost.

Figure 9 Comparison of the expected fitment rate of No intervention (Option 1) to Intervention (Options 2, 3 and 6) over time – passenger cars and SUVs

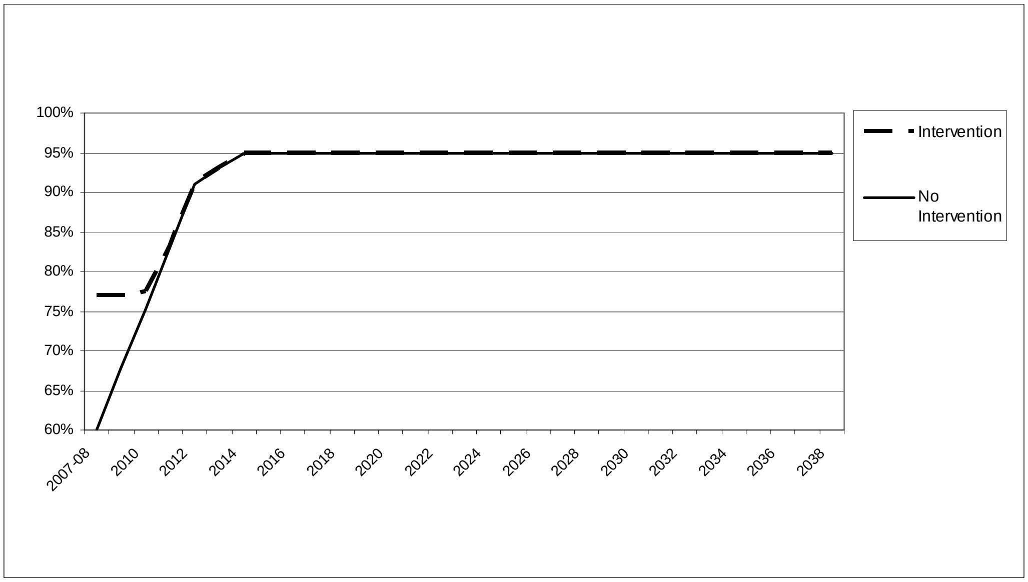
Option 2(a): User information campaign – Awareness



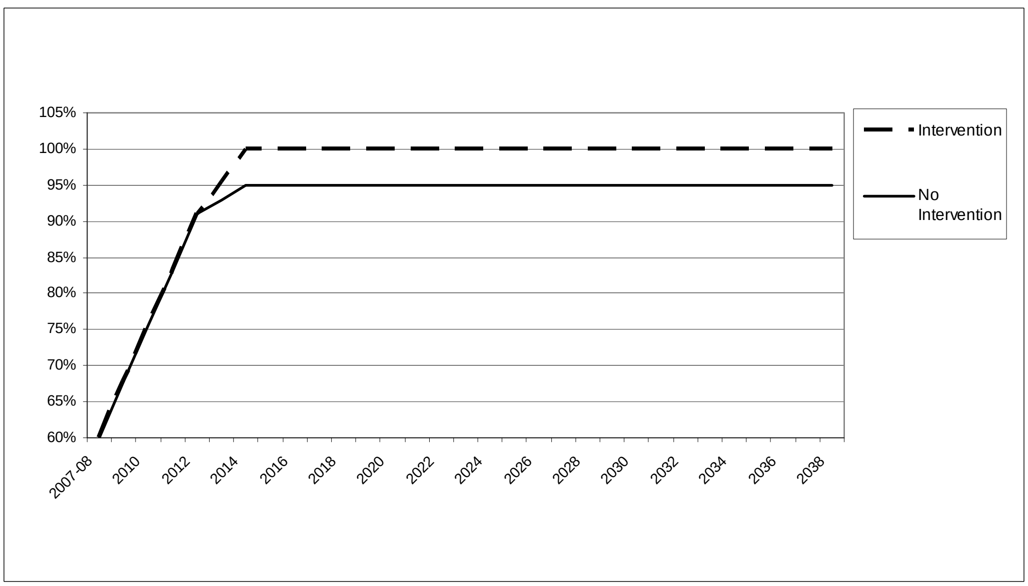
Option 2(b): User information campaign – Advertising



Option 3: Fleet purchasing policies



Option 6: Mandatory standards under the MVSA



Discussion of the Results

Option 6: Mandatory standards under the MVSA (Regulation), was the only option that gave a positive net benefit for the Best, Likely and Worst cases. Options 2 User information campaign and 3 Fleet purchasing policies were similar in the value of their benefits, but only positive in the case of part of Option 2(b), the Advertising campaigns.

This result was reflected in the Benefit-Cost Ratios (BCRs). The Option 6 BCR was above one, and so was Option 2(b), but only marginally. The other Options 2(a) and 3 were below one. This means that Option 6 and Option 2(b) are the only options that provide more benefits through reduced road trauma than they cost to implement. For Option 2(b) this was marginal.

In terms of costs over the 30 year period of the analysis, Option 2 User Information campaign - Awareness and Advertising option, was the most expensive to implement. This costed between $121m and $555m to implement (business and government costs). Option 6, the Regulation option was next at $238m while Option 3, the Fleet purchasing policies option was the cheapest at $101m.

In terms of lives saved, Option 2 User Information campaign - Advertising was the highest, followed by Option 6 Regulation, at 170 and 128 lives respectively saved over the 30 year period. Option 2 User Information campaign - Awareness and Option 3 Fleet purchasing policies saved a similar number of lives of 11-13.

Each option affected the Option 1 No intervention (or Business As Usual (BAU)) case in a different way. This is outlined below:

Option 1: No intervention, was the base case and so had no allocated benefits or costs associated with it. It assumed that the voluntary fitment rate would follow that advised by industry, with 90-95 per cent reached by 2012 and 95 per cent reached by 2014. After that it was assumed that the rate would stay at 95 per cent for the foreseeable future. This trend can generally be seen in the No intervention series within the graphs presented in Figure 9.

Option 2: User information campaigns used two approaches. In the first (Option 2(a) Awareness) it was assumed that an ongoing awareness campaign, costing $3m per year, would bring the fitment rate up to 77 per cent, but could do no more than maintain this level in the long term. Figure 9 shows that for three years, the rate for passenger cars is raised to this level, while the rate for SUVs is already above this value and so is not affected. After three years, both the passenger car and SUV rate have gone beyond this rate in the BAU scenario anyway, and so the campaign stops. This is why the government costs are reasonably low at around $8m, as are the benefits gained. Figure 8 shows the costs (business and government) peaking in the first year, then gradually reducing to nothing as the 0.77 rate for both passenger car and SUV (although the SUV rate was already greater) is reached and the campaign comes to a close. The benefits then flow on from that batch of ESC fitted vehicles moving through their life cycle.

In the second approach, (Option 2(b) Advertising), it was assumed that an ongoing advertising campaign, costing $18m per year, would increase the fitment rate at any time by 8 per cent for the period it was running. Figure 9 shows that for six years the rate for passenger cars and SUVs is raised. After this period, the campaign continues indefinitely, increasing the final 95 per cent BAU level up to 100 per cent. Figure 8 shows that there is a dip in the costs after the six years, as the campaign increases the fitment rate by 5 per cent in the long run (to get from 95 per cent to 100 per cent) instead of 8 per cent, followed by a gradual rise in line with the increasing fleet size. The benefits will continue to accrue as long as the BAU level would have otherwise have remained at 95 per cent.

Option 3: Fleet purchasing policies used a flat increase approach. Here it was assumed that initial fleet negotiations would increase the starting fitment rate by 20 per cent for passenger cars and 4.5 per cent for SUVs. This reflects the potential gains identified earlier in the RIS in some areas of the current fleet. For three years the rate is held at the increased level, until the BAU rate catches up and then overtakes it, at which point the negotiations stop. This is why the government costs are very low at only $131,000, as are the benefits gained over the three years. Figure 8 shows the costs (business and government) peaking in the first year, then gradually reducing to nothing as the BAU catches up, until the fleet negotiations finish. The benefits then flow on from that batch of ESC fitted vehicles moving through their life cycle.

Option 6: Mandatory standards under the MVSA (Regulation) was the simplest case. Between 2012 and 2014 there is a pro-rata transition phase from the BAU fitment rate to 100 per cent. As the final BAU rate was assumed to be 95 per cent, then like in Option 2(b), the regulation is ongoing and forces compliance of the last 5 per cent. This can be seen in Figure 9. It can also be seen in Figure 8 that the costs begin with the introduction of the regulation in 2012 and steady at the end of the transition phase in 2014, followed by a gradual rise in line with the increasing fleet size. As with Option 2(b), the benefits will continue to accrue as long as the BAU level would have otherwise have remained at 95 per cent.

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.

The cost of ESC design, fitment and regulation were considered to be reasonably accurate, being provided through the relevant industry and government sources. The effectiveness of ESC technology was also considered to be reasonably accurate, the research being in-depth and highly relevant to Australian context. It was also supported by other overseas studies. This was true for the life of a vehicle as well. This was set at 25 years in accordance with Australian crash likelihood data. The results were calculated using this data.

The main uncertainties that could adversely affect the options were the discount rate of the benefits and costs as well as the final expected voluntary fitment rate under the BAU (Option 1 No intervention) case.

Only Option 6 was tested. This was because the other options 2(a), 2(b) and 3 already had no tolerance for unfavourable uncertainties ($BCRs_{(Worst\ Case)}$ = 0.5, 1.0, and 0.5 respectively), whereas Option 6 had almost a thirty per cent tolerance to any unfavourable uncertainties ($BCR_{(Worst\ Case)}$ = 1.4).

For Option 6 only, the benefit-cost analysis was run with a discount rate of 10 per cent (an increase from 7 per cent), then it was run with a BAU voluntary fitment rate transitioning to 100 per cent between 2015 and 2016. Finally it was run with both of these together. The end result was that the BCR $_{\text{(Worst Case)}}$ was just under one and so the option would become marginal at this extreme scenario. Although it represented a Net Present Value of -$2.5m, (ie a potential loss of $2.5m dollars), this risk was not considered significant when compared to the Likely case of $139m positive benefit.

The results are shown at Appendix 13 - Benefit- Cost Analysis – Sensitivities.

Assumptions

A number of assumptions have had to be made in the benefit-cost analysis. Details of these can be found at Appendix 14 – Benefit- Cost Analysis – Assumptions.

8. ECONOMIC ASPECTS - IMPACT ANALYSIS

8.1. Introduction

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.

8.2. Identification of Affected Parties

The parties affected by the options are:

Business/Consumers

- vehicle manufacturers or importers,
- vehicle owners,
- vehicle operators, 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),
- Australian Automobile Aftermarket Association (AAAA) that represent the after-market industry.

8.3. Impact 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 looked at the impact of each of the options in terms of quantifying expected benefits and costs and identified how these would be distributed within the community. These were discussed below, and Table 9 on page 46 provides a summary of the benefits and costs of the options. These in turn have been taken from the Summary Tables in Appendix 12 –Benefit-Cost Analysis – Details of Results.

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

Educate consumers of any benefits of ESC technology 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 ESC would remain a commercial decision within this changed environment.

Benefits

Business/Consumers/Governments

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 Electronic Stability Control (ESC) due to the user information campaign.

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

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 fitted with ESC due to the user information campaign, and who avoid (or minimise the effects of) a crash due to the action of ESC.

This would add between $69m and $574m over thirty years, over and above Option 1 (a mixture of the two types of user information campaigns – awareness and advertising - was used for the calculation). 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, testing and installation costs for vehicles that are sold fitted with ESC due to the user information campaign. This would add between $97m and $368m over thirty years over and above Option 1 (a mixture of the two types of user information campaigns – awareness and advertising - was used for the calculations).

Governments

There would be a cost to governments for funding or running user information campaigns that inform the consumer of the benefits of Electronic Stability Control (ESC). This is estimated as between $8m and $226m over thirty years.

Option 3: Fleet purchasing policies

Only allow vehicles fitted with ESC 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 ESC would remain a commercial decision within this changed environment.

Benefits

Business/Consumers/Governments

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 ESC due to fleet purchasing policies.

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

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 fitted with ESC due to fleet purchasing policies, and who avoid (or minimise the effects of) a crash due to the action of ESC.

This would add between $56m over thirty years 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, testing and installation costs for vehicles that are sold fitted with ESC due to fleet purchasing policies. This would add between $87m and $116m over thirty years 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 fitment of ESC. This is estimated as $0.13m over thirty years.

Option 6: Mandatory standards under the MVSA

Mandate standards for ESC 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 ESC would no longer be a commercial decision within this changed environment.

Benefits

Business/Consumers/Governments

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 ESC due to the Australian Government mandating standards.

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

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 fitted with ESC due to the Australian Government mandating standards, and who avoid (or minimise the effects of) a crash due to the action of ESC.

This would add $376m over thirty years 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, testing and installation costs for vehicles that are sold fitted with ESC due to the Australian Government mandating standards. This would add between $214m and $261m over thirty years over and above Option 1. This cost would be passed on to the consumer.

Governments

There would be a cost to governments for developing, implementing and administering regulations (standards) that require the fitment of ESC. This is estimated as $0.42m over thirty years.

Table 9 Summary of Benefits and Costs for Electronic Stability Control over thirty years

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 $97m - $368m	None	Increased costs of vehicles $87m - $116m	None	Increased costs of vehicles & compliance costs $214m - $261m
Consumers	-		Reduced road Trauma $69m - $574m		Reduced road trauma $56m		Reduced road trauma $376m	
Government		-		Cost of funding and running campaigns $8m - $226m		Cost of administering fleet purchasing policies $0.13m		Cost of implementing and administering regulations. Does not include state and territory govts follow-on costs for in-service regulation $0.42m
Lives Saved	-		13-170		11		128	
Benefit/Cost Ratio	-		0.5-1.1		0.5-0.6		1.4-1.8	

Note: Total benefits are shown. The Summary in Appendix 12 –Benefit-Cost Analysis – Details of Results shows the split between Business/Consumers and Government costs.

9. DISCUSSION

The four scenarios that were prepared for estimating the benefits and costs from Electronic Stability Control (ESC) represented the four options that were considered feasible:

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

As a general observation, the efforts over the past few years of governments, researchers, manufacturers, consumer groups and others in encouraging the voluntary fitment of ESC have been well justified. There is a large body of evidence from around the world demonstrating significant reductions in road trauma for those vehicles fitted with the technology. Local research has also shown this to be the case in Australia for real-world conditions. This research was discussed earlier in the RIS and was detailed in Appendix 4- Effectiveness of Electronic Stability Control Systems and Appendix 5- MUARC Research.

In addition, the benefit-cost analysis for ESC found that there was also a case for increasing the ESC fitment rate for passenger cars and SUVs through government regulation.

9.1. Net Benefits

Option 6 Regulation had the highest Net Benefits at a Likely value of $139m over the thirty year period of the analysis. These benefits would continue to grow each year beyond the thirty years that the intervention was in place. Option 2 User information campaigns was the only other option that had any positive Net Benefits and these were in the order of $19m. The User information campaigns - Advertising option would also allow benefits to continue to grow beyond the thirty years.

9.2. Benefit-Cost Ratios

Option 6 Regulation had the highest Benefit-Cost Ratio (BCR) at a Likely value of 1.6. Again, the Option 2 User information campaigns was the other option that had a BCR greater or equal to one. The User information campaigns - Advertising option had a BCR of 1.1 and so was the next highest.

The positive BCRs for Option 6 Regulation and Option 2(b) User information campaigns - Advertising reflect that these options continue to influence the remaining 5 per cent of vehicles without ESC fitted that would be otherwise expected from 2014 onwards, whereas Option 2(a) User information campaigns - Awareness and Option 3 Fleet purchasing policies were only able to make limited gains early on. In addition, the cost of regulation is less than the cost of advertising to achieve the same effectiveness.

9.3. Lives Saved

Option 2(b) User information campaigns - Advertising and Option 6 Regulation had the highest additional Lives Saved, at 170 and 128 lives respectively. This was some ten times the number of lives under Options 2(a) User information campaigns –Awareness and Option 3 Fleet purchasing policies. This was because, as noted above, Options 2(b) and 6 were ongoing, accumulating benefits over the thirty year analysis period and beyond. Option 2(b) had slightly higher overall numbers than regulation because it was started earlier, whereas regulation was assumed to need a two year lead time.

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9.4. The Case for Intervention

Examining a case for government intervention to increase the fitment of Electronic Stability Control (ESC) may seem at odds with an increasing voluntary take-up of the technology, given industry plans to reach at least 90 per cent by 2012 (90 per cent for passenger cars and 95 for SUVs) and 95 per cent by 2014.

In general terms, high voluntary fitment rates reduce the need to intervene in the market, particularly through regulation. On the other hand there may be advantages to intervention by regulation, even at high rates. This may be the case where a technology offers significant benefits that have been proven in real-world conditions. This analysis has demonstrated that ESC is such a technology. Option 6 Regulation still has the potential to offer positive net benefits of $139m and a saving of an additional 128 lives over a thirty year period if the final level of voluntary take-up were to reach and maintain a high of 95 per cent. Further, there is a case even if the final level of take-up were to reach 100 per cent by 2015/16. This demonstrates the potential that ESC has to make a difference even over a short period of raised fitment rates.

Although Options 2 and 3 have been treated separately, in reality they are part of the No intervention option and have all contributed to the current level of take-up of ESC technology. Furthermore, they are not mutually exclusive and can continue in one form or another, regardless of what is recommended in this RIS. There can be little doubt that the rapid market response to date has involved effort and resources (information campaigns, direct discussion etc) from the federal and state governments, as well as other road safety groups, in working with the vehicle industry on the issue. Options 2 and 3 build on that success, but they assume to some extent that this current effort would be maintained as well.

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 two pronged response that is needed; firstly that consumers will receive the message favourably and secondly that manufacturers will perceive the demand and act accordingly.

However, the Australian Government cannot dictate whether agencies or business take action in relation to Options 1, 2, 3 or 4. There may be scope for some kind of agreement but no binding commitment could be guaranteed. The RIS can only discuss the likely contribution that these initiatives may make towards enhancing the take-up rate and ultimately the only choice is either to recommend regulatory intervention through Option 6 or to leave it to the marketplace (a combination of Options 1, 2, 3 and 4).

Option 6: Mandatory standards under the MVSA (Regulation) is the only option that would guarantee 100 per cent fitment within the implementation timeframe of the other major vehicle producing countries in the world (see later) and thereafter, to ensure on-going provision of ESC in new vehicles. There can be no guarantee that the other options would deliver an enduring result. Changing economic pressures, or the entry of new players into the market, could see a shift away from the current move to provide ECS equipped cars, particularly at the lower, more competitive end of the market. Monitoring the market would bring in added complications such as defining what ESC should be (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 have to be reconsidered, there would also be a long lead time (likely to be greater than two years due to the implementation, programming, development, testing and certification time necessary for taking ESC systems from first concept to on-the-road) needed to bring it in at a later time. Therefore, if 100 per cent penetration with high confidence is the ultimate goal, Option 6 is the only option that can deliver.

From an international perspective and as a contracting party to the United Nations 1998 Agreement (see page 25) Australia must subject the recently established Global Technical Regulation No. 8 for ESC to its domestic rulemaking process. This RIS is part of that process. While Australia is not obliged to regulate to mandate ESC (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 8. It is likely that much of the increase in ESC design and fitment throughout the world has at least partly been in anticipation of most economies doing so.

It is possible that, as the voluntary percentage take-up of ESC was increased in the lead up to any implementation of regulatory intervention, the net benefits of Option 6 could dwindle. However, as part of the sensitivity analysis, the Benefit-Cost Analysis was also performed under the assumption that the take-up would reach 100 per cent by 2015/16. Even under these conditions, Option 6 showed that it could provide generally positive net benefits and that these were higher than any other option. Although at the 100 per cent level and a discount rate of 10 per cent, the Worst Case result became a loss of $2.5m, this risk was not considered significant when compared to the Likely Case of $139m positive benefit.

Therefore, Option 6: Mandatory standards under the *Motor Vehicle Standards Act 1989* (C'th) (MVSA) is the recommended option. Given the proven benefits of ESC and its potential to save lives even at reasonably high voluntary fitment rates (from 15 – 128 over thirty years depending on that rate) it still represents an effective option. It is also the only option with a guaranteed 100 per cent outcome both at the time of implementation and for the future.

9.5. Impacts

Business/Consumers

The options 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. Local manufacturers, or those importing from Europe or the United States would have the least difficulty. Manufacturers importing from the Asian markets would have the greatest difficulty, as their program of ESC fitment is less advanced than that of other regions. Vehicles imported from Japan and Korea represent some 60 per cent of total imports of passenger vehicles to Australia (Department of Foreign Affairs and Trade, 2007).

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 ESC would have on allowable vehicle modifications, given the principle of continued compliance to the ADRs.

9.6. 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. 8 Electronic Stability Control Systems.

The European Union (EU) has announced that it intends to apply GTR 8 to new models in 2012 and all remaining models in 2014. For those countries, including Australia, who are also party to the United Nations Economic Commission for Europe (UNECE) 1958 Agreement, UNECE Regulation No. 13-H (braking) is expected to be amended to incorporate the text of GTR 8. Regulation 13-H will include an implementation timing of 2012-2014.

The EU implementation timetable of 2012-2014 would be the most feasible timetable for Australia. Information from vehicle and ESC system manufacturers, via the international peak representative bodies Organization of Motor Vehicle Manufacturers (OICA) and the European Association of Automotive Suppliers (CLEPA), as well as the UNECE working group that developed the GTR for ESC, established that the UNECE timetable was set to provide sufficient lead time for ESC system suppliers to meet the inevitable increase in world demand for ESC.

OICA's membership consists of 43 national trade associations around the world. Twenty of these associations represent the major automobile manufacturing countries in Europe, America, and Asia. Australia's automotive industry is a member of OICA through the Federal Chamber of Automotive Industries, the Australian peak body for motor vehicle manufacturers and importers. It would not be possible to rely on the costs as advised by the FCAI in this RIS for ESC systems under any sort of accelerated regulatory intervention other than the timetable discussed above. New costs would have to be sourced that take in to account the limited developmental and manufacturing resources currently available.

