



**A LITERATURE REVIEW OF ROAD SAFETY
STRATEGIES AND THE SAFE SYSTEM
APPROACH**

CURTIN-MONASH ACCIDENT RESEARCH CENTRE (C-MARC)

School of Public Health

Curtin University

GPO Box U1987

Perth WA 6845

Chen HY, Meuleners L

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Title

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Author(s)

Chen HY, Meuleners L

Performing Organisation

Curtin-Monash Accident Research Centre (C-MARC)
School of Public Health
Curtin University
GPO BoxU1987
Perth WA 6845

Tel: (08) 9266 9590

Fax: (08) 9266 2958

Sponsor

Main Roads Western Australia
Don Aitken Centre
Waterloo Crescent
EAST PERTH WA 6004

Abstract

This report reviews road safety strategies in Australia and worldwide that use the 'Safe System' approach. The vision, principles, and key elements of the 'Safe System' approach are critically examined. In addition, the WA Towards Zero Strategy is described and compared to the strategies of other States in Australia as well as other international road safety strategies. Finally, the strengths and weaknesses of the WA Towards Zero Strategy are discussed, with some recommendations for future improvements.

Keywords

Safe System, Vision Zero, Arrive Alive, Stainable Safety, road safety strategy

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EXECUTIVE SUMMARY

This report reviews Australian and international road safety strategies that are based on the ‘Safe System’ approach. Strategies are examined and compared to the WA Towards Zero strategy in terms of vision, years covered, principles, and key elements. To ensure the WA road safety strategy and the ‘Safe System’ approach continues to effectively prevent road trauma, its principles need to be constantly reviewed and compared to other States and countries so that necessary modifications can be made.

INTRODUCTION

The ‘Safe System’ approach to road safety originated in Sweden and the Netherlands. This approach was then adopted by the transport authority of Australia in November 2003. The concept behind the ‘Safe System’ approach is to build a road transport system that tolerates human error and minimises casualties following road crashes. The four key elements of the ‘Safe System’ approach are ‘Safe Road Users’, ‘Safe Roads and Roadsides’, ‘Safe Speeds’, and ‘Safe Vehicles’. In contrast to traditional road safety approaches that primarily focus on road users and risky behaviours, the ‘Safe System’ approach provides a systematic method to reduce crash occurrence and subsequent injuries in the event of a crash. The principles of the ‘Safe System’ approach have been used to guide the development of the 2011-2020 National Road Safety Strategy in Australia. Similarly, many countries also have adopted the ‘Safe System’ approach or parts of the ‘Safe System’ approach into their national road safety strategies.

METHODS

The Medline and ScienceDirect databases were searched for Australian and international publications on the ‘Safe System’ approach using the keywords ‘road safety strategy’ in combination with ‘Towards Zero’, ‘Vision Zero’, ‘Sustainable Safety’ or ‘Arrive Alive’. Publication reference lists were also scanned for relevant articles. In addition, each Australian State road authority’s website was searched for information as well as the websites of various Transport Authorities in other countries including those in North America, Europe, and New Zealand. The Google search

engine was also used to search for literature and road safety strategies using the ‘Safe System’ approach.

RESULTS

The Western Australian Towards Zero road safety strategy

Overall, the WA road safety strategy has fully adopted the ‘Safe System’ approach and used its principles to develop initiatives aimed at improving road safety in WA. Compared to other States and territories in Australia, the WA Towards Zero strategy is comprehensive, though there are still areas that could be improved.

The WA Government is one of the two pioneers in Australia who have formally introduced the ‘Safe System’ approach into their new State road safety strategy. This strategy covers the period of 2008 to 2020. The WA Towards Zero strategy represents a long-term vision of the WA Government to build a road transport system where crashes resulting in deaths or serious injuries are virtually eliminated. The main principles of this strategy include the limits of human performance, the limits of human tolerance to violent forces, shared responsibility, a forgiving road system, and the increased use of public transport. The key elements of the WA Towards Zero strategy target the four components of the road system, including ‘Safe road use’, ‘Safe roads and roadsides’, ‘Safe speeds’ and ‘Safe vehicles’, which are aligned with the ‘Safe System’ approach. It is anticipated that 11,000 people will be saved from fatal or severe injury crashes on WA roads between 2008 and 2020, if the WA Towards Zero strategy can be comprehensively implemented. Although challenges exist in implementing this strategy, several recommendations are made in this review to overcome such difficulties.

Road safety strategies within Australia

In Australia, the ‘Safe System’ approach is now being incorporated into all States and territories’ road safety strategies. This is to coordinate with the newly released National Road Safety Strategy 2011-2020, which is based on the ‘Safe System’ approach. The ‘Safe System’ approach provides guidelines that can be used to achieve the vision of zero road fatalities and serious injuries within a road system. Since road safety issues

vary across the States/territories of Australia, it is not surprising that each State/territory's strategy has different priorities and strategies. Despite this, these different road safety issues can usually be grouped into the four key elements of the 'Safe System' approach. Therefore, all these issues, theoretically, could be managed under the 'Safe System' approach.

The National Strategy

The new Australian National Road Safety Strategy, which covers the period of 2011 to 2020, has adopted the 'Safe System' approach. The previous strategy was also based on the 'Safe System' approach. The continuing use of this framework means that Australia's approaches are consistent with those of countries with the safest roads in the world, such as Sweden and the Netherlands. With this approach in place, the Australian Road Safety Strategy may allow the Australian Government to achieve at least a 30% reduction in the number of road fatalities and serious injuries by 2020. The key elements are 'Safe People', 'Safe Roads', 'Safe Speeds' and 'Safe Vehicles'. The main principles acknowledge the importance of 'Human error', 'Human frailty', 'Shared responsibility', and 'A forgiving road transport system'.

South Australia

The new road safety strategy of South Australia (SA) is very similar to that of Western Australia, which is called 'Towards Zero Together'. The main vision of the strategy is that all South Australians work together to address road trauma. This strategy is almost identical to the National Road Safety strategy in terms of principles and key targeted elements and is strongly based on the 'Safe System' approach. The SA strategy covers a 10-year period from 2011-2020. It aims to achieve less than 80 road fatalities and less than 800 serious injuries on SA roads by 2020. This is equivalent to the national target of at least a 30% reduction in severe road trauma compared to the last decade. A positive element of the SA strategy is its focus on increasing the involvement of Local Government in building a 'Safe System'.

Tasmania

The 'Our Safety, Our Future' strategy highlights the key message of the Tasmanian road safety strategy for the period of 2007-2016. The Tasmanian 'Our Safety, Our Future' road safety strategy aims to reduce serious injuries and fatalities on Tasmanian Roads by 20% by 2010, compared to 2005. It also aims to further reduce the number of serious injuries and fatalities by 20% by 2015 as compared to 2010, and another 20% by 2020 as compared to 2015. However, the key principles and targeted elements of the Tasmanian strategy are slightly different to other States. This is mainly due to the unique geography and limited resources in Tasmania. The main principles include shared responsibility for road safety and targeted responses that will reduce the most serious injuries and fatalities on the roads. Key targeted elements of the Tasmanian road safety strategy include 'Safer travel speeds', 'Best practice infrastructure', 'Increased safety for young road users' and 'Enhanced vehicle safety'.

Queensland

The Queensland Government implemented the 'Safe4life' State road safety strategy for the period of 2004 to 2011. This strategy aims to prevent road trauma, and is based on a belief that all road users can travel safely regardless of who and where they are. By the end of 2011, this strategy aims to reduce the road toll to below 5.6 deaths per 100,000 population. Unlike other State road safety strategies, this strategy is more 'cause problem-solving' oriented. Moreover, the key principles and key targeted elements are different from strategies using a 'Safe System' approach. For example, the Queensland Safe4life strategy mentions neither human error or frailty or the establishment of a forgiving road system and 'Safe speeds' is not one of the key targeted elements. Nevertheless, an advantage of the Safe4life strategy is the principle of equity, which is not acknowledged by other States and territories.