A world shortage in supply of ESC systems is an issue of concern for many vehicle manufacturers responding to the rapid increase in its voluntary fitment. There is a danger that this shortage could result in many lower-end vehicle models having to be withdrawn from the market should ESC be mandated prematurely. This issue may not be limited to vehicles currently without ESC. The Federal Chamber of Automotive Industries has indicated that there are some models with ESC that would meet the performance requirements of the GTR, but not the controls and telltale requirements. These models may not be viable under an earlier regulatory timing due to the cost of redesign.

It is also important to highlight that the earlier application of ESC regulations in the US would not facilitate an earlier application in Australia. Only around 4 per cent of Australia's imported passenger vehicles are sourced from the US, while around 25 per cent are sourced from the European Union (Department of Foreign Affairs and Trade, 2007), where a 2012-2014 implementation timetable for fitment of ESC will be implemented.

9.7. Scope of the Preferred Option

The recommended standard to be applied under Option 6 was the internationally accepted Global Technical Regulation (GTR) No. 8 Electronic Stability Control Systems. In the same way as the United States standard FMVSS 126, it requires ESC systems to be fitted to passenger cars, multipurpose vehicles, trucks and buses with a gross vehicle weight rating of 4,536 kg (10,000 pounds) or less.

This translates to the United Nations UNECE categories 1-1 (M1), 1-2 (M2) and 2 (N) of 4,536 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 Appendix 2 - Vehicle Categories).

It is recommended that this be the scope of any Australian regulation as well. Although the focus of the Australian effectiveness research has been on the passenger cars and sports utility vehicles, overseas research has found that ESC can offer similar benefits for the other vehicle categories as well (refer Appendix 4- Effectiveness of Electronic Stability Control Systems).

9.8. Other issues

It has been argued that the use of ESC could have either a positive or a negative effect on driving behaviour through a phenomenon known as Risk Homeostasis. If drivers believe that the system can prevent all loss of control then it may encourage drivers to drive irresponsibly. Similarly, drivers may not understand that the benefits of ESC may be negated with worn tyres or brakes (Erke, 2008). Research has suggested that there is a potential link between driver risk taking and choosing a vehicle that will allow the driver to undertake riskier driving behaviour (Horswill & Coster, 2002). Specific empirical studies confirming this link were yet to have been conducted.

Although the research carried out by Scully and Newstead (2007) showed that ESC fitment has been effective in Australia and New Zealand in preventing single vehicle crashes, the effect of ESC on multiple vehicle crashes was not clear. There were some minor indications that ESC could increase the risk of multiple vehicle crashes. The reasons for this were speculated on by the authors. A possible parallel was drawn between ESC and anti-lock brake system (ABS) technology. ABS did not realise its full benefits as it became more common in passenger cars. It could be that the technology gives a confidence to drivers that encourages greater risk taking. This then partially negates the potential benefits. However, Burton et al (2004) reported, in a summary of the available literature on the effectiveness of ABS, “that from a road safety perspective, (in) balancing increased risk to ABS vehicle occupants with decreased risk to other road users, there is no apparent benefit or disbenefit from the fitment of ABS”. This is in contrast to ESC, which has demonstrated strong levels of effectiveness both in studies and in real-world conditions.

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, Transport, Regional Development and Local Government. 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, Transport, Regional Development and Local Government. 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.

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 Regulation Impact Statement assists all stakeholders to identify the impacts of the proposals more precisely and enables more informed debate on the issues.

It is intended that he 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

Real-world studies have shown that Electronic Stability Control (ESC) has a significant potential to save lives by reducing the incident and severity of single motor vehicle crashes (SVCs).

The Australian market is responding well, having come from close to zero per cent fitment of ESC in 2000, to 60 per cent by 2008. This trend is similar to other parts of the world. The Australian market also indicates plans to have 90-95 per cent voluntary fitment by 2012-2014.

A benefit-cost analysis found that there was a case for the provision of ESC for both passenger cars and Sports Utility Vehicles (SUVs) through government intervention. The level of voluntary percentage take-up of ESC did not alter this finding. Option 6 Mandatory standards under the MVSA (Regulation) still offers positive net benefits of $139m, a Benefit-Cost Ratio of 1.6 and a saving of 128 lives over a thirty year period if the final level of voluntary take-up were to reach and maintain a high of 95 per cent. Further, there is a case even if the final level of take-up becomes 100 per cent by 2015/16. This demonstrates the potential that ESC has to make a difference even over a short period of raised fitment rates.

Given the strong potential of ESC to reduce road trauma, preference was also given to Option 6 because it could assure the highest level of compliance. Option 6: Mandatory standards under the MVSA 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. This would ensure an on-going provision of ESC in new vehicles. 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) is the recommended option. The recommended standard to be applied was the internationally accepted Global Technical Regulation (GTR) No. 8 Electronic Stability Control Systems. The standard would be applied to 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 Appendix 2 - Vehicle Categories).

The recommended implementation timetable is to be the same as the European Union's (and other countries under the United Nations Economic Commission for Europe (UNECE) 1958 Agreement) implementation timetable of 2012-2014, to account for the global shortage of ESC development resources and to ensure that ESC equipped vehicles are not excluded from the market due to the systems not meeting the requirements of the GTR.

12. IMPLEMENTATION AND REVIEW

An ADR for the control of vehicle stability 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, Transport, Regional Development and Local Government.

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.

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APPENDIX 1 - OVERVIEW OF ELECTRONIC STABILITY CONTROL SYSTEMS

Electronic Stability Control (ESC) is a technology that assists drivers to avoid a loss of control in critical driving conditions, such as at speed or on slippery surfaces. At its most basic, ESC automatically brakes individual wheels on a vehicle to compensate for understeer or oversteer events. This is done by measuring the vehicle's velocity, acceleration, direction of travel and steering wheel angle. When the vehicle begins to deviate from the path the driver has intended (determined by speed and steering wheel angle) the brakes are applied automatically to individual wheels to provide a turning moment that corrects the vehicle's heading.

Different manufacturers have different design philosophies and the systems go by different names including Electronic Stability Control (ESC), Electronic Stability Program (ESP), Vehicle Stability Control (VSC), StabiliTrak and Vehicle Stability Enhancement (VSE). Despite the different names and approaches to ESC there are several key components present in all systems.

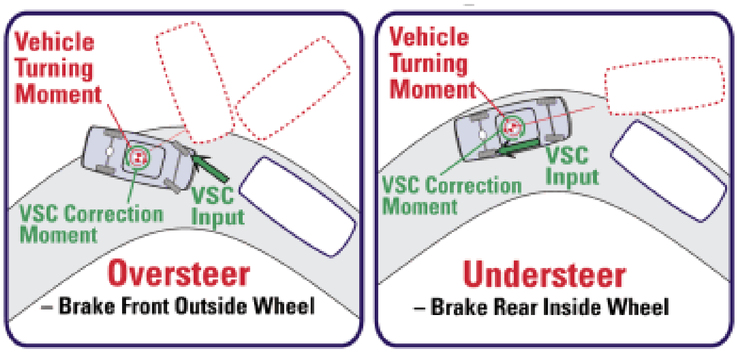
A four channel Anti-lock Braking System (ABS) is required to brake the wheels independently along with sensors to measure vehicle yaw (rotation around the vertical axis; i.e. spinning left or right). and steering wheel angle and some form of computer (with software) to control the system. The system could potentially be fitted to many new vehicles as four channel ABS is available on nearly all new passenger cars. ESC may also incorporate traction control. This senses slip of the driving wheels under acceleration and individually reduces excess engine power until control is regained. More advanced systems are able to detect the point of rollover and/or to alter the vehicle's suspension characteristics as well.

However, tuning the system to individual vehicle models can be costly as the software calibration is affected by a range of variables including tyre type and size, and power train and suspension tuning. Different calibrations are necessary for each variant within the model range.

There are basic prescriptive requirements of any ESC system:

- Having the ability to augment vehicle directional stability by applying and adjusting the brake torques individually to induce a correcting yaw moment;
- Being computer-controlled, with the computer using a closed-loop algorithm to limit vehicle oversteer and to limit vehicle understeer;
- Having a means to determine vehicle yaw rate and to estimate its sideslip or the time derivative of sideslip;
- Having a means to monitor driver steering input;
- Having an algorithm to determine the need, and means to modify engine torque, as necessary, to assist the driver, and
- Being operational over all speed ranges other than slow speeds.

Figure 10 How Electronic Stability Control works



s

Source: Toyota

Figure 10 shows how ESC is designed to detect the intended vehicle response, and intervene in the case that the actual vehicle response does not match with this. For example, in cases of oversteer, the ESC system may brake the outboard front wheel to correct the vehicle's tendency to spin out. Alternatively, in cases of understeer, the ESC system can correct the lack of vehicle rotation by braking the inboard rear wheel.

There are a number of manufacturers of ESC systems. These include:

- Robert Bosch GmbH
- TRW
- Continental- Teves
- FTE
- Automotive GmbH
- Delphi
- Advics
- Nissin Kogyo
- Hitachi

APPENDIX 2 - VEHICLE CATEGORIES

A two-character vehicle category code is shown for each vehicle category. This code is used to designate the relevant vehicles in the national standards, as represented by the ADRs, and in related documentation.

PASSENGER VEHICLES (OTHER THAN OMNIBUSES)

PASSENGER CAR (MA)
A passenger vehicle, not being an off-road passenger vehicle or a forward-control passenger vehicle, having up to 9 seating positions, including that of the driver.

FORWARD-CONTROL PASSENGER VEHICLE (MB)
A passenger vehicle, not being an off-road passenger vehicle, having up to 9 seating positions, including that of the driver, and in which the centre of the steering wheel is in the forward quarter of the vehicle's '*Total Length.*'

OFF-ROAD PASSENGER VEHICLE (MC)
A passenger vehicle having up to 9 seating positions, including that of the driver and being designed with special features for off-road operation. A vehicle with special features for off-road operation is a vehicle that:

(a) Unless otherwise '*Approved*' has 4 wheel drive; and

(b) has at least 4 of the following 5 characteristics calculated when the vehicle is at its '*Unladen Mass*' on a level surface, with the front wheels parallel to the vehicle's longitudinal centreline, and the tyres inflated to the '*Manufacturer*'s' recommended pressure:

(i) '*Approach Angle*' of not less than 28 degrees;

(ii) '*Breakover Angle*' of not less than 14 degrees;

(iii) '*Departure Angle*' of not less than 20 degrees;

(iv) '*Running Clearance*' of not less than 200 mm;

(v) '*Front Axle Clearance*', '*Rear Axle Clearance*' or '*Suspension Clearance*' of not less than 175 mm each.

OMNIBUSES
A passenger vehicle having more than 9 seating positions, including that of the driver.
An omnibus comprising 2 or more non-separable but articulated units shall be considered as a single vehicle.

LIGHT OMNIBUS (MD)
An omnibus with a '*Gross Vehicle Mass*' not exceeding 5.0 tonnes.

HEAVY OMNIBUS (ME)
An omnibus with a '*Gross Vehicle Mass*' exceeding 5.0 tonnes

GOODS VEHICLES
A motor vehicle constructed primarily for the carriage of goods and having at least 4 wheels; or 3 wheels and a '*Gross Vehicle Mass*' exceeding 1.0 tonne.

A vehicle constructed for both the carriage of persons and the carriage of goods shall be considered to be primarily for the carriage of goods if the number of seating positions times 68 kg is less than 50 per centof the difference between the '*Gross Vehicle Mass*' and the '*Unladen Mass*'. The equipment and installations carried on certain special-purpose vehicles not designed for the carriage of passengers (crane vehicles, workshop vehicles, publicity vehicles, etc.) are regarded as being equivalent to goods for the purposes of this definition. A goods vehicle comprising 2 or more non-separable but articulated units shall be considered as a single vehicle.

LIGHT GOODS VEHICLE (NA)
A goods vehicle with a '*Gross Vehicle Mass*' not exceeding 3.5 tonnes.

MEDIUM GOODS VEHICLE (NB)
A goods vehicle with a '*Gross Vehicle Mass*' exceeding 3.5 tonnes but not exceeding 12.0 tonnes.

Subcategories

Light Omnibus (MD)
Sub-category
MD1 - up to 3.5 tonnes '*GVM*', up to 12 '*Seats*'
MD2 - up to 3.5 tonnes '*GVM*', over 12 '*Seats*'
MD3 - over 3.5 tonnes, up to 4.5 tonnes '*GVM*'
MD4 - over 4.5 tonnes, up to 5 tonnes '*GVM*'
MD5 - up to 2.7 tonnes '*GVM*'
MD6 - over 2.7 tonnes '*GVM*'

Light Goods Vehicle (NA)
Sub-category
NA1 - up to 2.7 tonnes '*GVM*'
NA2 - over 2.7 tonnes '*GVM*'

Medium Goods Vehicle (NB)
Sub-category
NB1 over 3.5 tonnes, up to 4.5 tonnes '*GVM*'
NB2 over 4.5 tonnes, up to 12 tonnes '*GVM*'

APPENDIX 3- SINGLE AND MULTIPLE VEHICLE CRASHES AND RATIO OF INJURIES

(a) Single and multiple vehicle crashes

Vehicle occupants killed in single vehicle crashes (SVC), by vehicle type, by year, Australia

Vehicle body type	*1988*	*1990*	*1992*	*1994*	*1996*	*1997*	*1998*	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*Average*
Car	**623**	**521**	**413**	**454**	**478**	**411**	**416**	**382**	**409**	**389**	**429**	**394**	**363**	437
Utility - car design	90	90	12	18	38	30	17	21	27	16	11	12	5	
Panel van - car design	29	16	8	7	8	1	1	4	2	2	0	1	2	
Forward control passenger van	29	19	16	8	16	15	16	9	9	8	7	6	2	
4WD - not car design	**33**	**34**	**37**	**69**	**77**	**76**	**78**	**80**	**104**	**97**	**86**	**66**	**94**	72
Other vehicle	94	86	131	107	78	78	88	70	78	65	82	67	74	
Unknown	8	5	2	4	25	39	11	5	32	40	39	93	73	
Total	906	771	619	667	720	650	627	571	661	617	654	639	613	

Vehicle occupants killed in multiple vehicle crashes (MVC), by vehicle type, by year, Australia

Vehicle body type	*1988*	*1990*	*1992*	*1994*	*1996*	*1997*	*1998*	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*Average*
Car	**736**	**601**	**579**	**522**	**506**	**418**	**441**	**503**	**483**	**390**	**407**	**360**	**338**	483
Utility - car design	66	43	8	7	16	13	6	9	11	16	6	6	4	
Panel van - car design	14	9	12	6	5	3	7	1	2	1	1	0	1	
Forward control passenger van	34	20	21	18	14	9	6	11	15	18	2	1	6	
4WD - not car design	**13**	**17**	**9**	**16**	**18**	**23**	**21**	**29**	**30**	**22**	**26**	**24**	**27**	21
Other vehicle	37	37	59	46	58	36	57	52	50	46	36	50	43	
Unknown	12	0	1	3	10	35	4	3	30	55	57	69	81	
Total	912	727	689	618	627	537	542	608	621	548	535	510	500	

Total Car and SUV* SVC	509
Total Car and SUV* MVC	505
Ratio of SVC to Total	0.502

* 4WD - not car design

Source: Australian Transport Safety Bureau, Fatal Road Crash Database, 2008.

Notes

'Vehicle occupants' excludes bicycle and motorcycle riders.

'4WD - not car design' includes light trucks and light truck utilities fitted with 4WD.

Data was only collected every second year between 1988 and 1996.

The data does not necessarily include all vehicle occupant deaths that occurred in the given timeframe.

(b) Ratios of injuries

Data from: Single Vehicle Road Crashes (SVC), ATSB 2007.

Death	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	Total Fatal
MVC	650	500	500	480	450	420	470	500	400	400	420	400	5590
SVC	600	540	500	420	510	450	460	500	410	410	400	450	5650
Total	1250	1040	1000	900	960	870	930	1000	810	810	820	850	**11240**

Serious Injury	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	Total Serious Injury
MVC	8000	6200	6000	5800	580	6100	6800	6800	6500	7000	7000	7000	73780
SVC	6000	5500	5000	4800	4900	5000	5000	4900	4500	4800	4800	5000	60200
Total	14000	11700	11000	10600	5480	11100	11800	11700	11000	11800	11800	12000	**133980**

Grand Total
145220

Ratio Serious Injury/ Fatal	
MVC	13.20
SVC	10.65
Total	11.92

Data from: Mao et al (1997). Factors affecting severity of motor vehicle traffic crashes involving young drivers in Ontario. Injury Prevention, 3, 183-189.

Fatal	Serious	Minor	Total
1009	6646	75386	83041

Ratios	
Serious/ Fatal	6.59
Minor/ Serious	11.34
Minor/ Fatal	74.71

Minor Injuries= minor injuries requiring medical attention + minor injuries not requiring medical attention
Serious Injuries = injuries requiring hospitalisation as an 'in-pateint'

Data from: Injury Road Traffic Collisions and Casualties (2006-2007). Northern Ireland Police.

Year	Fatal	Serious	Minor	Total
1998	143	1526	10912	12581
1999	150	1462	11682	13294
2000	150	1573	12170	13893
2001	163	1801	12620	14584
2002	153	1638	10812	12603
2003	158	1487	9901	11546
2004	142	1258	9022	10422
2005	140	1128	7478	8746
2006	134	1115	7128	8377
2007	128	1194	7910	9232
Total	1461	14182	99635	115278

Ratios	
Serious/ Fatal	9.71
Minor/ Serious	7.03
Minor/ Fatal	68.20

Minor Injuries= minor injuries requiring medical attention + minor injuries not requiring medical attention
Serious Injuries = injuries requiring hospitalisation as an 'in-patient'

APPENDIX 4- EFFECTIVENESS OF ELECTRONIC STABILITY CONTROL SYSTEMS

Multiple studies from around the world have demonstrated the effectiveness of Electronic Stability Control (ESC) in helping to reduce vehicle crashes. One of the most relevant studies to the Australian context is the research undertaken by Scully & Newstead (2007) of the Monash University Accident Research Centre (MUARC).

Their study found that the fitment of ESC significantly reduced the likelihood of passenger car single vehicle crashes (SVCs) of all severities by about 24 per cent, and those that led to driver injury by about 27 per cent. It was particularly effective in four-wheel drive vehicles, reducing crashes of all severities by about 55 per cent and those with driver injury by about 68 per cent.

Other studies have found that ESC could reduce single vehicle fatalities by 30-40 per cent. Most of the current research supports these claims. Several studies into the effectiveness of ESC have been carried out in the United States and in Sweden, based on existing real-world crash data. The underlying technique for these studies has been to analyse the difference in performance between vehicles under similar road conditions both with and without ESC.

Swedish research used crash data between 1998 and 2004, comparing occurrences of accident scenarios involving similar (or preferably identical) vehicle models both with and without ESC. By examining crashes where ESC could make a difference (primarily single vehicle run off road or rollover) and a control group where ESC would be unlikely to be of assistance (rear end crashes) a picture of the effectiveness of ESC in the current road environment was formed. The overall effectiveness of avoiding a fatality or serious injury was found to be 21.6 ± 12.8 per cent. This increased to 56.2 ± 23.5 per cent on wet roads and 49.2 ± 30.2 per cent on ice or snow covered roads (Lie et al, 2006).

Research carried out by National Highway Traffic Safety Administration (NHTSA) in the United States followed a similar approach. A report published by NHTSA in 2004 suggested that ESC reduced single vehicle passenger car crashes by 35 per cent and that of Sport Utility Vehicles (SUVs) by 67 per cent. This research was carried out in a similar manner to the above with data collected between 1997 and 2003. Again, comparisons were made using the same vehicle models in differing crash scenarios, with multi vehicle crashes being the control group (NHTSA, 2004). The research was updated in 2006 (NHTSA, 2007) and found that ESC reduced single vehicle passenger car crashes by 34 per cent and that of Sport Utility Vehicles (SUVs) by 59 per cent. It also reduced fatal single vehicle passenger car crashes by 35 per cent and that of Sport Utility Vehicles (SUVs) by 67 per cent. It had the greatest effect on rollovers, reducing fatal single vehicle passenger car rollovers by 69 per cent and that of Sport Utility Vehicles (SUVs) by 88 per cent (however it had been highlighted elsewhere that around 70 per cent of the fatalities involved persons not wearing their seatbelt).

Other studies have also been carried out in Europe and Japan. These studies all suggested that ESC could provide a life saving benefit, although many were conducted with a small sample size. For example, Kreiss et al (2005) found an overall ESC effectiveness of 32.4 per cent and 55.5 per cent for fatal crashes. Effectiveness seemed to improve slightly with newer vehicle models, and effectiveness was greater in rural areas than in urban areas. Results indicated that

ESC effectiveness was greatest on dry roads, followed by wet roads in urban areas. In rural areas, ESC effectiveness was also greatest on dry roads; however, it was more effective on icy roads than on wet roads. However, the confidence limits are very wide, particularly for icy roads. ESC showed higher effectiveness for lighter mass vehicles than for heavy mass vehicles and for female drivers than for male drivers. The researchers infer that these effects are linked.

Summary

A summary of the effectiveness rates is given below. It can be seen that the rates are comparable for the same vehicle and crash type (particularly in the NHTSA studies), and are also comparable to the other studies reported by Scully & Newstead in Appendix 5- MUARC Research. The results from Scully & Newstead (2007) as highlighted in Table 10 below were used in the benefit-cost analysis in this Regulation Impact Statement, as they represented data from real world crashes in Australia.

Table 10 Effectiveness rates of ESC

Study	Vehicle type	Crash Type	Effectiveness (%)
Scully & Newstead (2007)	car	SVC	24
		SVC driver injured	**27**
	SUV	SVC	55
		SVC driver injured	**68**
Lie et al (2006)	car	All injury crashes (not rear-end)	17
		Fatal or serious injury	21
		Dry roads	25
		Wet roads	56
		Ice or snow on roads	49
NHTSA (2004)	car	SVC	35
	SUV	SVC	67
	car	SVC fatal	30
	SUV	SVC fatal	63
NHTSA (2007)	car	SVC	34
	SUV	SVC	59
	car	SVC fatal	35
	SUV	SVC fatal	67
	car	SVC rollover fatal	69
	SUV	SVC rollover fatal	88
Kreiss et al (2005)	car	all	32
		fatal	55

Source: various studies

APPENDIX 5- MUARC RESEARCH

Scully and Newstead (2007) from the Monash University Accident Research Centre (MUARC) used available crash data from Australia and New Zealand to evaluate the effectiveness of Electronic Stability Control (ESC) systems in reducing crash risk in passenger cars and four-wheel drive (4WD or SUV) passenger vehicles. Past and projected ESC fitment rates were also used to infer potential future benefits of ESC.

Method

7699 vehicles that were fitted with ESC were identified from police reported crash data from five Australian states (NSW, QLD, SA, VIC, WA) and from New Zealand. 203,186 vehicles were identified that were not fitted with ESC. The data set comprised crashes between 1997 and 2005. Only vehicles made after 1997 were included, as ESC equipped vehicles were relatively rare prior to this. The sample covered around 90 different models. Due to differences in crash reporting criteria, the Victorian and New Zealand data was subsequently unable to be used.

The induced exposure method was used to evaluate the effectiveness of ESC. Rear end impact crashes were used as a control group as they were expected to be insensitive to whether ESC was fitted. The change in the number of other types of crashes between vehicles with ESC fitted and ESC not fitted was then established. If there was still a change after adjusting for any differences in the control groups, this was attributed to the effects of ESC.

The method held provided that the characteristics of the compared vehicles differed only with respect to ESC fitment. The control and treatment samples were thus matched by vehicle type (either passenger cars or SUVs), year of manufacture and inclusion criteria of the crash reporting (for example, in Victoria and New Zealand, crash databases only included crashes where a road user was injured. Other jurisdictions also included crashes where property damage resulted).

MUARC analysed the effectiveness of ESC in preventing crashes resulting in driver injury (minor, serious or fatal) and crashes of all severities (i.e. including property damage only crashes). They looked at this for passenger cars and SUVs both together and separately, and for both single vehicle crashes (SVC) and multiple vehicle crashes (MVC).

Results

ESC was found to have reduced the risk of passenger cars being involved in SVCs of all severities and where the driver was injured (including fatally). This was by 24.1 per cent and 26.77 per cent respectively. ESC was also found to have reduced the risk of SUVs being involved in SVCs of all severities and where the driver was injured (including fatally). This was by 54.54 per cent and 67.81 per cent respectively.

Therefore, ESC was shown to be the most effective in reducing the risk of a SUV being involved in a SVC resulting in driver injury.

However, ESC was not found to have reduced the risk of passenger cars being involved in SVCs of all severities and where the driver was injured (including fatally). ESC was also not found to have reduced the risk of SUVs being involved in SVCs of all severities and where the driver was injured (including fatally).

In fact, when the analysis was restricted to crashes of all severities, it was found that ESC actually increased the risk of passenger cars being involved in a multiple vehicle crash of all severities by 15 per cent. The same trend was reported for SUVs; however, the result was not statistically significant.

Therefore, ESC was shown to be the most effective in reducing the risk of a SUV being involved in a SVC resulting in driver injury.

Due to some concerns about potential biases in the data, MUARC concluded that the effect of ESC on MVCs was not clear. Thus, the long term benefits of ESC were investigated based on estimated SVCs only. By 2014, it is projected that 47 per cent of post-1999 cars will be fitted with ESC, ESC will have prevented 113 serious single vehicle crashes in that year and prevented a total of 480 serious single vehicle crashes since 2000.

Conclusions

The MUARC research had shown that ESC reduced the cost of single vehicle road crashes where the driver was injured by around 27 per for passenger vehicles and 68 per cent for SUVs.

However, MUARC highlighted that the data available did not allow for the control of confounders related to the difference in how vehicles are driven when ESC is fitted.

These confounders include driver age, driver sex, road conditions and the speed of the crash. Moreover, the authors suggested that changes in driver behaviour in response to a vehicle safety system (a phenomenon known as risk compensation) may mitigate to some degree the potential benefits of the safety system. They recommended further research into this area with regards to ESC fitment.

Although the analyses shows that ESC fitment is effective in preventing single vehicle crashes, in particular for SUVs resulting in driver injury, the data available did not allow the estimation of the effectiveness of ESC in preventing crashes resulting in serious driver injury.

The authors also recommend future research in this area. The effect of ESC on multiple vehicle crashes in Australia and New Zealand was not clear from this preliminary analysis. Thus, the potential future benefits of ESC were based on the effectiveness of ESC in preventing single vehicle crashes.

Additional Research

Below is a table summarising the available studies of ESC effectives provided by Newstead and Scully (2007). For more information on these studies, refer pages 2-8 of their report.

Table 11 Effectiveness rates of ESC as reported by Newstead and Scully (2007)

Jurisdiction & Study	Target Crash Type	Estimated Reduction
Europe Sferco, Page, Le Coz & Fay (2001)	All injury crashes All fatal crashes Loss of control injury crashes Loss of control fatal crashes	18% 34% 42% 67%
Germany Langwieder , Gwehenberger, Hummel & Bende (2003)	Single vehicle skidding crashes All crashes	42-60% 20-25%
Japan Aga & Okada (2003)	Single car crashes Severe single car crashes Head-on crashes Severe head-on crashes	35% 50% 30% 40%
USA Farmer (2006)	All single vehicle – SUV All single vehicle – cars Fatal single vehicle- SUV Fatal single vehicle – cars Multiple vehicle – SUV Multiple vehicle - cars	49% 33% 59% 53% 32-37% 25%

APPENDIX 6 – AWARENESS CAMPAIGN - EFFECTIVENESS

Introduction

There are numerous examples of awareness advertising campaigns that have been successful. One particularly successful campaign was the Grim Reaper advertisements of 1987. In an attempt to educate the public about risk factors for HIV Aids; television and newspaper advertisements were run showing the Grim Reaper playing ten pin bowling with human pins. This campaign led to significant increases in HIV testing requests meaning that the campaign effectively reached the target market. Other awareness campaigns can be as successful if well designed, planned and positioned. Two examples are the recent Skin Cancer Awareness Campaign and the Liquids, Aerosols and Gels Awareness Campaign.

Analysis of Costings

Providing accurate costings is a difficult task. Each public awareness campaign will consist of different target markets, different objectives and different reaches to name a few common differences. In providing a minimum and maximum response two cases have been used; the maximum cost is developed from the Department of Health & Ageing’s Skin Cancer Awareness Campaign. The minimum cost is developed from the Office of Transport Security’s Liquids, Aerosols and Gels (LAGs) Awareness Campaign.

Maximum Cost

The “Protect yourself from skin cancer in five ways” campaign was developed in an effort to raise awareness of skin cancer amongst young people who often underestimate the dangers of skin cancer.

Research prior to the campaign found that young people were the most desirable target market as they had the highest incidence of burning and had an orientation toward tanning. This group is also highly influential in setting societal norms for outdoor behaviour. A mass marketed approach was deemed appropriate.

The Cancer Council support investment in raising awareness of skin cancer prevention as research shows that government investment in skin cancer prevention leads to a $5 benefit for every $1 spent.

Whilst it is not a direct measure of effectiveness, the National Sun Protection Survey would provide an indication as to the changed behaviours that may have arisen as a result of the advertising campaign. The research showed that there had been a 31 per cent fall in the number of adults reporting that they were sunburnt since the previous survey in 2004 suggesting that the campaign was to some extent effective.

The actual effectiveness of the campaign is yet to be publicly released.

The costs of this campaign were from three sources:

Creative Advertising Services (e.g. advertisement development)	$378,671
Media Buy (e.g. placement of advertisements)	$5,508,437
Evaluation Research (measuring the effectiveness of the campaign)	$211,424
Total	**$6,098,532**

Applicability to Electronic Stability Control (ESC)

Using a mass marketing approach can be regarded as an effective approach because it has the ability to reach a large number of people. However, this may not be the most efficient approach as the advertisements will be exposed to people that are not members of the target market. It should also be noted that political sensitivities can arise from large scale marketing campaigns and that there is likely to be a thorough analysis of the spending. As a result, it is imperative to demonstrate that the campaign is likely to be effective prior to launch and that there is a measure that can demonstrate this.

Minimum Cost

In August 2006, United Kingdom security services interrupted a terrorist operation that involved a plan to take concealed matter on board an international flight to subsequently build an explosive device. The operation led to the identification of a vulnerability with respect to the detection of liquid explosives.

As a result, the International Civil Aviation Organisation released security guidelines for screening Liquids, Aerosols & Gels (LAGS). As a result new measures were launched in Australia. To raise awareness of the changes the following awareness campaign was run over a period of four months:

- 14 million brochures were published in English, Japanese, Chinese, Korean & Malay and were distributed to airports, airlines, duty free outlets and travel agents
- 1200 Posters, 1700 counter top signs, 57000 pocket cards, 36 banners and 5000 information kits were prepared.
- Radio and television Interviews
- Items in news bulletins
- Advertising in major metropolitan and regional newspapers
- A website, hotline number and email address were established to provide travellers with a ready source of information.
- 5 million resealable plastic bags were distributed to international airports
- Training for 1900 airport security screeners and customer service staff was funded and facilitated by the department.

The campaign won the Public Relations Institute of Australia (ACT) 2007 Award for Excellence for a Government Sponsored Campaign having demonstrated a rapid rise in awareness. 77 per cent of travellers surveyed said they had heard of the new measures in general terms and 74 per cent of respondents claimed to be aware of the measures when prompted.

The costs of this campaign were from three sources:

Developmental Research (e.g. Understanding Public Awareness prior to the campaign)	$50,000
Media Buy (e.g. Placement of advertisements)	$1,002,619
Evaluation Research (Measuring the effectiveness of the campaign)	$40,000
Total	**$1,092,619**

Applicability to ESC

This campaign had a very narrow target market; international travellers. As a result the placement of the message for the most part was able to be specifically targeted to that market with minimum wastage through targeting airports and travel agents.

Should an ESC campaign be run, there would be a similar narrow target market; new car buyers. As a result, placement of similar marketing tools could be positioned in places where consumers search for information. Particular focus may be on new car yards.

APPENDIX 7 – INFORMATION CAMPAIGNS

Advertising Campaigns

The following are real-world advertising campaigns that featured ESC as a selling point:

The Hyundai advertising campaign was launched in April, offering free ESC on the Elantra 2.0 SX until the end of June. This was supplemented by television commercials launched in early May. The impact of this is noticeable in the sales figures with a 52.8 per cent increase in sales for this model over the period.

The Volkswagen Golf advertising campaign launched in late April aimed to inform the market that the Golf had "extra features at no extra cost". These features included ESC and the result was a 69.1 per cent increase in sales for those models over the April – June period.

The Mitsubishi Outlander advertising campaign was launched in February 2008. It focuses solely on the fact that the car has "Active Stability Control as standard". This means that any change in sales is most easily attributable directly to the campaign to promote Active Stability Control (ie ESC). There was an immediate effect with sales of the Mitsubishi Outlander increasing by 9.1 per cent for the month of February.

Other Campaigns

Other ESC campaigns are listed below.

<u>ESC Testing and Consumer Awareness Program</u>: This was an exercise conducted jointly by the Department of Infrastructure, Transport, Regional Development and Local Government and the Australian Automobile Association (AAA) under the auspices of the Australasian New Car Assessment Program (ANCAP). It involves initial testing using four popular selling vehicles of different configurations that are representative of the general fleet - a Hyundai Getz, Mitsubishi Pajero, Holden Commodore and Ford Territory. Further testing of other models may follow. The vehicles were tested with and without ESC functioning, using manoeuvres based on international standards. This provided an objective measurement of the value of ESC for each of the tested vehicles. The vehicles were not rated against each other. The output was intended to be a publicity campaign with national media coverage, in much the same way as a similar program last year with ANCAP demonstrated the benefits of head protecting side airbags. Consumer information would also include brochures and vision, showing the benefits of vehicles equipped with ESC in a variety of vehicles categories. The cost of the program was in the order of $200,000. One set of tests has already been done on the Commodore, but there is some uncertainty at this point about the next stage.

<u>Safer Motoring Program</u>: The Department of Infrastructure, Transport, Regional Development and Local Government and the state and territory road safety agencies have considered a proposal by the Australasian Fleet Managers Association (AFMA) for a "safer motoring program" with a request for funding of around $300,000. However, the effectiveness of the submission has yet to be proven against the proposed cost.

<u>Industry Cooperation</u>: The Department of Infrastructure, Transport, Regional Development and Local Government works routinely with the industry to encourage a focus on particular technologies, including ESC, and will continue to do so. The Queensland, Victorian and

Western Australian state governments have also been active with representations to the industry on ESC. The Western Australia Office of Road Safety has had a series of meetings with vehicle manufacturers, importers and the Federal Chamber of Automotive Industries (FCAI) with the aim of identifying ways of working closer together to promote vehicle safety to the community. Preliminary feedback received indicates that vehicle manufactures and importers appreciate the opportunity to work with authorities to progress safety. One of the outcomes of this is that the FCAI now includes information on its website to alert consumers to the vehicle models that are available with ESC.

ESC Promotional Campaign: The Victorian road authority VicRoads has entered into a partnership with the Royal Automobile Club of Victoria (RACV), Transport Accident Commission (TAC) and a major ESC manufacturer Robert Bosch GmbH, to increase public awareness of ESC through development and implementation of a promotional campaign. The campaign used the Bosch ESC simulator as a centrepiece attraction of a display to help demonstrate the safety benefits of ESC. The interactive display was showcased at Melbourne Central Shopping Centre, Melbourne International Motor Show and Melbourne Grand Prix. The display was also taken to the Australian Fleet Managers Association annual conference held in Melbourne. Following the success of the metropolitan campaign, the display was taken to regional centres as part of Auto Safety Week 2006 activities. The display was located in Ballarat, Wodonga and Traralgon, for approximately one week per location. The support of the State Coroner throughout both the metropolitan and regional campaigns lent considerable weight to the message. Further opportunities to promote ESC are currently being explored and include offering use of the display to dealerships, industry drive/testing days and featuring the display at Parliament.

APPENDIX 8- OVERVIEW OF GLOBAL TECHNICAL REGULATION NO. 8

The following is an overview of the requirements of Global Technical Regulation No. 8 Electronic Stability Control Systems. For the full requirements refer to the United Nations Economic Commission for Europe at www.unece.org/trans/main/welcwp29.htm

The Global Technical Regulation (GTR) for Electronic Stability Control (ESC) is intended to reduce the number of deaths and injuries that result from crashes in which the driver loses directional control of the vehicle. This includes those resulting in vehicle rollover. It does this by specifying performance and equipment requirements for ESC systems.

The test procedure was designed to induce excessive yaw in order to test for oversteer mitigation (ESC is also considered to be able to mitigate excessive understeer, however this is difficult to test for and so this was dealt with through the equipment requirement instead).

To determine a "pass/fail" result, there is an assessment of oversteer or "spinout". This is achieved by assessing the yaw rate at a point in time after completion of the steering inputs of the test manoeuvre. This is then compared to the peak yaw rate observed during the manoeuvre.

The GTR applies to all vehicles of Category 1-1, 1-2 and 2, with a gross vehicle mass (GVM) of 4,536 kilograms or less.

An ESC system must have all of the following attributes:

(a) Improves vehicle directional stability by at least having the ability to automatically control individually the braking torques of the left and right wheels on each axle or an axle of each axle group to induce a correcting yaw moment based on the evaluation of actual vehicle behaviour in comparison with a determination of vehicle behaviour demanded by the driver;

(b) Is computer-controlled with the computer using a closed-loop algorithm to limit vehicle oversteer and to limit vehicle understeer based on the evaluation of actual vehicle behaviour in comparison with a determination of vehicle behaviour demanded by the driver;

(c) A means to determine directly the value of vehicle's yaw rate and to estimate its side slip or side slip derivative with respect to time;

(d) A means to monitor driver steering inputs; and

(e) An algorithm to determine the need, and a means to modify propulsion

<u>Functional requirements.</u>

An ESC system shall be one that:

(a) Is capable of applying braking torques individually to all four wheels and has a control algorithm that utilizes this capability;

(b) Is operational over the full speed range of the vehicle, during all phases of driving including acceleration, coasting, and deceleration (including braking),except:

(i) When the driver has disabled ESC,

(ii) When the vehicle speed is below 20 km/h,

(iii) While the initial start-up self test and plausibility checks are completed,

(iv) When the vehicle is being driven in reverse;

(c) Remains capable of activation even if the antilock brake system or traction control system is also activated.

Performance Requirements.

During each test performed, the vehicle with the ESC system engaged shall satisfy the following directional stability criteria and responsiveness criterion at the maximum required steering angle;

The yaw rate measured one second after completion of a Sine with Dwell steering input shall not exceed 35 per cent of the first peak value of yaw rate recorded after the steering wheel angle changes sign (between first and second peaks) during the same test run; and the yaw rate measured 1.75 seconds after completion of the Sine with Dwell steering input shall not exceed 20 per cent of the first peak value of yaw rate recorded after the steering wheel angle changes sign (between first and second peaks) during the same test run.

The lateral displacement of the vehicle centre of gravity with respect to its initial straight path shall be at least 1.83 m for vehicles with a GVM of 3,500 kg or less, and 1.52 m for vehicles with a GVM greater than 3,500 kg.

Malfunction Detection

The vehicle shall be equipped with a tell-tale that provides a warning to the driver of the occurrence of any malfunction that affects the generation or transmission of control or response signals in the vehicle's ESC system. This shall illuminate for as long as the malfunction exists, whenever the ignition locking system is in the "On" ("Run") position. It shall also be activated as a check of lamp function.

ESC Off and other controls

The manufacturer may include an "ESC Off" control which shall be illuminated when the vehicle's headlamps are activated and places the ESC system in a mode in which it may no longer satisfy the required performance requirements. The Manufacturer may also provide controls for other systems that have an ancillary effect upon ESC operation.

The vehicle's ESC system shall always return to the manufacturer's original default mode at the initiation of each new ignition cycle if:

(a) The vehicle is in a four-wheel drive configuration which has the effect of locking the drive gears at the front and rear axles together and providing an additional gear reduction; or

(b) The vehicle is in a four-wheel drive configuration selected by the driver that is designed for operation at higher speeds on snow-, sand-, or dirt-packed roads and that has the effect of locking the drive gears at the front and rear axles together,

A control whose only purpose is to place the ESC system in a mode in which it will no longer satisfy the performance requirements shall be identified by a symbol for "ESC Off" or “Off” if it is part of a control whose purpose is to place the ESC system in different modes, at least one of which may no longer satisfy the performance requirements.

Where the ESC system mode is controlled by a multifunctional control, the driver display shall identify clearly to the driver the control position for this mode using the symbol ESC Off" or “Off”.

A control for another system that has the ancillary effect of placing the ESC system in a mode in which it no longer satisfies the performance requirements need not be identified by the "ESC Off" identifiers.

If the manufacturer elects to install a control to turn off or reduce the required performance of the ESC system, an "ESC Off" tell-tale must alert the driver to the lessened state of ESC system functionality.

<u>Test Conditions</u>

The ambient temperature must be between 0° C and 45° C with a maximum wind speed no greater than 5-10 m/s depending on the vehicle type. The test surface must be a dry, uniform, solid-paved surface with a nominal peak braking coefficient (PBC) of 0.9, unless otherwise specified, when measured using either the American Society for Testing and Materials (ASTM) E1136 standard reference test tyre, in accordance with ASTM Method E1337-90 without water delivery, at a speed of 40 mph; or the method specified in Annex 6, Appendix 2 of UNECE Regulation No. 13-H. The test surface has a consistent slope between level and 1 per cent.

The vehicle must be loaded with the fuel tank filled to at least 90 per cent of capacity, and total interior load of 168 kg comprised of the test driver, approximately 59 kg of test equipment (automated steering machine, data acquisition system and the power supply for the steering machine), and ballast as required.

The tyres must be inflated to the recommended cold tyre inflation pressure(s).

Outriggers may be used for testing if deemed necessary for test drivers' safety, however conditions apply.

A steering machine programmed to execute the required steering pattern shall be used and shall be capable of supplying steering torques between 40 to 60 Nm.

<u>Test Procedure.</u>

Conditioning

The brakes must be conditioned with ten stops from 56 km/h, with an average deceleration of approximately 0.5g, then three stops from 72 km/h.

The tyres must be conditioned by driving around a circle 30 metres in diameter at a speed that produces a lateral acceleration of approximately 0.5g to 0.6g for three clockwise laps followed by three counter clockwise laps.

Using a sinusoidal steering pattern at a frequency of 1 Hz, a peak steering wheel angle amplitude corresponding to a peak lateral acceleration of 0.5g to 0.6g, and a vehicle speed of 56 km/h, drive the vehicle through four passes, performing 10 cycles of sinusoidal steering during each pass. The steering wheel angle amplitude of the final cycle of the final pass must be twice that of the other cycles. The maximum time permitted between all laps and passes is five minutes.

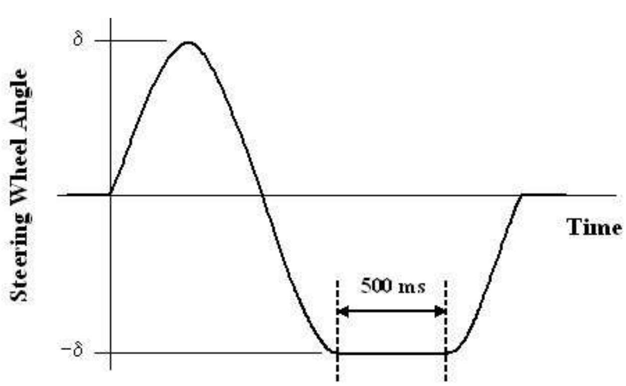
Testing

Carry out two series of runs of a Slowly Increasing Steer Test using a constant vehicle speed of 80 + 2 km/h and a steering pattern that increases by 13.5 degrees per second until a lateral acceleration of approximately 0.5g is obtained. Three repetitions are performed for each test series. One series uses counter clockwise steering, and the other series uses clockwise steering. The maximum time permitted between each test run is five minutes.

From the Slowly Increasing Steer tests, the quantity "A" is determined. "A" is the steering wheel angle in degrees that produces a steady state lateral acceleration of 0.3g. Utilizing linear regression, "A" is calculated, to the nearest 0.1 degrees, from each of the six Slowly Increasing Steer tests. The absolute value of the six A's calculated is averaged and rounded to the nearest 0.1 degrees to produce the final quantity, A, used below.

After the quantity "A" has been determined and without replacing the tyres, the tyre conditioning procedure described previously is performed immediately prior to conducting a Sine with Dwell Test. Initiation of the first Sine with Dwell test series shall begin within two hours after completion of the Slowly Increasing Steer tests of paragraph.