Victoria

Victoria was another State to first introduce the 'Safe System' approach into their State road safety strategy. The strategy, called 'Arrive Alive', covers the period of 2008 to 2017. This strategy aims to create a much safer road environment and to ensure that

road users do not lose their lives or become permanently disabled in the event of a crash. The strategy aims to reduce fatal and serious injury crashes by 30% by 2017, which equates to 100 lives and over 2,000 serious injuries. The strategy's principles are based on the 'Safe System' approach, with one additional principle focusing on interactions between key elements. The key elements listed include 'Safe roads and roadsides', 'Safe vehicles', and 'Safe behaviours'.

New South Wales

There was no specific State road safety strategy for New South Wales (NSW) located by our search. Nevertheless, other sources reveal that the NSW Government uses the 'Safe System' approach to manage road safety issues. In addition, the NSW Government aims to reduce road fatalities to 4.9 per 100,000 population by 2016.

Australian Capital Territory

The Australian Capital Territory's (ACT) upcoming road safety strategy, namely 'Towards Zero', is based on Sweden's 'Vision Zero' strategy. Unlike other States and the Northern Territory, the ACT has a well designed road system, a mostly urban environment and a relatively small population. As a result, the ACT has the best road safety record in Australia, which is equivalent to those countries with the best records, such as Sweden or the Netherlands. The concept of the ACT's Towards Zero strategy is again, to achieve zero deaths or serious injuries following a crash within the road transport system. The principles and key targeted elements are almost identical to the National Road Safety Strategy. The ACT also outlines a method for applying the 'Safe System' key elements using the '4 Es' of road safety—Education, Encouragement, Engineering, and Enforcement.

The Northern Territory

Compared to other States of Australia and other Organisation for Economic Co-operation and Development (OECD) countries, the Northern Territory (NT) has the worst road safety record. To reduce road trauma, the NT Government proposed a road safety strategy based on a Cause-Problem Solving model to cover the period of 2008 to

2013. The theme for the NT strategy is ‘Working in partnership to reduce road trauma and increase safer road use’. It acknowledges the need to change the road use culture in society in order to reduce the road toll in the NT. Although the NT strategy is not guided by the ‘Safe System’ approach, this is not surprising as the NT has very different geography and population compared to other States in Australia. It may be less cost effective to attempt to build a ‘Safe System’ in the NT at this stage.

International road safety strategies using the Safe System approach

Internationally, many countries have recognised that road safety strategies should aim to build a failure tolerant road transport system. Even though a variety of terminology has been used to describe these road safety strategies, they generally follow the ‘Safe System’ approach.

Europe

Several countries in Europe have based their road safety strategies on the ‘Safe System’ approach. The Netherlands, a world leader in road safety, initiated the concept of ‘Sustainable Safety’ in 1992. Their most recent strategy, ‘Advancing Sustainable Safety’, covers the period 2005 to 2020 and focuses on how to prevent human error and how to ensure that crash forces do not exceed human tolerance and severe injuries or deaths are practically non-existent. The Netherlands also developed the Sustainable Safety Indicator (DV-meter) which uses quantitative scores to indicate the extent to which the characteristics of the road design correspond with the ‘Safe System’ requirements. In 1997, Sweden adopted the systematic, proactive ‘Safe System’ approach to road safety and initiated the ‘Vision Zero’ concept. Sweden’s current road safety strategy maintains ‘Vision Zero’ as its main theme, and covers the period of 2007 to 2020. Because of their advanced road safety strategies, Sweden and the Netherlands have the best road safety records in the world. Due to their success, road safety strategies including ‘Vision Zero’ and ‘Sustainable Safety, are widely used around the world.

Similar strategies based on the ‘Safe System’ approach were also observed in other European countries including Austria, Denmark, the United Kingdom, Finland, Norway and Switzerland. Unique elements of these strategies include Austria’s focus on gaining broad support from various aspects of society to make the strategy succeed, Denmark’s engagement of society in road safety, Norway’s emphasis on police surveillance to facilitate the implementation of initiatives and Switzerland’s focus on raising awareness about road safety issues and its aim to build better emergency services. The literature also suggests that Germany uses a ‘Safe System’ approach.