Check that the ESC system is enabled. Subject the vehicle to two series of test runs using a steering pattern of a sine wave at 0.7 Hz frequency with a 500 ms delay beginning at the second peak amplitude as shown below.



One series uses counter clockwise steering for the first half cycle, and the other series uses clockwise steering for the first half cycle. The vehicle is allowed to cool-down between each test run of 90 seconds to five minutes, with the vehicle stationary.

The steering motion is initiated with the vehicle coasting in high gear at 80 ± 2 km/h. The steering amplitude for the initial run of each series is 1.5A, where "A" is the steering wheel angle determined previously.

In each series of test runs, the steering amplitude is increased from run to run, by 0.5A, provided that no such run will result in a steering amplitude greater than that of the final run.

The steering amplitude of the final run in each series is the greater of 6.5A or 270 degrees, provided the calculated magnitude of 6.5A is less than or equal to 300 degrees. If any 0.5A increment, up to 6.5A, is greater than 300 degrees, the steering amplitude of the final run shall be 300 degrees.

ESC Malfunction Detection

Simulate one or more ESC malfunction(s) by disconnecting the power source to any ESC component or disconnecting any electrical connection between ESC components (with the vehicle power off).

Drive the vehicle forward to obtain a vehicle speed of 48 ± 8 km/h at the latest 30 seconds after the engine has been started and within the next two minutes at this speed, conduct at least one left and one right smooth turning manoeuvre without losing directional stability and one brake application. Verify that the ESC malfunction indicator illuminates as required and remains illuminated as long as the engine is running or until the fault is corrected.

APPENDIX 9 – COSTS FOR FITTING ELECTRONIC STABILITY CONTROL

Basic fitment

The Federal Chamber of Automotive Industries (FCAI) estimated the following costs for fitting a vehicle with Electronic Stability Control (ESC):

Costs for ESC are incorporated in to the overall development cost of a new model. These could range between $5 and $10 million per model depending on the number of variants of the model. Each variant (possibly down to tyre variation) will require calibration and testing.

In addition to the development costs the cost of fitting ESC was estimated at;

- from $350 per vehicle for a car already fitted with an Antilock Braking System (ABS).
- from $700 (minimum) for vehicle not already fitted with an ABS.

A leading ESC systems designer and manufacturer was also contacted and gave general guidance that if only the production line (the system and its installation) costs were considered, a typical ESC system would be in the order of $800.

Therefore, a range from $350 to $800 per vehicle would be a reasonable initial assumption for the basic fitment of ESC to a vehicle.

It was then noted that of the twenty most popular passenger car models and SUV models (refer Figure 6 and Figure 7 on page 22), 97 per cent of passenger cars and 83 per cent of SUVs (by sales volume) are available with ABS as standard or (only in a minority of cases) optional. With the ratio of sales of passenger cars and SUVs currently at 80:20, this is a combined value of nearly 95 per cent (0.8 x 97% + 0.2 x 83%). Together these models represent almost 65 per cent of the total market segment (by sales volume).

It was assumed that the remaining models in this segment would have a similar distribution of ABS availability and so a slightly conservative figure of 90 per cent availability was used to establish the final average cost of ESC fitment as $395, (0.9 x $395 + 0.1 x $800).

Development (Design) costs

Additionally, the FCAI identified significant development costs for vehicles that do not already have ESC developed, such as some NA (light commercial) category vehicles. Typical development costs range from $5million to $10 million depending on the number of variants and vehicle specification levels, as each will need calibration for the ESC system.

The leading ESC systems designer and manufacturer advised that ESC must be tailored to each vehicle model, with an assumed 5-10 model variants to be individually fine-tuned. This process typically takes around two years and involves design and tuning to match the wheelbase, tyres, wheels, suspension, engine, transmission, brakes, centre of gravity and other parameters. It involves the tuning of approximately 10,000 parameters. All of this adds up to several thousand man hours of work for each model. From the ground up, this could be expected to be around $3m. Adapting a basic existing system to a model would be closer to $0.5m (a minor update to a variant would be around $0.25m).

Where a model already has an anti-lock braking system (ABS) there are savings in re-using wheel sensors and some electrical wiring, but this is minimal. An ESC unit replaces an ABS unit rather than supplements it. The additional sensors for lateral acceleration and yaw rate are fairly self-contained, but the steering angle sensor may require a major re-design of the steering column area.

Therefore, a range from $0.5m to $3m would be a reasonable assumption for the development of ESC for a vehicle model.

Testing costs

The ESC systems designer and manufacturer also gave a best estimate of the testing costs to a regulation (these would be additional to normal development tests). A typical test to FMVSS 126 would be carried out over 2-3 days and cost in the region of $50,000. This cost has to take into account not only the investment in a test track, but in test equipment such as a steering machine (itself valued at around $0.25m). A test to GTR 8 would be similar to FMVSS 126; with the track required to have a Peak Braking Coefficient nominally of 0.9. Initial advice from manufacturers is that there is at least one independently operated test track, and one other test track in Australia owned by the ESC systems designer, that would be adequate.

Therefore, a cost of $50,000 would be a reasonable assumption for the testing of ESC to a regulation for a vehicle model.

Type approval costs

The FCAI advised that type approval costs (certification costs) such as testing to Australian Design Rule (ADR) 31/.. or 35/.. , testing EMC interference, preparation of documentation/submission/resolution of issues – would approach $20,000 per model. Under the type-approval certification system used in Australia, the cost of submitting and processing a model application has been estimated by the Department of Infrastructure, Transport, Regional Development and Local Government as around $15,000. This estimate was guided by the estimates of some of the more complex tests given in Appendix 10 – Typical Costs for Regulation Compliance in Australia, as well as in recognition that the cost of the test itself (whether as part of an ADR 31/.. or 35/.. brake test, or as a stand alone ESC test), has been accounted for in the testing costs above.

Therefore, a cost of $15,000 would be a reasonable assumption for the type approval costs of ESC for a vehicle model.

Implementing and maintaining the regulation costs

There is also an estimated cost of $50,000 per year to governments to create, implement and maintain the regulation, as well as for state and territory jurisdictions to develop processes for its in-service use (such as vehicle modification requirements etc). This includes the initial development cost, as well as ongoing maintenance and interpretation advice.

Therefore, a yearly cost of $50,000 would be a reasonable assumption for the implementation and maintenance of a regulation.

A summary of the costs is given below.

Type of cost	*Estimated cost ($)*	*Notes*
Fitment of ESC system	395	per vehicle
Development of ESC system	0.5m - 3m	per model
Testing of ESC system to a regulation	50,000	per model
Type approval costs	15,000	per model
Implement and maintain regulation	50,000	per year

APPENDIX 10 – TYPICAL COSTS FOR REGULATION COMPLIANCE IN AUSTRALIA

ADR	Category	Activity	Affected Party	Cost	Cost Basis
07/00	certification	certification to ADR	industry	1,500	per model
10/00	certification	certification to ADR	industry	50,000	per annum
10/00	test	dynamic or barrier crash component costs	industry	10,000	per model
10/00	test	cost to perform crash test	industry	3,000	per model
10/00	test	cost of vehicle and "body block" components to perform test	industry	25,000	per model
11/00	test	testing	industry	500	per model
11/00	sumbit test	submission of evidence	industry	500	per model
11/00	certification	certification to ADR	industry	9,000	per model
12/00	certification	certification to ADR	industry	500	per model
14/00	certification/ design + build	certify mirrors to ADR - development costs	industry	250000 - 350000	per model
14/00	test	testing - cost of small car	industry	15,000	per model
14/00	test	testing - cost of 4WD	industry	60,000	per model
15/00	certification	certification to ADR	industry	10,000	per model
15/00	administer test	administration of ADR	government	1,000	per annum
16/00	certification	certification to ADR	industry	10,000	per model
16/00	administer test	administration of ADR	government	1,000	per annum
17/00	test	impact tests - fuel tanks	industry	4,000	per model
17/00	certification	certification of other parts of the fuel system	industry	5,000	per model
20/00	test	compliance testing	industry	6,000	per model
20/00	submit test	compliance administration	industry	500	per model
21/00	test	head form impact certification test	industry	4,000	per model
21/00	test	10g instrument panel compartment door loading test	industry	1,500	per model
21/00	submit test	submission of evidence	industry	500	per model
23/00	certification	certification tests to ADR	industry	8,000	per model
23/00	submit test	compliance administration	industry	500	per model
23/00	test	UNECE R30 certification test	industry	2,500	per model
24/00	certification	certification	industry	1,000	per model
29/00	certification	full ADR 29 test and submission of certification information.	industry	2,000	per model
29/00	test	destructive testing cost - pre-production body unit (shell and doors)	industry	2,000	
29/00	submit test	Submission of evidence	industry	500	per model
29/00	design + build	cost to design and build a vehicle to ADR 29	industry	20	per vehicle / unit
31/01	test	test to ADR	industry	10,000	per model
31/01	submit test	administration - submiting evidence	industry	2,000	per model
31/01	administer test	administration of ADR	government	15,000	--
33/00	compliance	ADR 33 compliance testing	industry	10,000	per model
34/00	test	testing to ADR	industry	360,000	per annum
34/00	design + build	design, manufacture and installation of the anchorage fittings	industry	1,450,000	per annum
35/01	test	test to ADR	industry	10,000	per model
38/02	certification	certification	industry	1,200	per model
42/04	test	crash test	industry	4,000,000	per model
42/04	--	underrun barrier unit cost	industry	400	per vehicle / unit
43/04	test	product development - cost of car	industry	20,000	per model
43/04	test	product development- Cost of a used rigid truck	industry	40,000	per model
43/04	test	product development -Cost of crash test	industry	25,000	per model
43/04	design + test	product development - Cost towards design, analysis and testing	industry	30,000	per model
43/04	build	product development- Cost of constructing a rear under-run barrier	industry	5,000	per model
43/04	--	product development - Other costs	industry	5,000	per model
58/00	compliance	manufacturing and compliance costs to ADR	industry	1,000	per annum
59/00	compliance	comly with ADR - materials cost	industry	1,200	per vehicle / unit
59/00	test	align with UNECE - testing	industry	12,000	per vehicle / unit
59/00	compliance	align with UNECE - materials cost	industry	1,200	per vehicle / unit
61/00	certification	inspection and certification	government	400,000	per annum
61/00	compliance	industry compliance costs	industry	500,000	per annum
62/00	certification	certification to UNECE as alt standard	industry	10,000	per model
62/00	certification	certification to UNECE as alt standard	industry	20,000	per model
62/00	certification	certification to UNECE as alt standard	industry	18,000	per model
62/00	test	lab testing of coupling type	industry	25,000	per vehicle / unit
62/00	certification	lab testing of coupling type + ancillary costs + certification costs	industry	50,000	per vehicle / unit
63/00	compliance	compliance	industry	7,500	per annum
63/00	administer test	compliance	government	200	per model
64/00	compliance	compliance	industry	5,000	per annum
64/00	administer test	compliance	government	200	per model
65/00	test	ADR 65 compliance test costs	industry	1000-2000	per model
65/00	submit test	Submission of certification information	industry	15,000	per annum

APPENDIX 11 - BENEFIT-COST ANALYSIS – METHODOLOGY

The model used in this analysis was the Net Present Value (NPV) model. The costs and expected benefits associated with a number of options for government intervention were summed over time. The further the cost or benefit occurred from the nominal starting date, the more they were discounted. This allowed all costs and benefits to be compared equally between the options, no matter at what point in time that they occurred. The analysis may be broken up in to the following parts:

1. The trend in new vehicle sales data for passenger cars and SUVs was established for the years 1999-2008. This was then extrapolated to 2038 by assuming a total increase in the current rate of 2 per cent per year.

2. The fitment rate of Electronic Stability Control (ESC) for the Business As Usual (BAU) case (assuming no intervention) was established, starting at the current rate of 50 per cent for passenger cars and 80 per cent for SUVs and including the 2012 levels of 90 and 95 respectively as advised by industry. The fitment rate was then established for each of the options. These were higher than the BAU, the actual amount depending on the characteristics of the proposed intervention.

3. The likelihood of a registered car having a crash where a driver is injured in some way (including fatally) was established for each year of a car's life using the method described in Fildes (2002). The method included historical data of crash rates over 25 years.

4. The differences between the BAU and each option were calculated, these resulting in the net number of vehicles fitted with ESC that were attributable to each option in a particular year.

5. For each year, the net number of vehicles fitted with ESC for each option was then multiplied by the likelihood of a crash per registration in that first year. This was then added to the likelihoods of older cars crashing during that year.

6. The proportion of single vehicle fatal crashes for passenger cars and SUVs as compared to the total of single and multiple vehicle crashes was established using Appendix 3- Single and Multiple Vehicle Crashes and Ratio of Injuries. The net number of vehicles from part 4. was multiplied by the number of expected crashes for that year as determined in part 5. This was then reduced by the proportion calculated in part 6. and multiplied further by 0.96 which represented the percentage of single vehicle crashes that could be influenced by ESC. The result was then multiplied by the effectiveness of ESC (27 per cent for passenger vehicles and 68 per cent for SUVs as reported at Appendix 4- Effectiveness of Electronic Stability Control Systems and highlighted in Table 10), the outcome being the number of injury based vehicle crashes that could be saved by ESC due to the intervention option.

7. The vehicles in part 7. were multiplied by the ratio of fatalities, serious injuries and minor injuries determined for single vehicle crashes, and then by the costs associated with each one of these crash types. This calculated the money value of the saved crashes which in turn became the benefits for each option. Research undertaken by

the Bureau of Transport Economics (2000) in Australia found that the cost in 1996 dollars of a fatality in a road crash was $1.5 million, a serious injury $325,000, and a minor injury $11,611. These costs were updated to 2008 costs and on the basis of a crash rather than a fatality using the inflation calculator at the Reserve Bank of Australia (http://www.rba.gov.au/calculator/calc.go) to $2.017 million, $548,701, and $18,527 respectively. In addition, the cost of a fatality was then modified to reflect willingness to pay terms. This was done using a base cost of $3.587m (Abelson 2007), multiplied by 1.1 to convert it to a cost per crash rather than per fatality, and then added other costs from the Bureau of Transport Economics (2000) to a value of $922, 551, to reach a final value for a fatal crash of $4.868m. These amounts were proportioned using the fatality and injury rates (refer page 13) to arrive at the cost of an average casualty crash of $147,083.

8. The fitment, system development, regulation compliance and government costs (as relevant) with each particular option were then calculated, using the values from Appendix 9 – Costs for Fitting Electronic Stability Control. Where these are on a yearly basis they were used directly. The fitment costs were based on the net number of vehicles in part 4. System development costs were based on the proportion of vehicle models that represented the net number of vehicles. This was determined through the relevant figure in Table 5. Regulation compliance costs (where applicable) were based on all passenger cars and SUVs in the new fleet and government costs were determined separately and were recorded in Table 6.

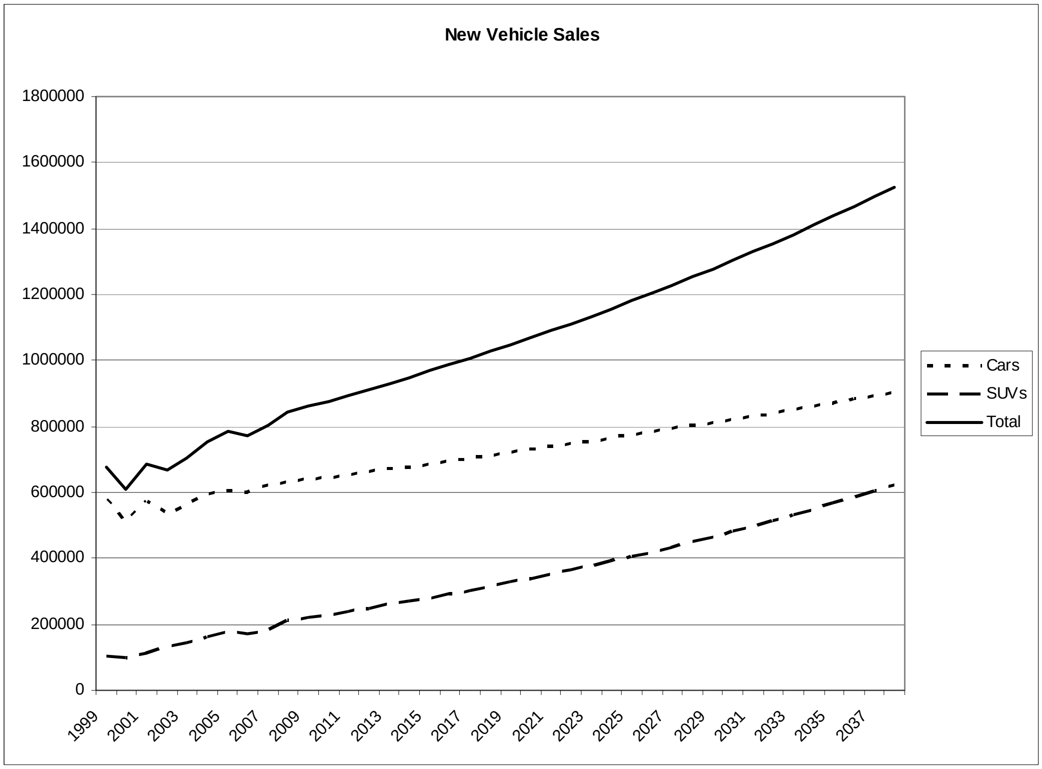
9. All the calculated values were discounted and summed, allowing calculations of Net Benefits, Total Costs, Benefit-Cost Ratios and lives saved. A discount rate of 7 per cent was assumed, this being in line with similar studies. However, a rate of 10 per cent was used as part of a sensitivity check.

APPENDIX 12 –BENEFIT-COST ANALYSIS – DETAILS OF RESULTS

1. Establish the trend in new vehicle sales data for passenger cars and SUVs for the years 1999-2008. Extrapolate to 2038 by assuming a total increase in the current rate of 2 per cent per year.

New Vehicle Sales			
Year	**Cars**	**SUVs**	**Total**
1998-99	575699	101783	677482
1999-00	509448	97588	607036
2000-01	571045	114790	685835
2001-02	537610	129062	666672
2002-03	560203	143967	704170
2003-04	594414	160924	755338
2004-05	604027	181958	785985
2005-06	599360	173325	772685
2006-07	624124	180354	804478
2007-08	631813	210943	842756
2008-09	*639395*	*220216*	*859611*
2009-10	*647067*	*229736*	*876803*
2010-11	*654832*	*239507*	*894339*
2011-12	*662690*	*249536*	*912226*
2012-13	*670643*	*259828*	*930471*
2013-14	*678690*	*270390*	*949080*
2014-15	*686835*	*281227*	*968062*
2015-16	*695077*	*292346*	*987423*
2016-17	*703418*	*303754*	*1007171*
2017-18	*711859*	*315456*	*1027315*
2018-19	*720401*	*327460*	*1047861*
2019-20	*729046*	*339773*	*1068818*
2020-21	*737794*	*352401*	*1090195*
2021-22	*746648*	*365351*	*1111999*
2022-23	*755607*	*378631*	*1134239*
2023-24	*764675*	*392249*	*1156923*
2024-25	*773851*	*406211*	*1180062*
2025-26	*783137*	*420526*	*1203663*
2026-27	*792535*	*435202*	*1227736*
2027-28	*802045*	*450246*	*1252291*
2028-29	*811670*	*465667*	*1277337*
2029-30	*821410*	*481474*	*1302884*
2030-31	*831267*	*497675*	*1328941*
2031-32	*841242*	*514278*	*1355520*
2032-33	*851337*	*531294*	*1382631*
2033-34	*861553*	*548730*	*1410283*
2034-35	*871891*	*566597*	*1438489*
2035-36	*882354*	*584904*	*1467259*
2036-37	*892942*	*603661*	*1496604*
2037-38	*903658*	*622878*	*1526536*

Source: Australian Bureau of Statistics Table 1:
New Motor Vehicles Sales by Type, All series
http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/9314.0Aug%20200
8?OpenDocument



2. Establish the fitment rate of Electronic Stability Control (ESC) for the Business As Usual (BAU) case. Establish the fitment rate for each of the options.

Benefit related to:	***Expected effectiveness***	***Option***	***Notes***
Information campaigns - targeted awareness	77%	2(a)	total awareness per new fleet per year
Information campaigns - advertising	8%	2(b)	increae per make per new fleet per year
Fleet purchasing policies (passenger cars)	20%	3	increase per new fleet per year
Fleet purchasing policies (SUVs)	4.5%	3	increase per new fleet per year
Regulation	100%	6	total per new fleet per year

Option 2(a) User information campaigns – Awareness

Fitment Rate						
	Cars		SUVs		Total	
	BAU	Option	BAU	Option	BAU	Option
2007-08	0.550	0.770	0.800	0.800	0.600	0.776
2009	0.638	0.770	0.838	0.838	0.678	0.784
2010	0.725	0.770	0.875	0.875	0.755	0.791
2011	0.813	0.813	0.913	0.913	0.833	0.833
2012	0.900	0.900	0.950	0.950	0.910	0.910
2013	0.925	0.925	0.950	0.950	0.930	0.930
2014	0.950	0.950	0.950	0.950	0.950	0.950
2015	0.950	0.950	0.950	0.950	0.950	0.950
2016	0.950	0.950	0.950	0.950	0.950	0.950
2017	0.950	0.950	0.950	0.950	0.950	0.950
2018	0.950	0.950	0.950	0.950	0.950	0.950
2019	0.950	0.950	0.950	0.950	0.950	0.950
2020	0.950	0.950	0.950	0.950	0.950	0.950
2021	0.950	0.950	0.950	0.950	0.950	0.950
2022	0.950	0.950	0.950	0.950	0.950	0.950
2023	0.950	0.950	0.950	0.950	0.950	0.950
2024	0.950	0.950	0.950	0.950	0.950	0.950
2025	0.950	0.950	0.950	0.950	0.950	0.950
2026	0.950	0.950	0.950	0.950	0.950	0.950
2027	0.950	0.950	0.950	0.950	0.950	0.950
2028	0.950	0.950	0.950	0.950	0.950	0.950
2029	0.950	0.950	0.950	0.950	0.950	0.950
2030	0.950	0.950	0.950	0.950	0.950	0.950
2031	0.950	0.950	0.950	0.950	0.950	0.950
2032	0.950	0.950	0.950	0.950	0.950	0.950
2033	0.950	0.950	0.950	0.950	0.950	0.950
2034	0.950	0.950	0.950	0.950	0.950	0.950
2035	0.950	0.950	0.950	0.950	0.950	0.950
2036	0.950	0.950	0.950	0.950	0.950	0.950
2037	0.950	0.950	0.950	0.950	0.950	0.950
2038	0.950	0.950	0.950	0.950	0.950	0.950

Option 2(b) User information campaigns – Advertising

Fitment Rate						
	Cars		SUVs		Total	
	BAU	Option	BAU	Option	BAU	Option
2007-08	0.550	0.594	0.800	0.864	0.600	0.648
2009	0.638	0.689	0.838	0.905	0.678	0.732
2010	0.725	0.783	0.875	0.945	0.755	0.815
2011	0.813	0.878	0.913	0.986	0.833	0.899
2012	0.900	0.972	0.950	1.000	0.910	0.978
2013	0.925	0.999	0.950	1.000	0.930	0.999
2014	0.950	1.000	0.950	1.000	0.950	1.000
2015	0.950	1.000	0.950	1.000	0.950	1.000
2016	0.950	1.000	0.950	1.000	0.950	1.000
2017	0.950	1.000	0.950	1.000	0.950	1.000
2018	0.950	1.000	0.950	1.000	0.950	1.000
2019	0.950	1.000	0.950	1.000	0.950	1.000
2020	0.950	1.000	0.950	1.000	0.950	1.000
2021	0.950	1.000	0.950	1.000	0.950	1.000
2022	0.950	1.000	0.950	1.000	0.950	1.000
2023	0.950	1.000	0.950	1.000	0.950	1.000
2024	0.950	1.000	0.950	1.000	0.950	1.000
2025	0.950	1.000	0.950	1.000	0.950	1.000
2026	0.950	1.000	0.950	1.000	0.950	1.000
2027	0.950	1.000	0.950	1.000	0.950	1.000
2028	0.950	1.000	0.950	1.000	0.950	1.000
2029	0.950	1.000	0.950	1.000	0.950	1.000
2030	0.950	1.000	0.950	1.000	0.950	1.000
2031	0.950	1.000	0.950	1.000	0.950	1.000
2032	0.950	1.000	0.950	1.000	0.950	1.000
2033	0.950	1.000	0.950	1.000	0.950	1.000
2034	0.950	1.000	0.950	1.000	0.950	1.000
2035	0.950	1.000	0.950	1.000	0.950	1.000
2036	0.950	1.000	0.950	1.000	0.950	1.000
2037	0.950	1.000	0.950	1.000	0.950	1.000
2038	0.950	1.000	0.950	1.000	0.950	1.000

Option 3 Fleet purchasing policies

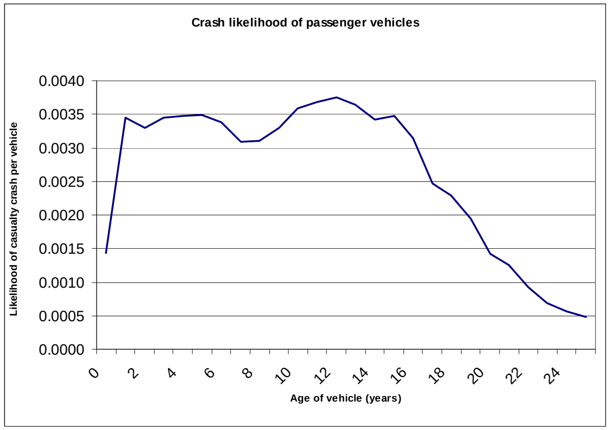
Fitment Rate						
	Cars		SUVs		Total	
	BAU	Option	BAU	Option	BAU	Option
2007-08	0.550	0.750	0.800	0.845	0.600	0.769
2009	0.638	0.750	0.838	0.845	0.678	0.769
2010	0.725	0.750	0.875	0.875	0.755	0.775
2011	0.813	0.813	0.913	0.913	0.833	0.833
2012	0.900	0.900	0.950	0.950	0.910	0.910
2013	0.925	0.925	0.950	0.950	0.930	0.930
2014	0.950	0.950	0.950	0.950	0.950	0.950
2015	0.950	0.950	0.950	0.950	0.950	0.950
2016	0.950	0.950	0.950	0.950	0.950	0.950
2017	0.950	0.950	0.950	0.950	0.950	0.950
2018	0.950	0.950	0.950	0.950	0.950	0.950
2019	0.950	0.950	0.950	0.950	0.950	0.950
2020	0.950	0.950	0.950	0.950	0.950	0.950
2021	0.950	0.950	0.950	0.950	0.950	0.950
2022	0.950	0.950	0.950	0.950	0.950	0.950
2023	0.950	0.950	0.950	0.950	0.950	0.950
2024	0.950	0.950	0.950	0.950	0.950	0.950
2025	0.950	0.950	0.950	0.950	0.950	0.950
2026	0.950	0.950	0.950	0.950	0.950	0.950
2027	0.950	0.950	0.950	0.950	0.950	0.950
2028	0.950	0.950	0.950	0.950	0.950	0.950
2029	0.950	0.950	0.950	0.950	0.950	0.950
2030	0.950	0.950	0.950	0.950	0.950	0.950
2031	0.950	0.950	0.950	0.950	0.950	0.950
2032	0.950	0.950	0.950	0.950	0.950	0.950
2033	0.950	0.950	0.950	0.950	0.950	0.950
2034	0.950	0.950	0.950	0.950	0.950	0.950
2035	0.950	0.950	0.950	0.950	0.950	0.950
2036	0.950	0.950	0.950	0.950	0.950	0.950
2037	0.950	0.950	0.950	0.950	0.950	0.950
2038	0.950	0.950	0.950	0.950	0.950	0.950

Option 6 Mandatory standards under the MVSA (Regulation)

Fitment Rate						
	Cars		SUVs		Total	
	BAU	Option	BAU	Option	BAU	Option
2007-08	0.550	0.550	0.800	0.800	0.600	0.600
2009	0.638	0.638	0.838	0.838	0.678	0.678
2010	0.725	0.725	0.875	0.875	0.755	0.755
2011	0.813	0.813	0.913	0.913	0.833	0.833
2012	0.900	0.900	0.950	0.950	0.910	0.910
2013	0.925	0.950	0.950	0.975	0.930	0.955
2014	0.950	1.000	0.950	1.000	0.950	1.000
2015	0.950	1.000	0.950	1.000	0.950	1.000
2016	0.950	1.000	0.950	1.000	0.950	1.000
2017	0.950	1.000	0.950	1.000	0.950	1.000
2018	0.950	1.000	0.950	1.000	0.950	1.000
2019	0.950	1.000	0.950	1.000	0.950	1.000
2020	0.950	1.000	0.950	1.000	0.950	1.000
2021	0.950	1.000	0.950	1.000	0.950	1.000
2022	0.950	1.000	0.950	1.000	0.950	1.000
2023	0.950	1.000	0.950	1.000	0.950	1.000
2024	0.950	1.000	0.950	1.000	0.950	1.000
2025	0.950	1.000	0.950	1.000	0.950	1.000
2026	0.950	1.000	0.950	1.000	0.950	1.000
2027	0.950	1.000	0.950	1.000	0.950	1.000
2028	0.950	1.000	0.950	1.000	0.950	1.000
2029	0.950	1.000	0.950	1.000	0.950	1.000
2030	0.950	1.000	0.950	1.000	0.950	1.000
2031	0.950	1.000	0.950	1.000	0.950	1.000
2032	0.950	1.000	0.950	1.000	0.950	1.000
2033	0.950	1.000	0.950	1.000	0.950	1.000
2034	0.950	1.000	0.950	1.000	0.950	1.000
2035	0.950	1.000	0.950	1.000	0.950	1.000
2036	0.950	1.000	0.950	1.000	0.950	1.000
2037	0.950	1.000	0.950	1.000	0.950	1.000
2038	0.950	1.000	0.950	1.000	0.950	1.000

3. Establish the likelihood of a registered car having a crash where a driver is injured in some way (including fatally) for each year of a car's life as given in Fildes (2002).

Age of vehicle	Crashes	Annual registrations	Likelihood of casualty crash
1	1087	760523	0.0014
2	2556	740998	0.0034
3	2572	778997	0.0033
4	2412	698916	0.0035
5	2194	630869	0.0035
6	2142	613261	0.0035
7	1990	588550	0.0034
8	1637	530947	0.0031
9	1635	526303	0.0031
10	1591	482099	0.0033
11	2038	567202	0.0036
12	2008	544296	0.0037
13	1790	477461	0.0037
14	1510	414467	0.0036
15	1636	478197	0.0034
16	2176	625061	0.0035
17	1827	579925	0.0032
18	1297	524515	0.0025
19	1330	580654	0.0023
20	1082	555753	0.0019
21	804	565653	0.0014
22	667	532710	0.0013
23	489	532473	0.0009
24	360	517449	0.0007
25	314	556300	0.0006
26	263	551011	0.0005



4. Calculate the net difference in the number of vehicles fitted with ESC between the BAU and each option.

5. For each year and each option, multiply the net number of vehicles fitted with ESC by the likelihood of a crash per registration in that first year. Add this to the likelihoods of all older cars crashing during that year.

6. For each year and each option, multiply 5. by the proportion of single vehicle fatal crashes for passenger cars and SUVs in Appendix 3- Single and Multiple Vehicle Crashes and Ratio of Injuries, then by 0.96, then by the effectiveness of ESC reported at Appendix 4- Effectiveness of Electronic Stability Control Systems.

7. Multiply 5. by the costs associated with the average crash. This gives the benefits.

Type of Injury	Ratio between all injuries*	Proportion of all injuries	Value of single event	Value of an average casualty crash
Fatality	1	0.012	$4,868,801	$59,630
Serious Injury	10.65	0.130	$548,701	$71,570
Minor Injury	70	0.857	$18,527	$15,884
Total		1		$147,083

*Established as:1:10.65:70

Option 2(a) User information campaigns – Awareness

Year	Likelihood of crash per vehicle	Option minus BAU (Cars)	Option minus BAU (SUVs)	Cars: Age of vehicle (years)																															Total vehicles
				0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
1	0.0014	84720	0		121																														121
2	0.0034	29118	0		292	42																													334
3	0.0033	0	0		280	100	0																												380
4	0.0035	0	0		292	96	0	0																											389
5	0.0035	0	0		295	100	0	0	0																										395
6	0.0035	0	0		296	101	0	0	0	0																									397
7	0.0034	0	0		286	102	0	0	0	0	0																								388
8	0.0031	0	0		261	98	0	0	0	0	0	0																							360
9	0.0031	0	0		263	90	0	0	0	0	0	0	0																						353
10	0.0033	0	0		280	90	0	0	0	0	0	0	0	0																					370
11	0.0036	0	0		304	96	0	0	0	0	0	0	0	0	0																				400
12	0.0037	0	0		313	105	0	0	0	0	0	0	0	0	0	0																			417
13	0.0037	0	0		318	107	0	0	0	0	0	0	0	0	0	0	0																		425
14	0.0036	0	0		309	109	0	0	0	0	0	0	0	0	0	0	0	0																	418
15	0.0034	0	0		290	106	0	0	0	0	0	0	0	0	0	0	0	0	0																396
16	0.0035	0	0		295	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0															395
17	0.0032	0	0		267	101	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0														368
18	0.0025	0	0		209	92	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0													301
19	0.0023	0	0		194	72	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0												266
20	0.0019	0	0		165	67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0											232
21	0.0014	0	0		120	57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0										177
22	0.0013	0	0		106	41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									147
23	0.0009	0	0		78	36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0								114
24	0.0007	0	0		59	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							86
25	0.0006	0	0		48	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						68
26	0.0005	0	0		40	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					57
27	0.0000	0	0			14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				14
28	0.0000	0	0				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0
29	0.0000	0	0					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
30	0.0000	0	0						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Year	Likelihood of crash per vehicle	Option minus BAU (Cars)	Option minus BAU (SUVs)	SUVs Age of vehicle (years)																															Total vehicles
				0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
1	0.0014	84720	0		0																														0
2	0.0034	29118	0		0	0																													0
3	0.0033	0	0		0	0	0																												0
4	0.0035	0	0		0	0	0	0																											0
5	0.0035	0	0		0	0	0	0	0																										0
6	0.0035	0	0		0	0	0	0	0	0																									0
7	0.0034	0	0		0	0	0	0	0	0	0																								0
8	0.0031	0	0		0	0	0	0	0	0	0	0																							0
9	0.0031	0	0		0	0	0	0	0	0	0	0	0																						0
10	0.0033	0	0		0	0	0	0	0	0	0	0	0	0																					0
11	0.0036	0	0		0	0	0	0	0	0	0	0	0	0	0																				0
12	0.0037	0	0		0	0	0	0	0	0	0	0	0	0	0	0																			0
13	0.0037	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0																		0
14	0.0036	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0																	0
15	0.0034	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0																0
16	0.0035	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0															0
17	0.0032	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0														0
18	0.0025	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0													0
19	0.0023	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0												0
20	0.0019	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0											0
21	0.0014	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0										0
22	0.0013	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									0
23	0.0009	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0								0
24	0.0007	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							0
25	0.0006	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						0
26	0.0005	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					0
27	0.0000	0	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				0
28	0.0000	0	0				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0
29	0.0000	0	0					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
30	0.0000	0	0						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Option 2(b) User information campaigns – Advertising

Year	Likelihood of crash per vehicle	Option minus BAU (Cars)	Option minus BAU (SUVs)	Cars Age of vehicle (years) 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Total vehicles
1	0.0014	32609	14754		47																														47
2	0.0034	37530	16082		112	54																													166
3	0.0033	42564	17484		108	129	61																												298
4	0.0035	47714	12477		113	124	147	68																											451
5	0.0035	49628	12991		113	130	141	165	71																										619
6	0.0035	33935	13519		114	131	147	158	171	49																									769
7	0.0034	34342	14061		110	131	148	165	164	117	49																								884
8	0.0031	34754	14617		101	127	149	166	171	112	118	50																							993
9	0.0031	35171	15188		101	116	144	167	173	117	113	120	50																						1101
10	0.0033	35593	15773		108	117	131	161	173	118	119	115	121	51																					1214
11	0.0036	36020	16373		117	124	132	147	168	119	119	120	116	123	51																				1336
12	0.0037	36452	16989		120	135	140	148	153	115	120	121	121	118	124	52																			1468
13	0.0037	36890	17620		122	138	153	157	154	105	116	121	122	123	119	126	53																		1610
14	0.0036	37332	18268		119	141	157	171	164	105	106	118	123	124	124	120	127	53																	1752
15	0.0034	37780	18932		112	137	160	176	178	112	107	107	119	124	125	126	122	129	54																1887
16	0.0035	38234	19612		114	128	155	179	183	122	113	108	108	120	126	127	127	123	130	55															2019
17	0.0032	38693	20311		103	131	146	174	186	125	123	115	109	110	122	127	128	129	125	132	55														2139
18	0.0025	39157	21026		81	118	148	163	181	127	127	125	116	111	111	123	129	130	130	126	133	56													2236
19	0.0023	39627	21760		75	93	134	166	170	124	129	128	126	117	112	112	125	130	131	132	128	135	57												2324
20	0.0019	40102	22512		63	86	105	150	173	116	125	130	130	128	119	113	114	126	132	133	134	129	137	57											2401
21	0.0014	40583	23283		46	73	97	118	156	118	117	127	132	131	129	120	115	115	128	134	135	135	131	138	58										2454
22	0.0013	41070	24074		41	53	83	109	123	107	120	119	128	133	133	131	122	116	116	129	135	136	137	132	140	59									2502
23	0.0009	41563	24884		30	47	60	93	114	84	108	121	120	130	135	134	133	123	117	118	131	137	138	138	134	142	59								2546
24	0.0007	42062	25714		23	34	53	68	97	78	85	109	122	122	131	137	136	134	125	119	119	132	138	139	140	136	143	60							2582
25	0.0006	42567	26565		18	26	39	60	71	66	79	86	111	124	123	133	138	138	136	126	120	121	134	140	141	142	137	145	61						2614
26	0.0005	43078	27437		16	21	30	44	62	48	67	80	87	112	125	125	134	140	139	137	128	122	122	136	142	143	143	139	147	62					2650
27	0.0000	43595	28330			18	24	33	46	42	49	68	81	88	113	127	126	136	142	141	139	129	123	124	137	143	145	145	141	149	62				2670
28	0.0000	44118	29245				20	27	35	31	43	49	68	82	89	115	128	128	138	143	143	141	131	125	125	139	145	146	147	142	150	63			2693
29	0.0000	44647	30183					23	28	24	32	44	50	69	83	90	116	130	129	139	145	144	142	132	126	127	141	147	148	149	144	152	64		2717
30	0.0000	45183	31144						24	19	24	32	44	51	70	83	91	118	132	131	141	147	146	144	134	128	128	142	149	150	150	146	154	65	2741

Year	Likelihood of crash per vehicle	Option minus BAU (Cars)	Option minus BAU (SUVs)	SUVs Age of vehicle (years)																															Total vehicles
				0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
1	0.0014	32609	14754		21																														21
2	0.0034	37530	16082		51	23																													74
3	0.0033	42564	17484		49	55	25																												129
4	0.0035	47714	12477		51	53	60	18																											182
5	0.0035	49628	12991		51	55	58	43	19																										226
6	0.0035	33935	13519		52	56	60	41	45	19																									273
7	0.0034	34342	14061		50	56	61	43	43	47	20																								320
8	0.0031	34754	14617		45	54	61	43	45	45	49	21																							363
9	0.0031	35171	15188		46	50	59	44	45	47	46	50	22																						409
10	0.0033	35593	15773		49	50	54	42	45	47	49	48	52	23																					459
11	0.0036	36020	16373		53	53	54	38	44	47	49	50	50	54	23																				517
12	0.0037	36452	16989		54	58	58	39	40	46	49	51	52	52	56	24																			580
13	0.0037	36890	17620		55	59	63	41	40	42	48	51	53	54	54	59	25																		644
14	0.0036	37332	18268		54	60	65	45	43	42	43	49	53	55	57	56	61	26																	708
15	0.0034	37780	18932		50	59	66	46	47	45	44	45	51	55	57	59	58	63	27																771
16	0.0035	38234	19612		51	55	64	47	48	49	46	45	47	53	57	59	61	60	65	28															836
17	0.0032	38693	20311		46	56	60	45	49	50	51	48	47	49	55	59	61	63	63	68	29														899
18	0.0025	39157	21026		36	51	61	43	47	51	52	53	50	49	50	57	62	64	65	65	70	30													955
19	0.0023	39627	21760		34	40	55	43	44	49	53	54	55	52	51	52	60	64	66	68	67	73	31												1010
20	0.0019	40102	22512		29	37	43	39	45	46	51	55	56	57	54	53	54	62	66	68	70	69	75	32											1062
21	0.0014	40583	23283		21	31	40	31	41	47	48	53	57	58	59	56	55	56	64	69	71	73	72	78	33										1112
22	0.0013	41070	24074		18	23	34	29	32	43	49	50	55	59	60	61	58	57	58	66	71	73	75	74	80	34									1161
23	0.0009	41563	24884		14	20	25	24	30	33	44	51	52	57	61	63	63	60	59	60	69	73	76	78	77	83	36								1209
24	0.0007	42062	25714		10	15	22	18	25	31	35	46	53	54	60	64	65	66	62	61	63	71	76	78	80	79	86	37							1256
25	0.0006	42567	26565		8	11	16	16	18	26	32	36	48	55	56	62	66	67	68	65	63	65	74	79	81	83	82	89	38						1304
26	0.0005	43078	27437		7	9	12	11	16	19	27	33	38	50	57	58	64	68	70	70	67	65	67	76	81	84	86	85	92	39					1354
27	0.0000	43595	28330			8	10	9	12	17	20	28	35	39	52	59	60	67	71	72	73	69	68	69	79	84	87	89	88	95	40				1399
28	0.0000	44118	29245				8	7	9	12	18	21	30	36	40	54	61	62	69	74	75	76	72	70	72	81	87	89	92	91	98	42			1445
29	0.0000	44647	30183					6	7	9	13	18	22	31	38	42	56	64	65	71	76	78	78	74	72	74	84	90	92	95	94	101	43		1492
30	0.0000	45183	31144						6	8	10	13	19	22	32	39	44	58	66	67	74	79	80	81	77	75	77	87	93	95	98	97	104	45	1544

Option 3 Fleet purchasing policies

Year	Likelihood of crash per vehicle	Option minus BAU (Cars)	Option minus BAU (SUVs)	Cars Age of vehicle (years) 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Total vehicles
1	0.0014	71932	1652		103																														103
2	0.0034	16177	0		248	23																													271
3	0.0033	0	0		237	56	0																												293
4	0.0035	0	0		248	53	0	0																											302
5	0.0035	0	0		250	56	0	0	0																										306
6	0.0035	0	0		251	56	0	0	0	0																									308
7	0.0034	0	0		243	57	0	0	0	0	0																								300
8	0.0031	0	0		222	55	0	0	0	0	0	0																							276
9	0.0031	0	0		223	50	0	0	0	0	0	0	0																						273
10	0.0033	0	0		237	50	0	0	0	0	0	0	0	0																					288
11	0.0036	0	0		258	53	0	0	0	0	0	0	0	0	0																				312
12	0.0037	0	0		265	58	0	0	0	0	0	0	0	0	0	0																			323
13	0.0037	0	0		270	60	0	0	0	0	0	0	0	0	0	0	0																		329
14	0.0036	0	0		262	61	0	0	0	0	0	0	0	0	0	0	0	0																	323
15	0.0034	0	0		246	59	0	0	0	0	0	0	0	0	0	0	0	0	0																305
16	0.0035	0	0		250	55	0	0	0	0	0	0	0	0	0	0	0	0	0	0															306
17	0.0032	0	0		227	56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0														283
18	0.0025	0	0		178	51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0													229
19	0.0023	0	0		165	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0												205
20	0.0019	0	0		140	37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0											177
21	0.0014	0	0		102	31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0										134
22	0.0013	0	0		90	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									113
23	0.0009	0	0		66	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0								86
24	0.0007	0	0		50	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							65
25	0.0006	0	0		41	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						52
26	0.0005	0	0		34	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					43
27	0.0000	0	0			8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				8
28	0.0000	0	0				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0
29	0.0000	0	0					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
30	0.0000	0	0						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Year	Likelihood of crash per vehicle	Option minus BAU (Cars)	Option minus BAU (SUVs)	SUVs Age of vehicle (years)																															Total vehicles
				0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
1	0.0014	71932	1652		2																														2
2	0.0034	16177	0		6	0																													6
3	0.0033	0	0		5	0	0																												5
4	0.0035	0	0		6	0	0	0																											6
5	0.0035	0	0		6	0	0	0	0																										6
6	0.0035	0	0		6	0	0	0	0	0																									6
7	0.0034	0	0		6	0	0	0	0	0	0																								6
8	0.0031	0	0		5	0	0	0	0	0	0	0																							5
9	0.0031	0	0		5	0	0	0	0	0	0	0	0																						5
10	0.0033	0	0		5	0	0	0	0	0	0	0	0	0																					5
11	0.0036	0	0		6	0	0	0	0	0	0	0	0	0	0																				6
12	0.0037	0	0		6	0	0	0	0	0	0	0	0	0	0	0																			6
13	0.0037	0	0		6	0	0	0	0	0	0	0	0	0	0	0	0																		6
14	0.0036	0	0		6	0	0	0	0	0	0	0	0	0	0	0	0	0																	6
15	0.0034	0	0		6	0	0	0	0	0	0	0	0	0	0	0	0	0	0																6
16	0.0035	0	0		6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0															6
17	0.0032	0	0		5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0														5
18	0.0025	0	0		4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0													4
19	0.0023	0	0		4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0												4
20	0.0019	0	0		3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0											3
21	0.0014	0	0		2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0										2
22	0.0013	0	0		2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									2
23	0.0009	0	0		2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0								2
24	0.0007	0	0		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							1
25	0.0006	0	0		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						1
26	0.0005	0	0		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					1
27	0.0000	0	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				0
28	0.0000	0	0				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0
29	0.0000	0	0					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
30	0.0000	0	0						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Option 6 Mandatory standards under the MVSA (Regulation)