North America

The Canadian Government aims to build the ‘Safest Roads in the World’ and the upcoming national road safety strategy covers the period of 2011 to 2015, a much shorter period than most other strategies. However, the Canadian road safety strategy lists the ‘Safe System’ approach as just one of five principles guiding their road safety initiatives. This suggests that Canadian Government uses the ‘Safe System’ approach as a tool for managing the road safety issues. Another principle of the Canadian road safety strategy is to adopt ‘Best Practices’ in road safety, which may help guide local governments in choosing sustainable, feasible and acceptable road safety initiatives. The United States of America’s (USA) ‘Towards Zero Deaths’ strategy highlights the need to change the culture towards road safety and the need to build the foundation of safety. Although the key elements targeted by strategy are similar to other countries that use a ‘Safe System’ approach, the principles of the ‘Safe System’ are not strictly followed by the USA strategy. A unique element of the USA road safety strategy is the specific focus on improving emergency medical services. However, not all States in USA have the same road safety visions.

New Zealand

The New Zealand (NZ) road safety strategy entitled ‘Safer Journeys’ covers the period of 2010 to 2020. The vision of the strategy is to build a safe road system increasingly free of death and serious injury, while recognising that it is impossible to prevent all crashes on the roads. The NZ Safer Journeys road safety strategy adopted the ‘Safe

System' approach. The NZ Government also determines priority areas to be addressed across the elements of the 'Safe System'. Unlike the other countries aiming to achieve a national target, the NZ Government sets up detailed performance indicators and monitors and evaluates them accordingly.

Asia

The Japanese Government aims to construct the safest roads in the world and the current road safety strategy covers the period of 2006 to 2012. The program's principle and key elements illustrate the focus of the Japanese strategy on information technology (IT) to facilitate the interaction between people, vehicles, and road infrastructure. However, this strategy is not strictly 'Safe System' oriented as shared responsibility is not embedded into the strategy. Hong Kong appears to be the only jurisdiction in China to use a 'Safe System' approach - 'Zero accidents on the road', to manage road safety.

DISCUSSION

The 'Safe System' approach has been adopted by many world leaders in road safety. This review of road safety strategies revealed that the 'Safe System' approach has become the main stream and will be the predominant approach guiding road safety advancements over the next few decades. The 'Safe System' approach is now being adopted in most States/territories of Australia and guides the National Road Safety Strategy 2011-2020. Despite variations in terminology used, it is clear that the road safety strategies of SA, TAS, VIC, and the ACT are similar to that of WA, which is strongly based on the 'Safe System' approach. On the other hand, QLD and the NT base their road safety strategies on the Cause Problem Solving Model, which focuses on the most significant road safety issues first.

Strengths of the WA Towards Zero Strategy

Firstly, the WA Towards Zero strategy is the only one to adopt the principle of increasing public transport use, even though it is briefly mentioned within some of the States' road safety strategies, such as SA. Theoretically, increasing the use of public

transport is a highly effective strategy for reducing crashes. Public transport not only decreases the number of vehicles on the road (fewer conflicts) but also provides a mode of transport where passengers are better protected and at lower risk of crashes. This principle could be applied to the strategies of other States and territories of Australia as well as to countries around the world. For example, this principle may help reduce road trauma in India and China which are projected to contribute the majority of road fatalities worldwide in the near future.

The second major strength of the WA Towards Zero strategy is the inclusion of well-developed performance indicators for each key area of the strategy. This will facilitate the implementation, monitoring and evaluation of the ‘Safe System’ approach in WA and guide adjustments to the strategy over time where required.

Weaknesses of the WA Towards Zero Strategy

While the WA Towards Zero strategy has made a strong effort to incorporate the ‘Safe System’ approach, it does not always consider using a systems approach to develop new initiatives. In fact, only a few tasks listed in the WA Towards Zero Strategy actually incorporate more than one element of the road system. Examples of these include installation of alcohol interlocks (interaction between Safe Vehicles and Safe Road Use) and the use of Intelligent Transport Systems (interaction between Safe Roads and Safe Vehicles). The Victorian Arrive Alive strategy lists ‘understanding the interactions between key elements of the road system’ as a key principle. It is important for WA to focus on this principle in order to develop effective multi-dimensional initiatives that integrate two or more of the key elements of the road system.

Secondly, gaining the support of key stakeholders for road safety is important in WA. While the WA strategy focuses strongly on shared responsibility for road safety, practical methods and effective initiatives that facilitate community involvement and build a sense of responsibility for road safety are required. In addition, improving emergency medical services, particularly in rural and remote regions, is not documented in the WA strategy.