Year	Likelihood of crash per vehicle	Option minus BAU (Cars)	Option minus BAU (SUVs)	Cars Age of vehicle (years) 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Total vehicles
1	0.0014	0	0		0																														0
2	0.0034	0	0		0	0																													0
3	0.0033	0	0		0	0	0																												0
4	0.0035	0	0		0	0	0	0																											0
5	0.0035	16766	6496		0	0	0	0	24																										24
6	0.0035	33935	13519		0	0	0	0	58	49																									106
7	0.0034	34342	14061		0	0	0	0	55	117	49																								221
8	0.0031	34754	14617		0	0	0	0	58	112	118	50																							338
9	0.0031	35171	15188		0	0	0	0	58	117	113	120	50																						459
10	0.0033	35593	15773		0	0	0	0	59	118	119	115	121	51																					582
11	0.0036	36020	16373		0	0	0	0	57	119	119	120	116	123	51																				705
12	0.0037	36452	16989		0	0	0	0	52	115	120	121	121	118	124	52																			822
13	0.0037	36890	17620		0	0	0	0	52	105	116	121	122	123	119	126	53																		937
14	0.0036	37332	18268		0	0	0	0	55	105	106	118	123	124	124	120	127	53																	1056
15	0.0034	37780	18932		0	0	0	0	60	112	107	107	119	124	125	126	122	129	54																1185
16	0.0035	38234	19612		0	0	0	0	62	122	113	108	108	120	126	127	127	123	130	55															1322
17	0.0032	38693	20311		0	0	0	0	63	125	123	115	109	110	122	127	128	129	125	132	55														1463
18	0.0025	39157	21026		0	0	0	0	61	127	127	125	116	111	111	123	129	130	130	126	133	56													1606
19	0.0023	39627	21760		0	0	0	0	57	124	129	128	126	117	112	112	125	130	131	132	128	135	57												1744
20	0.0019	40102	22512		0	0	0	0	58	116	125	130	130	128	119	113	114	126	132	133	134	129	137	57											1881
21	0.0014	40583	23283		0	0	0	0	53	118	117	127	132	131	129	120	115	115	128	134	135	135	131	138	58										2016
22	0.0013	41070	24074		0	0	0	0	41	107	120	119	128	133	133	131	122	116	116	129	135	136	137	132	140	59									2135
23	0.0009	41563	24884		0	0	0	0	38	84	108	121	120	130	135	134	133	123	117	118	131	137	138	138	134	142	59								2241
24	0.0007	42062	25714		0	0	0	0	33	78	85	109	122	122	131	137	136	134	125	119	119	132	138	139	140	136	143	60							2339
25	0.0006	42567	26565		0	0	0	0	24	66	79	86	111	124	123	133	138	138	136	126	120	121	134	140	141	142	137	145	61						2424
26	0.0005	43078	27437		0	0	0	0	21	48	67	80	87	112	125	125	134	140	139	137	128	122	122	136	142	143	143	139	147	62					2498
27	0.0000	43595	28330			0	0	0	15	42	49	68	81	88	113	127	126	136	142	141	139	129	123	124	137	143	145	145	141	149	62				2565
28	0.0000	44118	29245				0	0	12	31	43	49	68	82	89	115	128	128	138	143	143	141	131	125	125	139	145	146	147	142	150	63			2623
29	0.0000	44647	30183					0	9	24	32	44	50	69	83	90	116	130	129	139	145	144	142	132	126	127	141	147	148	149	144	152	64		2676
30	0.0000	45183	31144						8	19	24	32	44	51	70	83	91	118	132	131	141	147	146	144	134	128	128	142	149	150	150	146	154	65	2725

Year	Likelihood of crash per vehicle	Option minus BAU (Cars)	Option minus BAU (SUVs)	SUVs Age of vehicle (years)																															Total vehicles
				0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
1	0.0014	0	0		0																														0
2	0.0034	0	0		0	0																													0
3	0.0033	0	0		0	0	0																												0
4	0.0035	0	0		0	0	0	0																											0
5	0.0035	16766	6496		0	0	0	0	9																										9
6	0.0035	33935	13519		0	0	0	0	22	19																									42
7	0.0034	34342	14061		0	0	0	0	21	47	20																								88
8	0.0031	34754	14617		0	0	0	0	22	45	49	21																							136
9	0.0031	35171	15188		0	0	0	0	23	47	46	50	22																						188
10	0.0033	35593	15773		0	0	0	0	23	47	49	48	52	23																					241
11	0.0036	36020	16373		0	0	0	0	22	47	49	50	50	54	23																				296
12	0.0037	36452	16989		0	0	0	0	20	46	49	51	52	52	56	24																			351
13	0.0037	36890	17620		0	0	0	0	20	42	48	51	53	54	54	59	25																		406
14	0.0036	37332	18268		0	0	0	0	21	42	43	49	53	55	57	56	61	26																	464
15	0.0034	37780	18932		0	0	0	0	23	45	44	45	51	55	57	59	58	63	27																527
16	0.0035	38234	19612		0	0	0	0	24	49	46	45	47	53	57	59	61	60	65	28															595
17	0.0032	38693	20311		0	0	0	0	24	50	51	48	47	49	55	59	61	63	63	68	29														667
18	0.0025	39157	21026		0	0	0	0	24	51	52	53	50	49	50	57	62	64	65	65	70	30													741
19	0.0023	39627	21760		0	0	0	0	22	49	53	54	55	52	51	52	60	64	66	68	67	73	31												816
20	0.0019	40102	22512		0	0	0	0	23	46	51	55	56	57	54	53	54	62	66	68	70	69	75	32											892
21	0.0014	40583	23283		0	0	0	0	20	47	48	53	57	58	59	56	55	56	64	69	71	73	72	78	33										968
22	0.0013	41070	24074		0	0	0	0	16	43	49	50	55	59	60	61	58	57	58	66	71	73	75	74	80	34									1041
23	0.0009	41563	24884		0	0	0	0	15	33	44	51	52	57	61	63	63	60	59	60	69	73	76	78	77	83	36								1111
24	0.0007	42062	25714		0	0	0	0	13	31	35	46	53	54	60	64	65	66	62	61	63	71	76	78	80	79	86	37							1179
25	0.0006	42567	26565		0	0	0	0	9	26	32	36	48	55	56	62	66	67	68	65	63	65	74	79	81	83	82	89	38						1244
26	0.0005	43078	27437		0	0	0	0	8	19	27	33	38	50	57	58	64	68	70	70	67	65	67	76	81	84	86	85	92	39					1306
27	0.0000	43595	28330			0	0	0	6	17	20	28	35	39	52	59	60	67	71	72	73	69	68	69	79	84	87	89	88	95	40				1366
28	0.0000	44118	29245				0	0	5	12	18	21	30	36	40	54	61	62	69	74	75	76	72	70	72	81	87	89	92	91	98	42			1425
29	0.0000	44647	30183					0	4	9	13	18	22	31	38	42	56	64	65	71	76	78	78	74	72	74	84	90	92	95	94	101	43		1483
30	0.0000	45183	31144						3	8	10	13	19	22	32	39	44	58	66	67	74	79	80	81	77	75	77	87	93	95	98	97	104	45	1541

Option 2(a) User information campaigns – Awareness

Year		Vehicle Sales			Option's Expected Fitment Rate			BAU Expected (Voluntary) Fitment Rate			Option minus BAU			Net Single Vehicle Crashes (SVCs) Avoided			Value of Net SVCs Avoided		
		Cars	SUVs	Total	Cars	SUVs	Total	Cars	SUVs	Total	Cars	SUVs	Total	Cars	SUVs	Total	Cars	SUVs	Total
0	2007-08	631813	210943	842756	486496	168754	655250	347497	168754	516252	138,999	-	138,999	-	-	-	-	-	-
1	2009	639395	220216	859611	492334	184431	676765	407614	184431	592045	84,720	-	84,720	16	-	16	2,317,648	-	2,317,648
2	2010	647067	229736	876803	498242	201019	699261	469124	201019	670143	29,118	-	29,118	43	-	43	6,389,949	-	6,389,949
3	2011	654832	239507	894339	532051	218550	750601	532051	218550	750601	-	-	-	49	-	49	7,276,274	-	7,276,274
4	2012	662690	249536	912226	596421	237059	833480	596421	237059	833480	-	-	-	51	-	51	7,436,168	-	7,436,168
5	2013	670643	259828	930471	620344	246837	867181	620344	246837	867181	-	-	-	51	-	51	7,562,689	-	7,562,689
6	2014	678690	270390	949080	644756	256870	901626	644756	256870	901626	-	-	-	52	-	52	7,601,983	-	7,601,983
7	2015	686835	281227	968062	652493	267166	919659	652493	267166	919659	-	-	-	51	-	51	7,429,392	-	7,429,392
8	2016	695077	292346	987423	660323	277729	938052	660323	277729	938052	-	-	-	47	-	47	6,883,932	-	6,883,932
9	2017	703418	303754	1007171	668247	288566	956813	668247	288566	956813	-	-	-	46	-	46	6,755,791	-	6,755,791
10	2018	711859	315456	1027315	676266	299684	975949	676266	299684	975949	-	-	-	48	-	48	7,082,729	-	7,082,729
11	2019	720401	327460	1047861	684381	311087	995468	684381	311087	995468	-	-	-	52	-	52	7,665,605	-	7,665,605
12	2020	729046	339773	1068818	692593	322784	1015377	692593	322784	1015377	-	-	-	54	-	54	7,984,678	-	7,984,678
13	2021	737794	352401	1090195	700904	334781	1035685	700904	334781	1035685	-	-	-	55	-	55	8,135,247	-	8,135,247
14	2022	746648	365351	1111999	709315	347083	1056399	709315	347083	1056399	-	-	-	54	-	54	7,997,089	-	7,997,089
15	2023	755607	378631	1134239	717827	359700	1077527	717827	359700	1077527	-	-	-	52	-	52	7,578,081	-	7,578,081
16	2024	764675	392249	1156923	726441	372636	1099077	726441	372636	1099077	-	-	-	51	-	51	7,551,744	-	7,551,744
17	2025	773851	406211	1180062	735158	385900	1121059	735158	385900	1121059	-	-	-	48	-	48	7,048,731	-	7,048,731
18	2026	783137	420526	1203663	743980	399500	1143480	743980	399500	1143480	-	-	-	39	-	39	5,765,501	-	5,765,501
19	2027	792535	435202	1227736	752908	413442	1166350	752908	413442	1166350	-	-	-	35	-	35	5,092,321	-	5,092,321
20	2028	802045	450246	1252291	761943	427734	1189677	761943	427734	1189677	-	-	-	30	-	30	4,433,570	-	4,433,570
21	2029	811670	465667	1277337	771086	442384	1213470	771086	442384	1213470	-	-	-	23	-	23	3,389,874	-	3,389,874
22	2030	821410	481474	1302884	780339	457400	1237739	780339	457400	1237739	-	-	-	19	-	19	2,822,485	-	2,822,485
23	2031	831267	497675	1328941	789703	472791	1262494	789703	472791	1262494	-	-	-	15	-	15	2,186,979	-	2,186,979
24	2032	841242	514278	1355520	799180	488564	1287744	799180	488564	1287744	-	-	-	11	-	11	1,639,968	-	1,639,968
25	2033	851337	531294	1382631	808770	504729	1313499	808770	504729	1313499	-	-	-	9	-	9	1,303,015	-	1,303,015
26	2034	861553	548730	1410283	818475	521294	1339769	818475	521294	1339769	-	-	-	7	-	7	1,088,551	-	1,088,551
27	2035	871891	566597	1438489	828297	538268	1366564	828297	538268	1366564	-	-	-	2	-	2	266,013	-	266,013
28	2036	882354	584904	1467259	838236	555659	1393896	838236	555659	1393896	-	-	-	-	-	-	-	-	-
29	2037	892942	603661	1496604	848295	573478	1421774	848295	573478	1421774	-	-	-	-	-	-	-	-	-
30	2038	903658	622878	1526536	858475	591734	1450209	858475	591734	1450209	-	-	-	-	-	-	-	-	-
														NPV 30 years			$69,062,382	$0	$69,062,382

Option 2(b) User information campaigns – Advertising

Year		Vehicle Sales			Option's Expected Fitment Rate			BAU Expected (Voluntary) Fitment Rate			Option minus BAU			Net Single Vehicle Crashes (SVCs) Avoided			Value of Net SVCs Avoided		
		Cars	SUVs	Total	Cars	SUVs	Total	Cars	SUVs	Total	Cars	SUVs	Total	Cars	SUVs	Total	Cars	SUVs	Total
0	2007-08	631813	210943	842756	375297	182255	557552	347497	168754	516252	27,800	13,500	41,300	-	-	-	-	-	-
1	2009	639395	220216	859611	440223	199186	639409	407614	184431	592045	32,609	14,754	47,364	6	7	13	892,076	1,016,558	1,908,634
2	2010	647067	229736	876803	506654	217100	723754	469124	201019	670143	37,530	16,082	53,611	22	24	46	3,179,614	3,561,332	6,740,946
3	2011	654832	239507	894339	574615	236034	810650	532051	218550	750601	42,564	17,484	60,048	39	42	81	5,702,937	6,226,896	11,929,833
4	2012	662690	249536	912226	644135	249536	893671	596421	237059	833480	47,714	12,477	60,190	59	60	118	8,641,104	8,780,841	17,421,944
5	2013	670643	259828	930471	669972	259828	929800	620344	246837	867181	49,628	12,991	62,619	81	74	155	11,847,228	10,901,187	22,748,415
6	2014	678690	270390	949080	678690	270390	949080	644756	256870	901626	33,935	13,519	47,454	100	90	190	14,709,791	13,166,203	27,875,994
7	2015	686835	281227	968062	686835	281227	968062	652493	267166	919659	34,342	14,061	48,403	115	105	220	16,920,355	15,403,642	32,323,997
8	2016	695077	292346	987423	695077	292346	987423	660323	277729	938052	34,754	14,617	49,371	129	119	248	19,015,342	17,507,572	36,522,914
9	2017	703418	303754	1007171	703418	303754	1007171	668247	288566	956813	35,171	15,188	50,359	143	134	277	21,069,899	19,691,946	40,761,845
10	2018	711859	315456	1027315	711859	315456	1027315	676266	299684	975949	35,593	15,773	51,366	158	150	308	23,227,970	22,119,141	45,347,112
11	2019	720401	327460	1047861	720401	327460	1047861	684381	311087	995468	36,020	16,373	52,393	174	170	343	25,579,579	24,937,159	50,516,738
12	2020	729046	339773	1068818	729046	339773	1068818	692593	322784	1015377	36,452	16,989	53,441	191	190	381	28,090,986	27,941,375	56,032,361
13	2021	737794	352401	1090195	737794	352401	1090195	700904	334781	1035685	36,890	17,620	54,510	210	211	421	30,814,602	31,061,976	61,876,578
14	2022	746648	365351	1111999	746648	365351	1111999	709315	347083	1056399	37,332	18,268	55,600	228	232	460	33,542,188	34,148,798	67,690,985
15	2023	755607	378631	1134239	755607	378631	1134239	717827	359700	1077527	37,780	18,932	56,712	246	253	498	36,115,695	37,163,463	73,279,158
16	2024	764675	392249	1156923	764675	392249	1156923	726441	372636	1099077	38,234	19,612	57,846	263	274	537	38,645,506	40,301,978	78,947,484
17	2025	773851	406211	1180062	773851	406211	1180062	735158	385900	1121059	38,693	20,311	59,003	278	295	573	40,947,089	43,340,911	84,288,000
18	2026	783137	420526	1203663	783137	420526	1203663	743980	399500	1143480	39,157	21,026	60,183	291	313	604	42,788,847	46,056,198	88,845,045
19	2027	792535	435202	1227736	792535	435202	1227736	752908	413442	1166350	39,627	21,760	61,387	302	331	633	44,483,793	48,681,051	93,164,844
20	2028	802045	450246	1252291	802045	450246	1252291	761943	427734	1189677	40,102	22,512	62,615	312	348	661	45,950,756	51,207,794	97,158,550
21	2029	811670	465667	1277337	811670	465667	1277337	771086	442384	1213470	40,583	23,283	63,867	319	364	684	46,974,140	53,608,812	100,582,952
22	2030	821410	481474	1302884	821410	481474	1302884	780339	457400	1237739	41,070	24,074	65,144	326	381	706	47,898,014	55,981,523	103,879,537
23	2031	831267	497675	1328941	831267	497675	1328941	789703	472791	1262494	41,563	24,884	66,447	331	396	727	48,739,973	58,256,473	106,996,447
24	2032	841242	514278	1355520	841242	514278	1355520	799180	488564	1287744	42,062	25,714	67,776	336	412	748	49,410,628	60,564,165	109,974,793
25	2033	851337	531294	1382631	851337	531294	1382631	808770	504729	1313499	42,567	26,565	69,132	340	427	768	50,037,418	62,868,899	112,906,317
26	2034	861553	548730	1410283	861553	548730	1410283	818475	521294	1339769	43,078	27,437	70,514	345	444	788	50,716,297	65,252,993	115,969,290
27	2035	871891	566597	1438489	871891	566597	1438489	828297	538268	1366564	43,595	28,330	71,924	347	458	806	51,110,784	67,414,863	118,525,647
28	2036	882354	584904	1467259	882354	584904	1467259	838236	555659	1393896	44,118	29,245	73,363	350	474	824	51,547,654	69,646,277	121,193,931
29	2037	892942	603661	1496604	892942	603661	1496604	848295	573478	1421774	44,647	30,183	74,830	354	489	843	52,006,194	71,939,212	123,945,406
30	2038	903658	622878	1526536	903658	622878	1526536	858475	591734	1450209	45,183	31,144	76,327	357	506	863	52,466,548	74,419,638	126,886,186
														NPV 30 years			$275,411,380	$298,615,803	$574,027,184

Option 3 Fleet purchasing policies

Year		Vehicle Sales			Option's Expected Fitment Rate			BAU Expected (Voluntary) Fitment Rate			Option minus BAU			Net Single Vehicle Crashes (SVCs) Avoided			Value of Net SVCs Avoided		
		Cars	SUVs	Total	Cars	SUVs	Total	Cars	SUVs	Total	Cars	SUVs	Total	Cars	SUVs	Total	Cars	SUVs	Total
0	2007-08	631813	210943	842756	473860	178247	652107	347497	168754	516252	126,363	9,492	135,855	-	-	-	-	-	-
1	2009	639395	220216	859611	479546	186083	665629	407614	184431	592045	71,932	1,652	73,584	13	1	14	1,967,814	113,794	2,081,608
2	2010	647067	229736	876803	485301	201019	686319	469124	201019	670143	16,177	-	16,177	35	2	37	5,191,634	274,628	5,466,262
3	2011	654832	239507	894339	532051	218550	750601	532051	218550	750601	-	-	-	38	2	40	5,613,733	262,867	5,876,600
4	2012	662690	249536	912226	596421	237059	833480	596421	237059	833480	-	-	-	39	2	41	5,773,655	274,760	6,048,415
5	2013	670643	259828	930471	620344	246837	867181	620344	246837	867181	-	-	-	40	2	42	5,856,644	276,885	6,133,529
6	2014	678690	270390	949080	644756	256870	901626	644756	256870	901626	-	-	-	40	2	42	5,885,642	278,084	6,163,725
7	2015	686835	281227	968062	652493	267166	919659	652493	267166	919659	-	-	-	39	2	41	5,736,638	269,198	6,005,836
8	2016	695077	292346	987423	660323	277729	938052	660323	277729	938052	-	-	-	36	2	38	5,291,769	245,470	5,537,239
9	2017	703418	303754	1007171	668247	288566	956813	668247	288566	956813	-	-	-	36	2	37	5,231,719	247,334	5,479,052
10	2018	711859	315456	1027315	676266	299684	975949	676266	299684	975949	-	-	-	37	2	39	5,505,479	262,746	5,768,225
11	2019	720401	327460	1047861	684381	311087	995468	684381	311087	995468	-	-	-	41	2	43	5,968,710	286,067	6,254,777
12	2020	729046	339773	1068818	692593	322784	1015377	692593	322784	1015377	-	-	-	42	2	44	6,191,706	293,718	6,485,423
13	2021	737794	352401	1090195	700904	334781	1035685	700904	334781	1035685	-	-	-	43	2	45	6,303,829	298,481	6,602,310
14	2022	746648	365351	1111999	709315	347083	1056399	709315	347083	1056399	-	-	-	42	2	44	6,176,739	290,060	6,466,799
15	2023	755607	378631	1134239	717827	359700	1077527	717827	359700	1077527	-	-	-	40	2	42	5,838,277	272,382	6,110,659
16	2024	764675	392249	1156923	726441	372636	1099077	726441	372636	1099077	-	-	-	40	2	42	5,852,237	277,165	6,129,402
17	2025	773851	406211	1180062	735158	385900	1121059	735158	385900	1121059	-	-	-	37	2	39	5,415,324	250,823	5,666,148
18	2026	783137	420526	1203663	743980	399500	1143480	743980	399500	1143480	-	-	-	30	1	31	4,379,909	196,872	4,576,780
19	2027	792535	435202	1227736	752908	413442	1166350	752908	413442	1166350	-	-	-	27	1	28	3,919,187	182,363	4,101,550
20	2028	802045	450246	1252291	761943	427734	1189677	761943	427734	1189677	-	-	-	23	1	24	3,389,680	155,005	3,544,685
21	2029	811670	465667	1277337	771086	442384	1213470	771086	442384	1213470	-	-	-	17	1	18	2,559,729	113,164	2,672,893
22	2030	821410	481474	1302884	780339	457400	1237739	780339	457400	1237739	-	-	-	15	1	15	2,163,949	99,686	2,263,636
23	2031	831267	497675	1328941	789703	472791	1262494	789703	472791	1262494	-	-	-	11	0	12	1,652,059	73,116	1,725,175
24	2032	841242	514278	1355520	799180	488564	1287744	799180	488564	1287744	-	-	-	8	0	9	1,242,205	55,391	1,297,596
25	2033	851337	531294	1382631	808770	504729	1313499	808770	504729	1313499	-	-	-	7	0	7	992,531	44,939	1,037,470
26	2034	861553	548730	1410283	818475	521294	1339769	818475	521294	1339769	-	-	-	6	0	6	831,912	38,001	869,913
27	2035	871891	566597	1438489	828297	538268	1366564	828297	538268	1366564	-	-	-	1	-	1	147,785	-	147,785
28	2036	882354	584904	1467259	838236	555659	1393896	838236	555659	1393896	-	-	-	-	-	-	-	-	-
29	2037	892942	603661	1496604	848295	573478	1421774	848295	573478	1421774	-	-	-	-	-	-	-	-	-
30	2038	903658	622878	1526536	858475	591734	1450209	858475	591734	1450209	-	-	-	-	-	-	-	-	-
														NPV 30 years			$53,709,860	$2,566,491	$56,276,351

Option 6 Mandatory standards under the MVSA (Regulation)

Year		Vehicle Sales			Option's Expected Fitment Rate			BAU Expected (Voluntary) Fitment Rate			Option minus BAU			Net Single Vehicle Crashes (SVCs) Avoided			Value of Net SVCs Avoided		
		Cars	**SUVs**	**Total**	**Cars**	**SUVs**	**Total**	**Cars**	**SUVs**	**Total**	**Cars**	**SUVs**	**Total**	**Cars**	**SUVs**	**Total**	**Cars**	**SUVs**	**Total**
0	2007-08	631813	210943	842756	347497	168754	516252	347497	168754	516252	-	-	-	-	-	-	-	-	-
1	2009	639395	220216	859611	407614	184431	592045	407614	184431	592045	-	-	-	-	-	-	-	-	-
2	2010	647067	229736	876803	469124	201019	670143	469124	201019	670143	-	-	-	-	-	-	-	-	-
3	2011	654832	239507	894339	532051	218550	750601	532051	218550	750601	-	-	-	-	-	-	-	-	-
4	2012	662690	249536	912226	596421	237059	833480	596421	237059	833480	-	-	-	-	-	-	-	-	-
5	2013	670643	259828	930471	637110	253332	890443	620344	246837	867181	16,766	6,496	23,262	3	3	6	458,663	447,542	906,205
6	2014	678690	270390	949080	678690	270390	949080	644756	256870	901626	33,935	13,519	47,454	14	14	28	2,035,264	2,011,560	4,046,824
7	2015	686835	281227	968062	686835	281227	968062	652493	267166	919659	34,342	14,061	48,403	29	29	58	4,239,427	4,250,630	8,490,057
8	2016	695077	292346	987423	695077	292346	987423	660323	277729	938052	34,754	14,617	49,371	44	45	89	6,470,002	6,577,530	13,047,533
9	2017	703418	303754	1007171	703418	303754	1007171	668247	288566	956813	35,171	15,188	50,359	60	62	121	8,784,419	9,052,941	17,837,359
10	2018	711859	315456	1027315	711859	315456	1027315	676266	299684	975949	35,593	15,773	51,366	76	79	155	11,140,107	11,637,901	22,778,008
11	2019	720401	327460	1047861	720401	327460	1047861	684381	311087	995468	36,020	16,373	52,393	92	97	189	13,493,138	14,291,983	27,785,121
12	2020	729046	339773	1068818	729046	339773	1068818	692593	322784	1015377	36,452	16,989	53,441	107	115	222	15,742,522	16,916,869	32,659,391
13	2021	737794	352401	1090195	737794	352401	1090195	700904	334781	1035685	36,890	17,620	54,510	122	133	255	17,929,625	19,549,791	37,479,417
14	2022	746648	365351	1111999	746648	365351	1111999	709315	347083	1056399	37,332	18,268	55,600	137	152	289	20,212,695	22,347,679	42,560,373
15	2023	755607	378631	1134239	755607	378631	1134239	717827	359700	1077527	37,780	18,932	56,712	154	173	327	22,680,027	25,402,322	48,082,349
16	2024	764675	392249	1156923	764675	392249	1156923	726441	372636	1099077	38,234	19,612	57,846	172	195	367	25,302,933	28,693,310	53,996,243
17	2025	773851	406211	1180062	773851	406211	1180062	735158	385900	1121059	38,693	20,311	59,003	190	219	409	28,007,719	32,153,010	60,160,729
18	2026	783137	420526	1203663	783137	420526	1203663	743980	399500	1143480	39,157	21,026	60,183	209	243	452	30,730,452	35,722,778	66,453,230
19	2027	792535	435202	1227736	792535	435202	1227736	752908	413442	1166350	39,627	21,760	61,387	227	267	494	33,380,254	39,314,807	72,695,062
20	2028	802045	450246	1252291	802045	450246	1252291	761943	427734	1189677	40,102	22,512	62,615	245	292	537	36,009,021	42,978,522	78,987,542
21	2029	811670	465667	1277337	811670	465667	1277337	771086	442384	1213470	40,583	23,283	63,867	262	317	580	38,582,670	46,684,453	85,267,123
22	2030	821410	481474	1302884	821410	481474	1302884	780339	457400	1237739	41,070	24,074	65,144	278	341	619	40,862,296	50,196,361	91,058,657
23	2031	831267	497675	1328941	831267	497675	1328941	789703	472791	1262494	41,563	24,884	66,447	292	364	656	42,890,727	53,546,560	96,437,287
24	2032	841242	514278	1355520	841242	514278	1355520	799180	488564	1287744	42,062	25,714	67,776	304	386	691	44,774,048	56,837,656	101,611,704
25	2033	851337	531294	1382631	851337	531294	1382631	808770	504729	1313499	42,567	26,565	69,132	315	408	723	46,399,730	59,955,992	106,355,722
26	2034	861553	548730	1410283	861553	548730	1410283	818475	521294	1339769	43,078	27,437	70,514	325	428	753	47,819,925	62,945,195	110,765,120
27	2035	871891	566597	1438489	871891	566597	1438489	828297	538268	1366564	43,595	28,330	71,924	334	448	782	49,095,093	65,863,138	114,958,230
28	2036	882354	584904	1467259	882354	584904	1467259	838236	555659	1393896	44,118	29,245	73,363	341	467	808	50,205,736	68,686,671	118,892,407
29	2037	892942	603661	1496604	892942	603661	1496604	848295	573478	1421774	44,647	30,183	74,830	348	486	834	51,215,277	71,475,400	122,690,677
30	2038	903658	622878	1526536	903658	622878	1526536	858475	591734	1450209	45,183	31,144	76,327	355	505	860	52,166,336	74,270,182	126,436,518
														NPV 30 years			$171,213,132	$205,076,792	$376,289,923

8. Calculate the fitment, system development, regulation compliance and government costs (where relevant) for each particular option.

As per Table 5

ADR Category	***Description***	***Number of Makes per year****	***Number of Models per year***	***Number of Vehicles per year***
MA	Passenger car	**44**	**35.6**	637019
MB	Passenger van			
MC	SUV		**10.4**	
NA	Light goods van/ute/SUV	16	16.4	177556
NB1	Goods van/SUV		14.6	
MD1	Light bus		0.4	
MD2	Light bus		0.2	
MD3	Light bus		1.4	

As per Table 6

Cost related to:	***Estimated cost ($)***	***Option***	***Notes***	***Cost Impact***
Fitment of ESC system (max)	395	all	per vehicle	Business
Fitment of ESC system (min)	395	all	per vehicle	Business
Development of ESC system (max)	3,000,000	all	per model	Business
Development of ESC system (min)	500,000	all	per model	Business
Information campaigns - targeted	1,000,000	2(a)	per 4 month campaign, assume continuous campaign (3 per year)	Government
Information campaigns - advertising	1,500,000	2(b)	per month, assume continous campaign (12 months per year) which covers all makes of vehicles	Government
Fleet purchasing policies	50,000	3	per year	Government
Testing of ESC system to a regulation	50,000	6	per model	Business
Type approval costs	15,000	6	per model	Business
Implement and maintain regulation	50,000	6	per year	Government

Option 2(a) User information campaigns – Awareness

Year		Fitment Costs			System Development Costs			Regulation Compliance Costs			Government Costs		
		Min 395	Max 395	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average
0	2007-08	54,904,550	54,904,550	54,904,550	4,048,000	24,288,000	14,168,000	-	-	-	3,000,000	3,000,000	3,000,000
1	2009	33,464,323	33,464,323	33,464,323	2,438,000	14,628,000	8,533,000	-	-	-	3,000,000	3,000,000	3,000,000
2	2010	11,501,625	11,501,625	11,501,625	828,000	4,968,000	2,898,000	-	-	-	3,000,000	3,000,000	3,000,000
3	2011	-	-	-	-	-	-	-	-	-	-	-	-
4	2012	-	-	-	-	-	-	-	-	-	-	-	-
5	2013	-	-	-	-	-	-	-	-	-	-	-	-
6	2014	-	-	-	-	-	-	-	-	-	-	-	-
7	2015	-	-	-	-	-	-	-	-	-	-	-	-
8	2016	-	-	-	-	-	-	-	-	-	-	-	-
9	2017	-	-	-	-	-	-	-	-	-	-	-	-
10	2018	-	-	-	-	-	-	-	-	-	-	-	-
11	2019	-	-	-	-	-	-	-	-	-	-	-	-
12	2020	-	-	-	-	-	-	-	-	-	-	-	-
13	2021	-	-	-	-	-	-	-	-	-	-	-	-
14	2022	-	-	-	-	-	-	-	-	-	-	-	-
15	2023	-	-	-	-	-	-	-	-	-	-	-	-
16	2024	-	-	-	-	-	-	-	-	-	-	-	-
17	2025	-	-	-	-	-	-	-	-	-	-	-	-
18	2026	-	-	-	-	-	-	-	-	-	-	-	-
19	2027	-	-	-	-	-	-	-	-	-	-	-	-
20	2028	-	-	-	-	-	-	-	-	-	-	-	-
21	2029	-	-	-	-	-	-	-	-	-	-	-	-
22	2030	-	-	-	-	-	-	-	-	-	-	-	-
23	2031	-	-	-	-	-	-	-	-	-	-	-	-
24	2032	-	-	-	-	-	-	-	-	-	-	-	-
25	2033	-	-	-	-	-	-	-	-	-	-	-	-
26	2034	-	-	-	-	-	-	-	-	-	-	-	-
27	2035	-	-	-	-	-	-	-	-	-	-	-	-
28	2036	-	-	-	-	-	-	-	-	-	-	-	-
29	2037	-	-	-	-	-	-	-	-	-	-	-	-
30	2038	-	-	-	-	-	-	-	-	-	-	-	-
		$89,930,451	$89,930,451	$89,930,451	$6,588,516	$39,531,095	$23,059,805	$0	$0	$0	$7,872,948	$7,872,948	$7,872,948

Option 2(b) User information campaigns – Advertising

Year		Fitment Costs			System Development Costs			Regulation Compliance Costs			Government Costs		
		Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average
		395	395										
0	2007-08	16,313,549	16,313,549	16,313,549	1,104,000	6,624,000	3,864,000	-	-	-	18,000,000	18,000,000	18,000,000
1	2009	18,708,633	18,708,633	18,708,633	1,246,600	7,479,600	4,363,100	-	-	-	18,000,000	18,000,000	18,000,000
2	2010	21,176,513	21,176,513	21,176,513	1,389,200	8,335,200	4,862,200	-	-	-	18,000,000	18,000,000	18,000,000
3	2011	23,719,007	23,719,007	23,719,007	1,531,800	9,190,800	5,361,300	-	-	-	18,000,000	18,000,000	18,000,000
4	2012	23,775,246	23,775,246	23,775,246	1,554,800	9,328,800	5,441,800	-	-	-	18,000,000	18,000,000	18,000,000
5	2013	24,734,488	24,734,488	24,734,488	1,591,600	9,549,600	5,570,600	-	-	-	18,000,000	18,000,000	18,000,000
6	2014	18,744,333	18,744,333	18,744,333	1,150,000	6,900,000	4,025,000	-	-	-	18,000,000	18,000,000	18,000,000
7	2015	19,119,219	19,119,219	19,119,219	1,150,000	6,900,000	4,025,000	-	-	-	18,000,000	18,000,000	18,000,000
8	2016	19,501,604	19,501,604	19,501,604	1,150,000	6,900,000	4,025,000	-	-	-	18,000,000	18,000,000	18,000,000
9	2017	19,891,636	19,891,636	19,891,636	1,150,000	6,900,000	4,025,000	-	-	-	18,000,000	18,000,000	18,000,000
10	2018	20,289,469	20,289,469	20,289,469	1,150,000	6,900,000	4,025,000	-	-	-	18,000,000	18,000,000	18,000,000
11	2019	20,695,258	20,695,258	20,695,258	1,150,000	6,900,000	4,025,000	-	-	-	18,000,000	18,000,000	18,000,000
12	2020	21,109,163	21,109,163	21,109,163	1,150,000	6,900,000	4,025,000	-	-	-	18,000,000	18,000,000	18,000,000
13	2021	21,531,346	21,531,346	21,531,346	1,150,000	6,900,000	4,025,000	-	-	-	18,000,000	18,000,000	18,000,000
14	2022	21,961,973	21,961,973	21,961,973	1,150,000	6,900,000	4,025,000	-	-	-	18,000,000	18,000,000	18,000,000
15	2023	22,401,213	22,401,213	22,401,213	1,150,000	6,900,000	4,025,000	-	-	-	18,000,000	18,000,000	18,000,000
16	2024	22,849,237	22,849,237	22,849,237	1,150,000	6,900,000	4,025,000	-	-	-	18,000,000	18,000,000	18,000,000
17	2025	23,306,222	23,306,222	23,306,222	1,150,000	6,900,000	4,025,000	-	-	-	18,000,000	18,000,000	18,000,000
18	2026	23,772,346	23,772,346	23,772,346	1,150,000	6,900,000	4,025,000	-	-	-	18,000,000	18,000,000	18,000,000
19	2027	24,247,793	24,247,793	24,247,793	1,150,000	6,900,000	4,025,000	-	-	-	18,000,000	18,000,000	18,000,000
20	2028	24,732,749	24,732,749	24,732,749	1,150,000	6,900,000	4,025,000	-	-	-	18,000,000	18,000,000	18,000,000
21	2029	25,227,404	25,227,404	25,227,404	1,150,000	6,900,000	4,025,000	-	-	-	18,000,000	18,000,000	18,000,000
22	2030	25,731,952	25,731,952	25,731,952	1,150,000	6,900,000	4,025,000	-	-	-	18,000,000	18,000,000	18,000,000
23	2031	26,246,591	26,246,591	26,246,591	1,150,000	6,900,000	4,025,000	-	-	-	18,000,000	18,000,000	18,000,000
24	2032	26,771,523	26,771,523	26,771,523	1,150,000	6,900,000	4,025,000	-	-	-	18,000,000	18,000,000	18,000,000
25	2033	27,306,953	27,306,953	27,306,953	1,150,000	6,900,000	4,025,000	-	-	-	18,000,000	18,000,000	18,000,000
26	2034	27,853,092	27,853,092	27,853,092	1,150,000	6,900,000	4,025,000	-	-	-	18,000,000	18,000,000	18,000,000
27	2035	28,410,154	28,410,154	28,410,154	1,150,000	6,900,000	4,025,000	-	-	-	18,000,000	18,000,000	18,000,000
28	2036	28,978,357	28,978,357	28,978,357	1,150,000	6,900,000	4,025,000	-	-	-	18,000,000	18,000,000	18,000,000
29	2037	29,557,924	29,557,924	29,557,924	1,150,000	6,900,000	4,025,000	-	-	-	18,000,000	18,000,000	18,000,000
30	2038	30,149,083	30,149,083	30,149,083	1,150,000	6,900,000	4,025,000	-	-	-	18,000,000	18,000,000	18,000,000
		$274,694,005	$274,694,005	$274,694,005	$15,522,375	$93,134,251	$54,328,313	$0	$0	$0	$225,572,655	$225,572,655	$225,572,655

Option 3 Fleet purchasing policies

Year		Fitment Costs			System Development Costs			Regulation Compliance Costs			Government Costs		
		Min 395	Max 395	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average
0	2007-08	53,662,739	53,662,739	53,662,739	3,887,000	23,322,000	13,604,500	-	-	-	50,000	50,000	50,000
1	2009	29,065,495	29,065,495	29,065,495	2,104,500	12,627,000	7,365,750	-	-	-	50,000	50,000	50,000
2	2010	6,389,791	6,389,791	6,389,791	460,000	2,760,000	1,610,000	-	-	-	50,000	50,000	50,000
3	2011	-	-	-	-	-	-	-	-	-	-	-	-
4	2012	-	-	-	-	-	-	-	-	-	-	-	-
5	2013	-	-	-	-	-	-	-	-	-	-	-	-
6	2014	-	-	-	-	-	-	-	-	-	-	-	-
7	2015	-	-	-	-	-	-	-	-	-	-	-	-
8	2016	-	-	-	-	-	-	-	-	-	-	-	-
9	2017	-	-	-	-	-	-	-	-	-	-	-	-
10	2018	-	-	-	-	-	-	-	-	-	-	-	-
11	2019	-	-	-	-	-	-	-	-	-	-	-	-
12	2020	-	-	-	-	-	-	-	-	-	-	-	-
13	2021	-	-	-	-	-	-	-	-	-	-	-	-
14	2022	-	-	-	-	-	-	-	-	-	-	-	-
15	2023	-	-	-	-	-	-	-	-	-	-	-	-
16	2024	-	-	-	-	-	-	-	-	-	-	-	-
17	2025	-	-	-	-	-	-	-	-	-	-	-	-
18	2026	-	-	-	-	-	-	-	-	-	-	-	-
19	2027	-	-	-	-	-	-	-	-	-	-	-	-
20	2028	-	-	-	-	-	-	-	-	-	-	-	-
21	2029	-	-	-	-	-	-	-	-	-	-	-	-
22	2030	-	-	-	-	-	-	-	-	-	-	-	-
23	2031	-	-	-	-	-	-	-	-	-	-	-	-
24	2032	-	-	-	-	-	-	-	-	-	-	-	-
25	2033	-	-	-	-	-	-	-	-	-	-	-	-
26	2034	-	-	-	-	-	-	-	-	-	-	-	-
27	2035	-	-	-	-	-	-	-	-	-	-	-	-
28	2036	-	-	-	-	-	-	-	-	-	-	-	-
29	2037	-	-	-	-	-	-	-	-	-	-	-	-
30	2038	-	-	-	-	-	-	-	-	-	-	-	-
		$80,754,995	$80,754,995	$80,754,995	$5,846,359	$35,078,155	$20,462,257	$0	$0	$0	$131,216	$131,216	$131,216

Option 6 Mandatory standards under the MVSA (Regulation)