Finally, other countries are currently setting up a best practice framework as part of their road safety strategies that will compile research and evidence on the effectiveness of road safety initiatives. Unfortunately, there is no such framework in either WA or other States/territories within Australia. Therefore, information and best practices in roads safety may not be being optimally shared and translated into effective ‘Safe System’ based initiatives at the Federal, State and local level.

Recommendations for the WA Towards Zero Strategy

1. A better understanding of interactions between key elements of the road system;
2. Gaining support from all stakeholders, such as policy makers, police and the community;
3. An enhanced emergency medical service to reduce rural and remote road trauma;
4. A best-practice framework that is flexible and applicable to local areas;
5. A mechanism to regularly monitor and evaluate performance indicators;
6. A clear strategy for engaging the community in shared responsibility for road safety
7. Incentives for participation in road safety;
8. Support for local governments in understanding and implementing the ‘Safe System’ approach to road safety into local areas.

Conclusion and Future Directions

In conclusion, the WA Towards Zero Strategy is a positive step for road safety in WA and is built on a strong theoretical foundation which is based on the ‘Safe System’ approach. Putting the ‘Safe System’ approach into practice over the next decade will be a challenge for road safety authorities. Over the next decade, practical methods for incorporating the ‘Safe System’ approach into all road safety efforts at the State and local levels need to be developed. The strategy also requires regular monitoring and evaluation to ensure that performance indicators are being met and to allow timely adjustments to be made if initiatives are not successful or new evidence emerges. This flexibility is essential as roads, vehicles and policies may change during the over the period covered by the WA Towards Zero Strategy. Converting the ‘Safe System’ theory

into practice, monitoring and evaluation and a flexible strategy are necessary to achieve the WA Towards Zero Strategy's ultimate goal of no deaths or serious injuries on WA roads.

1. INTRODUCTION

The previous road safety strategy in Western Australia (WA), ‘Arriving Safely’ covered the period 2003 to 2007. The new WA strategy, ‘Towards Zero’ provides guidelines for road safety between 2008 to 2020 (Office of Road Safety 2009). The principles behind the Towards Zero strategy are consistent with those of the Australian National Road Safety Strategy for 2011 to 2020. Both are based on the ‘Safe System’ approach that originated in Sweden and the Netherlands (Wegman and Mulder 2000; Elvebakk 2007). This approach is also being integrated into a number of other road safety plans or strategies nationally and internationally.

The ‘Safe System’ approach is unique in that it takes into account all key elements of the road transport system and their interactions when developing road safety strategies. In general, the four key elements of the ‘Safe System’ approach are Safe Road Users, Safe Roads and Roadsides, Safe Speeds, and Safe Vehicles. Despite differences in strategies across States and countries, the ‘Safe System’ approach aims to build a road transport system which tolerates human error and prevents death or serious injury in the event of a crash (The Australasian College of Road Safety 2010). In contrast, traditional road safety approaches mainly focus on road users and their behavior. Elements of the ‘Safe System’ approach are now widely used in many countries, including Australia. However, in order to guide WA’s road safety strategy in the coming decade, it is important to review this strategy to understand how the ‘Safe System’ approach is being adopted. Furthermore, comparing and contrasting WA’s road safety strategy to other Australian and international strategies will allow strengths and weaknesses to be identified and recommendations for modifications to be made if required.

1.1 Aim

The aim of this study is to review road safety strategies that adopt the ‘Safe System’ approach in Australia and worldwide, in terms of concept, principles, and targeted key elements, and compare them to the ‘Towards Zero’ road safety strategy, which is endorsed by the WA Government. Strengths of the strategies and areas for further consideration will be identified.

1.2 Significance

The results of this review will provide Main Roads WA and other responsible agencies with comprehensive information about Australian and international road safety strategies adopting the 'Safe System' approach. Such information is essential to ensure that the WA road safety strategy meets the best practices in concept, principles, and targeted key elements now and into the future.