Year		Fitment Costs			System Development Costs			Regulation Compliance Costs			Government Costs		
		Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average
		395	395										
0	2007-08	-	-	-	-	-	-	-	-	-	-	-	-
1	2009	-	-	-	-	-	-	-	-	-	-	-	-
2	2010	-	-	-	-	-	-	-	-	-	-	-	-
3	2011	-	-	-	-	-	-	-	-	-	-	-	-
4	2012	-	-	-	-	-	-	-	-	-	-	-	-
5	2013	9,188,398	9,188,398	9,188,398	575,000	3,450,000	2,012,500	1,495,000	1,495,000	1,495,000	50,000	50,000	50,000
6	2014	18,744,333	18,744,333	18,744,333	1,150,000	6,900,000	4,025,000	2,990,000	2,990,000	2,990,000	50,000	50,000	50,000
7	2015	19,119,219	19,119,219	19,119,219	1,150,000	6,900,000	4,025,000	2,990,000	2,990,000	2,990,000	50,000	50,000	50,000
8	2016	19,501,604	19,501,604	19,501,604	1,150,000	6,900,000	4,025,000	2,990,000	2,990,000	2,990,000	50,000	50,000	50,000
9	2017	19,891,636	19,891,636	19,891,636	1,150,000	6,900,000	4,025,000	2,990,000	2,990,000	2,990,000	50,000	50,000	50,000
10	2018	20,289,469	20,289,469	20,289,469	1,150,000	6,900,000	4,025,000	2,990,000	2,990,000	2,990,000	50,000	50,000	50,000
11	2019	20,695,258	20,695,258	20,695,258	1,150,000	6,900,000	4,025,000	2,990,000	2,990,000	2,990,000	50,000	50,000	50,000
12	2020	21,109,163	21,109,163	21,109,163	1,150,000	6,900,000	4,025,000	2,990,000	2,990,000	2,990,000	50,000	50,000	50,000
13	2021	21,531,346	21,531,346	21,531,346	1,150,000	6,900,000	4,025,000	2,990,000	2,990,000	2,990,000	50,000	50,000	50,000
14	2022	21,961,973	21,961,973	21,961,973	1,150,000	6,900,000	4,025,000	2,990,000	2,990,000	2,990,000	50,000	50,000	50,000
15	2023	22,401,213	22,401,213	22,401,213	1,150,000	6,900,000	4,025,000	2,990,000	2,990,000	2,990,000	50,000	50,000	50,000
16	2024	22,849,237	22,849,237	22,849,237	1,150,000	6,900,000	4,025,000	2,990,000	2,990,000	2,990,000	50,000	50,000	50,000
17	2025	23,306,222	23,306,222	23,306,222	1,150,000	6,900,000	4,025,000	2,990,000	2,990,000	2,990,000	50,000	50,000	50,000
18	2026	23,772,346	23,772,346	23,772,346	1,150,000	6,900,000	4,025,000	2,990,000	2,990,000	2,990,000	50,000	50,000	50,000
19	2027	24,247,793	24,247,793	24,247,793	1,150,000	6,900,000	4,025,000	2,990,000	2,990,000	2,990,000	50,000	50,000	50,000
20	2028	24,732,749	24,732,749	24,732,749	1,150,000	6,900,000	4,025,000	2,990,000	2,990,000	2,990,000	50,000	50,000	50,000
21	2029	25,227,404	25,227,404	25,227,404	1,150,000	6,900,000	4,025,000	2,990,000	2,990,000	2,990,000	50,000	50,000	50,000
22	2030	25,731,952	25,731,952	25,731,952	1,150,000	6,900,000	4,025,000	2,990,000	2,990,000	2,990,000	50,000	50,000	50,000
23	2031	26,246,591	26,246,591	26,246,591	1,150,000	6,900,000	4,025,000	2,990,000	2,990,000	2,990,000	50,000	50,000	50,000
24	2032	26,771,523	26,771,523	26,771,523	1,150,000	6,900,000	4,025,000	2,990,000	2,990,000	2,990,000	50,000	50,000	50,000
25	2033	27,306,953	27,306,953	27,306,953	1,150,000	6,900,000	4,025,000	2,990,000	2,990,000	2,990,000	50,000	50,000	50,000
26	2034	27,853,092	27,853,092	27,853,092	1,150,000	6,900,000	4,025,000	2,990,000	2,990,000	2,990,000	50,000	50,000	50,000
27	2035	28,410,154	28,410,154	28,410,154	1,150,000	6,900,000	4,025,000	2,990,000	2,990,000	2,990,000	50,000	50,000	50,000
28	2036	28,978,357	28,978,357	28,978,357	1,150,000	6,900,000	4,025,000	2,990,000	2,990,000	2,990,000	50,000	50,000	50,000
29	2037	29,557,924	29,557,924	29,557,924	1,150,000	6,900,000	4,025,000	2,990,000	2,990,000	2,990,000	50,000	50,000	50,000
30	2038	30,149,083	30,149,083	30,149,083	1,150,000	6,900,000	4,025,000	2,990,000	2,990,000	2,990,000	50,000	50,000	50,000
		$180,414,956	$180,414,956	$180,414,956	$9,313,212	$55,879,275	$32,596,244	$24,214,352	$24,214,352	$24,214,352	$421,581	$421,581	$421,581

9. Sum and discount all the calculated values for each year. Use a discount rate of 7 per cent (see Appendix 13 - Benefit- Cost Analysis – Sensitivities for a 10 per cent sensitivity check). Calculate the Net Benefits, Total Costs, Benefit-Cost Ratios and lives saved.

Option 2(a) User information campaigns – Awareness

Year		Net Benefits			Lives Saved
		Min	Max	Average	
0	2007-08	- 82,192,550	- 61,952,550	- 72,072,550	-
1	2009	- 48,774,675	- 36,584,675	- 42,679,675	0.21
2	2010	- 13,079,676	- 8,939,676	- 11,009,676	0.6
3	2011	7,276,274	7,276,274	7,276,274	0.7
4	2012	7,436,168	7,436,168	7,436,168	0.7
5	2013	7,562,689	7,562,689	7,562,689	0.7
6	2014	7,601,983	7,601,983	7,601,983	0.7
7	2015	7,429,392	7,429,392	7,429,392	0.7
8	2016	6,883,932	6,883,932	6,883,932	0.6
9	2017	6,755,791	6,755,791	6,755,791	0.6
10	2018	7,082,729	7,082,729	7,082,729	0.6
11	2019	7,665,605	7,665,605	7,665,605	0.7
12	2020	7,984,678	7,984,678	7,984,678	0.7
13	2021	8,135,247	8,135,247	8,135,247	0.7
14	2022	7,997,089	7,997,089	7,997,089	0.7
15	2023	7,578,081	7,578,081	7,578,081	0.7
16	2024	7,551,744	7,551,744	7,551,744	0.7
17	2025	7,048,731	7,048,731	7,048,731	0.6
18	2026	5,765,501	5,765,501	5,765,501	0.5
19	2027	5,092,321	5,092,321	5,092,321	0.5
20	2028	4,433,570	4,433,570	4,433,570	0.4
21	2029	3,389,874	3,389,874	3,389,874	0.3
22	2030	2,822,485	2,822,485	2,822,485	0.3
23	2031	2,186,979	2,186,979	2,186,979	0.2
24	2032	1,639,968	1,639,968	1,639,968	0.1
25	2033	1,303,015	1,303,015	1,303,015	0.1
26	2034	1,088,551	1,088,551	1,088,551	0.1
27	2035	266,013	266,013	266,013	0.0
28	2036	-	-	-	-
29	2037	-	-	-	-
30	2038	-	-	-	-
			NPV Benefits		**13**
		-$68,272,112	**-$35,329,533**	**-$51,800,823**	
			BCR		
		0.5	**0.7**	**0.6**	

Option 2(b) User information campaigns – Advertising

Year		Net Benefits			Lives Saved
		Min	Max	Average	
0	2007-08	- 40,937,549	- 35,417,549	- 38,177,549	-
1	2009	- 42,279,600	- 36,046,600	- 39,163,100	0.17
2	2010	- 40,770,766	- 33,824,766	- 37,297,766	0.6
3	2011	- 38,979,974	- 31,320,974	- 35,150,474	1.1
4	2012	- 33,682,102	- 25,908,102	- 29,795,102	1.6
5	2013	- 29,535,673	- 21,577,673	- 25,556,673	2.1
6	2014	- 15,768,339	- 10,018,339	- 12,893,339	2.6
7	2015	- 11,695,222	- 5,945,222	- 8,820,222	3.0
8	2016	- 7,878,690	- 2,128,690	- 5,003,690	3.3
9	2017	- 4,029,790	1,720,210	- 1,154,790	3.7
10	2018	157,643	5,907,643	3,032,643	4.2
11	2019	4,921,481	10,671,481	7,796,481	4.6
12	2020	10,023,198	15,773,198	12,898,198	5.1
13	2021	15,445,231	21,195,231	18,320,231	5.7
14	2022	20,829,012	26,579,012	23,704,012	6.2
15	2023	25,977,945	31,727,945	28,852,945	6.7
16	2024	31,198,247	36,948,247	34,073,247	7.2
17	2025	36,081,778	41,831,778	38,956,778	7.7
18	2026	40,172,699	45,922,699	43,047,699	8.1
19	2027	44,017,051	49,767,051	46,892,051	8.5
20	2028	47,525,801	53,275,801	50,400,801	8.9
21	2029	50,455,548	56,205,548	53,330,548	9.2
22	2030	53,247,585	58,997,585	56,122,585	9.5
23	2031	55,849,856	61,599,856	58,724,856	9.8
24	2032	58,303,270	64,053,270	61,178,270	6.7
25	2033	60,699,364	66,449,364	63,574,364	6.9
26	2034	63,216,197	68,966,197	66,091,197	7.1
27	2035	65,215,493	70,965,493	68,090,493	7.2
28	2036	67,315,574	73,065,574	70,190,574	7.4
29	2037	69,487,482	75,237,482	72,362,482	7.6
30	2038	71,837,103	77,587,103	74,712,103	7.7
			NPV Benefits		**170**
		-$19,373,728	**$58,238,148**	**$19,432,210**	
			BCR		
		1.0	**1.1**	**1.0**	

Option 3 Fleet purchasing policies

Year		Net Benefits Min	Net Benefits Max	Net Benefits Average	Lives Saved
0	2007-08	-77,034,739	-57,599,739	-67,317,239	-
1	2009	-39,660,887	-29,138,387	-34,399,637	0.19
2	2010	-3,733,530	-1,433,530	-2,583,530	0.5
3	2011	5,876,600	5,876,600	5,876,600	0.5
4	2012	6,048,415	6,048,415	6,048,415	0.6
5	2013	6,133,529	6,133,529	6,133,529	0.6
6	2014	6,163,725	6,163,725	6,163,725	0.6
7	2015	6,005,836	6,005,836	6,005,836	0.6
8	2016	5,537,239	5,537,239	5,537,239	0.5
9	2017	5,479,052	5,479,052	5,479,052	0.5
10	2018	5,768,225	5,768,225	5,768,225	0.5
11	2019	6,254,777	6,254,777	6,254,777	0.6
12	2020	6,485,423	6,485,423	6,485,423	0.6
13	2021	6,602,310	6,602,310	6,602,310	0.6
14	2022	6,466,799	6,466,799	6,466,799	0.6
15	2023	6,110,659	6,110,659	6,110,659	0.6
16	2024	6,129,402	6,129,402	6,129,402	0.6
17	2025	5,666,148	5,666,148	5,666,148	0.5
18	2026	4,576,780	4,576,780	4,576,780	0.4
19	2027	4,101,550	4,101,550	4,101,550	0.4
20	2028	3,544,685	3,544,685	3,544,685	0.3
21	2029	2,672,893	2,672,893	2,672,893	0.2
22	2030	2,263,636	2,263,636	2,263,636	0.2
23	2031	1,725,175	1,725,175	1,725,175	0.2
24	2032	1,297,596	1,297,596	1,297,596	0.1
25	2033	1,037,470	1,037,470	1,037,470	0.1
26	2034	869,913	869,913	869,913	0.1
27	2035	147,785	147,785	147,785	0.0
28	2036	-	-	-	-
29	2037	-	-	-	-
30	2038	-	-	-	-
		NPV Benefits			**11**
		-$59,688,015	**-$30,456,219**	**-$45,072,117**	
		BCR			
		0.5	**0.6**	**0.6**	

Option 6 Mandatory standards under the MVSA (Regulation)

Year		Net Benefits Min	Net Benefits Max	Net Benefits Average	Lives Saved
0	2007-08	-	-	-	-
1	2009	-	-	-	-
2	2010	-	-	-	-
3	2011	-	-	-	-
4	2012	-	-	-	-
5	2013	-13,277,193	-10,402,193	-11,839,693	0.1
6	2014	-24,637,509	-18,887,509	-21,762,509	0.4
7	2015	-20,569,162	-14,819,162	-17,694,162	0.8
8	2016	-16,394,071	-10,644,071	-13,519,071	1.2
9	2017	-11,994,276	-6,244,276	-9,119,276	1.6
10	2018	-7,451,460	-1,701,460	-4,576,460	2.1
11	2019	-2,850,137	2,899,863	24,863	2.5
12	2020	1,610,228	7,360,228	4,485,228	3.0
13	2021	6,008,070	11,758,070	8,883,070	3.4
14	2022	10,658,400	16,408,400	13,533,400	3.9
15	2023	15,741,136	21,491,136	18,616,136	4.4
16	2024	21,207,006	26,957,006	24,082,006	4.9
17	2025	26,914,507	32,664,507	29,789,507	5.5
18	2026	32,740,884	38,490,884	35,615,884	6.1
19	2027	38,507,269	44,257,269	41,382,269	6.7
20	2028	44,314,794	50,064,794	47,189,794	7.2
21	2029	50,099,719	55,849,719	52,974,719	7.8
22	2030	55,386,705	61,136,705	58,261,705	8.3
23	2031	60,250,696	66,000,696	63,125,696	8.8
24	2032	64,900,181	70,650,181	67,775,181	6.2
25	2033	69,108,769	74,858,769	71,983,769	6.5
26	2034	72,972,028	78,722,028	75,847,028	6.8
27	2035	76,608,076	82,358,076	79,483,076	7.0
28	2036	79,974,049	85,724,049	82,849,049	7.3
29	2037	83,192,753	88,942,753	86,067,753	7.5
30	2038	86,347,435	92,097,435	89,222,435	7.7
		NPV Benefits			**128**
		$115,359,759	**$161,925,822**	**$138,642,791**	
		BCR			
		1.4	**1.8**	**1.6**	

SUMMARY

Option 2(a)- User information campaigns (total 77% effectiveness, $3m campaign cost per year)

	Net Benefit	Cost to Business	Cost to Government	Benefit Cost Ratio	Number of Lives Saved
Best Case	-$35,329,533	$96,518,967	$7,872,948	0.7	
Likely Case	**-$51,800,823**	**$112,990,256**	**$7,872,948**	**0.6**	**13**
Worst Case	-$68,272,112	$129,461,546	$7,872,948	0.5	

Option 2(b)- User information campaigns (+8% effectiveness, $18m campaign cost per year)

	Net Benefit	Cost to Business	Cost to Government	Benefit Cost Ratio	Number of Lives Saved
Best Case	$58,238,148	$290,216,380	$225,572,655	1.1	
Likely Case	**$19,432,210**	**$329,022,318**	**$225,572,655**	**1.0**	**170**
Worst Case	-$19,373,728	$367,828,256	$225,572,655	1.0	

Option 3- Fleet purchasing policies (+20% passenger cars, +4.5% SUVs on initial voluntary rate)

	Net Benefit	Cost to Business	Cost to Government	Benefit Cost Ratio	Number of Lives Saved
Best Case	-$30,456,219	$86,601,354	$131,216	0.6	
Likely Case	**-$45,072,117**	**$101,217,252**	**$131,216**	**0.6**	**11**
Worst Case	-$59,688,015	$115,833,150	$131,216	0.5	

Option 6- Mandatory standards (total 100% effectiveness)

	Net Benefit	Cost to Business	Cost to Government	Benefit Cost Ratio	Number of Lives Saved
Best Case	$161,925,822	$213,942,521	$421,581	1.8	
Likely Case	**$138,642,791**	**$237,225,552**	**$421,581**	**1.6**	**128**
Worst Case	$115,359,759	$260,508,583	$421,581	1.4	

Best Case - 25 year period @7% discount rate, minimum costs

Likely Case - 25 year period @7% discount rate, average costs

Worst Case - 25 year period @7% discount rate, maximum costs

APPENDIX 13 - BENEFIT- COST ANALYSIS – SENSITIVITIES

The following sensitivities were tested for Option 6 Mandatory Standards under the MVSA (Regulation):

(a) Basic output: Discount rate 7 per cent, Business As Usual (BAU) case, 95 per cent by 2014

Option 6- Mandatory standards (total 100% effectiveness)

	Net Benefit	Cost to Business	Cost to Government	Benefit Cost Ratio	Number of Lives Saved
Best Case	$161,925,822	$213,942,521	$421,581	1.8	
Likely Case	**$138,642,791**	**$237,225,552**	**$421,581**	**1.6**	**128**
Worst Case	$115,359,759	$260,508,583	$421,581	1.4	

(b) Discount rate of 10 per cent

Option 6- Mandatory standards (total 100% effectiveness)

	Net Benefit	Cost to Business	Cost to Government	Benefit Cost Ratio	Number of Lives Saved
Best Case	$75,814,032	$139,799,220	$284,411	1.5	
Likely Case	**$60,271,813**	**$155,341,440**	**$284,411**	**1.4**	**128**
Worst Case	$44,729,593	$170,883,659	$284,411	1.3	

(c) BAU case, 100 per cent by 2015/16

Option 6- Mandatory standards (total 100% effectiveness)

	Net Benefit	Cost to Business	Cost to Government	Benefit Cost Ratio	Number of Lives Saved
Best Case	$10,588,511	$49,007,743	$93,555	1.2	
Likely Case	**$7,003,601**	**$52,592,653**	**$93,555**	**1.1**	**15**
Worst Case	$3,418,690	$56,177,564	$93,555	1.1	

(d) Discount rate of 10 per cent and a BAU case, 100 per cent by 2015/16

Option 6- Mandatory standards (total 100% effectiveness)

	Net Benefit	Cost to Business	Cost to Government	Benefit Cost Ratio	Number of Lives Saved
Best Case	$3,375,002	$36,611,901	$77,207	1.1	
Likely Case	**$417,637**	**$39,569,266**	**$77,207**	**1.0**	**15**
Worst Case	-$2,539,728	$42,526,631	$77,207	0.9	

APPENDIX 14 – BENEFIT- COST ANALYSIS – ASSUMPTIONS

A number of assumptions have been made in the benefit-cost analysis. These are listed below (in no particular order).

1. The potential benefits were based on the identified cost of a fatality, serious injury and minor injury for a single vehicle crash (SVC) in Australia. The ratio between fatalities and serious injuries in Australia for these crashes was known, however the ratio to minor injuries had to be estimated from overseas crash data. Refer Appendix 3- Single and Multiple Vehicle Crashes and Ratio of Injuries. This would not affect the relative merits of the options but may change their final values.

2. The effectiveness of Electronic Stability Control (ESC) under the various scenarios was based on a comprehensive study of Australian crashes. As the effectiveness rate was comparable with other studies for the same crash type, a variation (or tolerance) was not calculated. The effectiveness was applied equally to fatalities, serious injuries and minor injuries as the exact distribution of these was not known. It was also assumed that the outcome for passenger cars and Sports Utility Vehicles (SUVs) could be extended to other light commercial vehicles. This position is supported by research from the United States. However, the data was not available to include them in these calculations. This would not affect the relative merits of the options but may change their final values.

3. A discount rate of 7 per cent was assumed, this being in line with similar studies. However, a rate of 10 per cent was used as part of the sensitivity checks. Also, the expected life of a vehicle was set at 25 years as per the historical data used for the calculations. Refer Appendix 11 - Benefit-Cost Analysis – Methodology. This would not affect the relative merits of the options but may change their final values slightly.

4. A historically based fleet profile was used to adjust the contribution that each vehicle fitted with ESC would provide towards the total benefit. This contribution was based on both the proportion of vehicles in the fleet of any particular age, and the tendency for vehicles of a particular age to be involved in road crashes. It was assumed that this profile could continue to represent the fleet into the future. Refer Appendix 11 - Benefit-Cost Analysis – Methodology. This would not affect the relative merits of the options but may change how rapidly the benefits would be realised and their final values slightly.

5. There were no benefits allocated to the conversion of minor injuries to no injuries and so the scenarios may be slightly conservative. However, such conversions would be too difficult to estimate with any accuracy. It has been noted that other similar studies have not included such estimates. This may underestimate the benefits overall.

6. The forecast for fleet sales to 2038 was initially based on the sales data from 1999-2008. However this data showed a rise in passenger cars sales of around 1 per cent per year and a rise in SUVs of around 8.4 per cent per year. It was assumed that the sharp rise in SUV sales was peculiar to this period only and a long term rate of 1.2 per cent and 2 per cent was applied instead. This would not affect the relative merits of the options but may change how rapidly the benefits would be realised.

7. It was assumed that the Option 2(a) User information campaign – Awareness, would only affect passenger cars as it was based on achieving a 77 per cent awareness and therefore ESC sales. However ESC sales for SUVs had already reached 80 per cent. This may underestimate the merits of this option slightly.

8. It was assumed in Option 2(b) User information campaign – Advertising, that the 4.5 per cent improvement in ESC sales for the most popular SUVs could be achieved through fleet sales. However, the fleet sales mechanism is more relevant to passenger cars. This may overestimate the merits of this option slightly.

9. It was assumed that new passenger car sales make up an average of 80 per cent of passenger car and SUV sales. This has been true up until recently; however it is also acknowledged that SUV sales have been increasing rapidly. This would not affect the relative merits of the options but may underestimate the benefits overall (as ESC is more effective for SUVs).

10. Certification costs were assumed to impact Business rather than Government as the certification scheme is in the most part cost recovered. This would not affect the results other than the distribution of costs slightly.

11. Option 2(a) User information campaign – Awareness and Option 2(b) User information campaign – Advertising were costed on an ongoing basis; it was assumed that there was no residual effect assumed after the campaigns stopped. This may underestimate the merits of these options.

12. It was assumed that vehicle models in the passenger car and SUV market segment would have a similar proportion of ABS availability to the 40 most popular passenger car and SUV models (that together represent 65 per cent of the market segment by sales). This may overestimate the net benefits available from all the options.

APPENDIX 15 -TECHNICAL LIAISON GROUP (TLG)

Organisation
Manufacturer Representatives Australian Road Transport Suppliers Association Commercial Vehicle Industry Association Federal Chamber of Automotive Industries Federation of Automotive Product Manufacturers Truck Industry Council Bus Industry Federation
Consumer Representatives Australian Automobile Association Australian Trucking Association Australian Motorcycle Council
Government Representatives Department of Infrastructure, Transport, Regional Development and Local Government, Australian Government Department of Transport, Energy and Infrastructure, South Australia Queensland Transport Roads and Traffic Authority, New South Wales VicRoads, Victoria Department of Planning and Infrastructure, Western Australia Office of Transport, Australian Capital Territory Department of Infrastructure, Energy and Resources, Tasmania Department of Planning and Infrastructure, Northern Territory Land Transport Safety Authority of New Zealand
Inter Governmental Agency National Transport Commission

APPENDIX 16 - ACRONYMS

ADR	Australian Design Rule
ANCAP	Australasian New Car Assessment Program
ATC	Australian Transport Council
BTE	Bureau of Transport Economics
COAG	Council of Australian Governments
DITRDLG	Department of Infrastructure, Transport, Regional Development and Local Government
ESC	Electronic Stability Control
ECE	Economic Commission for Europe
EU	European Union
FAPM	Federation of Automotive Product Manufacturers
FCAI	Federal Chamber of Automotive Industries
FMVSS	Federal Motor Vehicle Safety Standards
GTR	Global Technical Regulation
MVSA	Motor Vehicle Standards Act 1989
NTC	National Transport Commission
RIS	Regulation Impact Statement
SUV	Sports Utility Vehicle, Four-wheel-drive, 4WD,
SV, SVC	Single Vehicle Crash
TACE	Transport Agencies Chief Executives
TPA	Trade Practices Act 1974
UN	United Nations
WTO	World Trade Organisation