2. METHODS

The Medline and ScienceDirect databases were searched for Australian and international publications on the 'Safe System' approach using the keywords 'road safety strategy' in combination with 'Towards Zero', 'Vision Zero', 'Sustainable Safety' or 'Arrive Alive'. Publication reference lists were also scanned for relevant articles. In addition, each Australian State road authority's website was searched for information as well as the websites of various Transport Authorities in other countries including those in North America, Europe, and New Zealand. The Google search engine was also used to search for literature and road safety strategies relevant to the 'Safe System' approach.

3. RESULTS

3.1 Introduction

The search of the literature identified most Australian States and territories' road safety strategies, which covered various periods of time. The road safety strategy of NSW could not be found via our search. The search identified 16 other countries which have adopted the 'Safe System' approach within their road safety strategies. However, details of these strategies were not always available in English. The search also identified published articles and conference papers detailing the 'Safe System' approach and its applications. The findings of this review are summarised below.

3.2 The Western Australian Towards Zero road safety strategy

The WA Government is one of the two States in Australia who have formally introduced the 'Safe System' approach into their new road safety strategy (The Australasian College of Road Safety 2010). This strategy, called Towards Zero, covers the period of 2008 to 2020 (Cameron 2009; Office of Road Safety 2009). Towards Zero represents the long-term vision of the WA Government to build a road transport system where crashes resulting in deaths or serious injuries are virtually eliminated (Office of Road Safety 2009). The formulation of this strategy took significant time and consideration and the process is documented elsewhere (Corben, Logan et al. 2007; Corben, Logan et al. 2008). The ultimate goal of the strategy is to achieve zero serious injuries and deaths on the roads by the year 2020. The achievement of this goal relies on all members of society recognising the importance of road safety and devoting themselves to making the roads safer. The key elements of the 'Safe System' approach include:

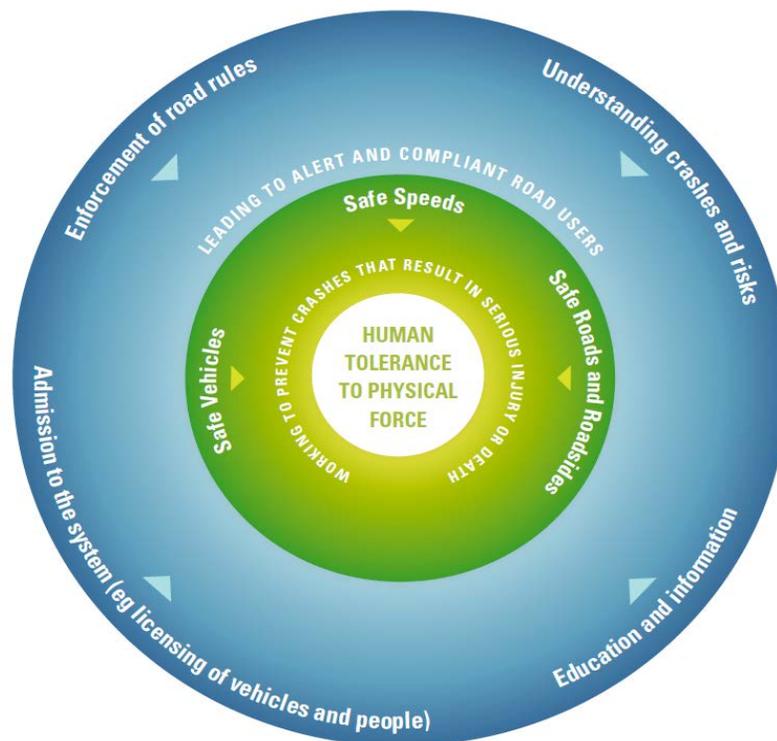
- Safe Road Use
- Safe Roads and Roadsides
- Safe Speeds
- Safe Vehicles.

Specifically, the Towards Zero strategy aims to save 11,000 people from fatal or severe injury crashes on WA roads between 2008 and 2020, as a result of comprehensive implementation of the Towards Zero strategies. This will also result in a huge cost saving for the WA health system and community, estimated at about \$6.6 billion (Corben, Logan et al. 2007). Therefore, translating the Towards Zero strategy into practice will not only benefit WA road users, but also the whole WA society.

3.2.1 Vision of the Western Australian Towards Zero Strategy

The Towards Zero strategy holds the view that although crashes will always occur on the roads, no one should die or be severely injured as the result of a crash. To achieve this goal, the whole community is required to make a fundamental change in the way it thinks and acts towards road safety. It is therefore important that everyone takes responsibility and action and works co-operatively to improve road safety and achieve the ultimate goal of zero deaths and serious injuries on the roads.

Figure 3.1: The Safe System approach as applied to the WA Towards Zero strategy (Australian Transport Council (ATC) 2006)



3.2.2 Principles of the Western Australian Towards Zero Strategy

There are five principles in WA's Towards Zero Strategy:

1. The limits of human performance—to acknowledge the normality of 'human error' and fallibility.
2. The limits of human tolerance to violent forces—to protect all road users from the amount of force that exceeds human limits during the occurrence of a crash.
3. Shared responsibility—to acknowledge that everyone takes both an individual and shared role in road safety within a 'Safe System'.
4. A forgiving road system—to allow human errors and avoid deaths and serious injuries when crashes occur.
5. Increased use of public transport—to increase the use of public transport to reduce road trauma, traffic congestion, and vehicle emissions, and to support sustainability (Office of Road Safety 2009).

3.2.3 Key elements within the Western Australian Towards Zero Strategy

Four key elements of the 'Safe System' approach are targeted by the Towards Zero strategy:

Safe Road Use

Influencing road user behavior by:

- Advising, educating, and encouraging road users to comply with road rules;
- Promoting the philosophy of shared responsibility;
- Encouraging road users to drive unimpaired and alert and according to the prevailing conditions;
- Managing the gradual introduction of novices into the system and understanding their specific needs; and
- Taking action against those who break the rules.

Safe Roads and Roadsides

Improving road infrastructure by:

- Designing and maintaining roads and roadsides to reduce the risk of crashes occurring and the severity of injury if a crash does occur; and
- Providing a transport system that supports safe outcomes.

Safe Speeds

Ensuring speed limits and travel speeds reflect the safety of the road infrastructure by:

- Undertaking speed enforcement and education; and
- Establishing speed limits according to the features of the road and roadsides, vehicle crash-worthiness and the functional performance and known limits of the road user.

Safe Vehicles

Improving the safety of the vehicles in the road system by:

- Promoting safety features that reduce the likelihood of a crash (and reduce the impact of the crash on vehicle occupants as well as pedestrians and cyclists);
- Encouraging consumers and businesses to purchase safer vehicles; and
- Implementing mandatory safe vehicle procurement in Government fleets and recommending additional safety features to be considered.

(Office of Road Safety 2009)

WA has a different geographic environment to other States and territories of Australia. Therefore, WA has unique road safety problems and priorities. The matrix in Figure 3.2 illustrates how the key elements described above are comprehensively addressed by the current WA Towards Zero strategy.

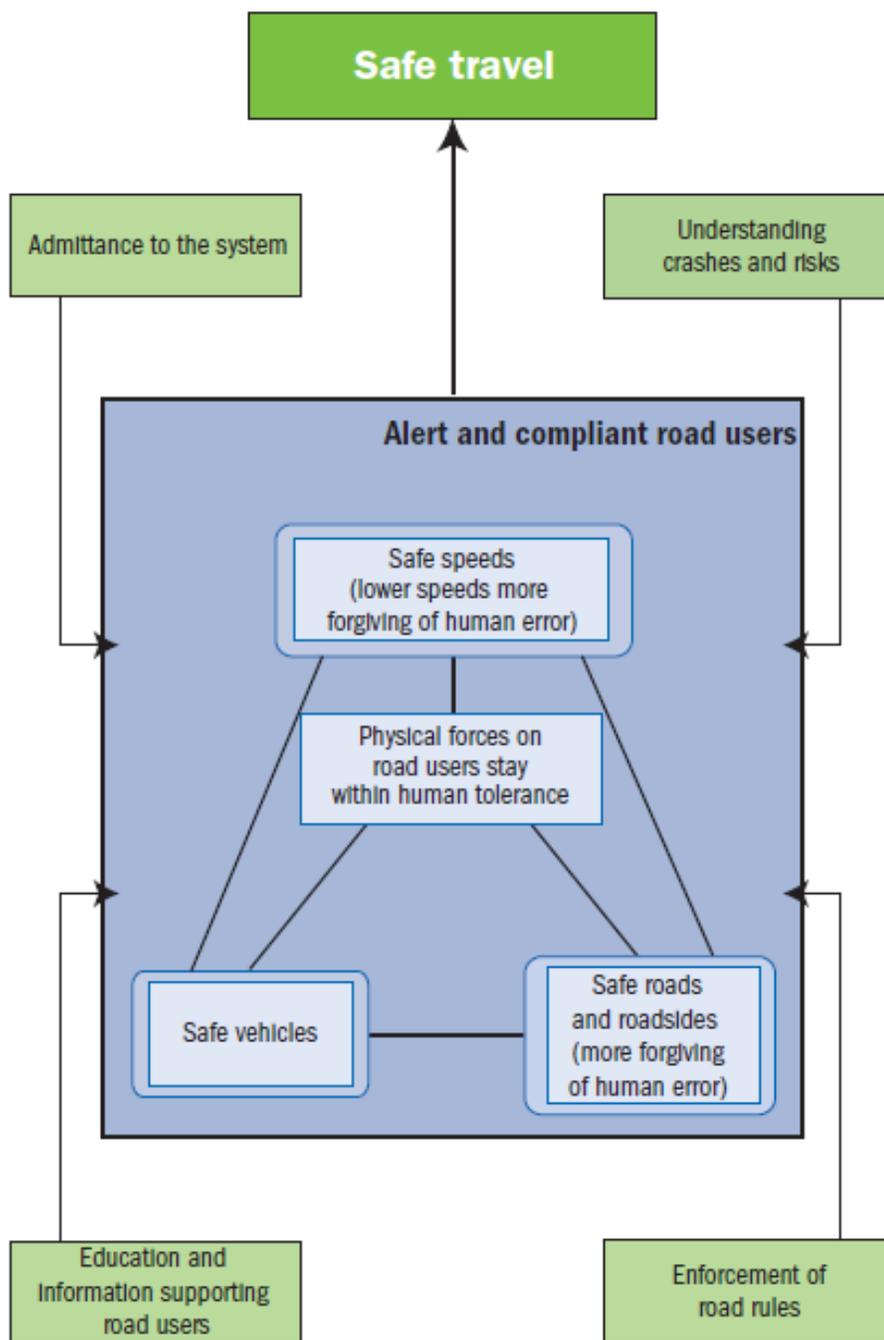
Figure 3.2: The Safe System Matrix for Western Australia (Corben, Logan et al. 2008)

Area	Safe Road Use	Safe Roads and Roadside	Safe Speeds	Safe Vehicles
All of WA	Ongoing behaviour change programs	Black Spot and Safer Roads Programs	Enhanced enforcement	Crash avoidance and occupant protection countermeasures
Metro Perth	Targeted behaviour programs to match geographic priorities	Safe System intersection transformation	Specific speed limit adjustments to match geographic priorities	Specific crash avoidance counter-measures to match geographic priorities
Regional WA		Safe System transformation on key routes		
Remote WA				

3.3 The Australian National Road Safety Strategy

In 1992, the first Australian National Road Safety Strategy was established. The last national strategy covered the period of 2001 to 2010 and employed the ‘Safe System’ approach. It aimed to achieve a 40% reduction in the road fatality rate (ATC and ATSB 2000). This approach is identical to what has been used in the WA Towards Zero strategy as well as in the road safety strategies of other countries, such as Sweden and the Netherlands. The ultimate goal is also similar—to establish a road transport system in which human mistakes do not result in death or serious injury (May, Tranter et al. 2008). Although the last national strategy did not reach the set goal of a 40% reduction in road fatalities (a 34% reduction was achieved), it strengthened national commitment to road safety and made significant improvements in many areas (The Australasian College of Road Safety 2010). The new strategy covering the period of 2011 to 2020 is also adopting the ‘Safe System’ approach (ATC 2011). Figure 3.3 shows how the ‘Safe System’ principles are adopted as Australia’s road safety framework. The use of this framework means that Australia is consistent with the approaches used by the countries with the safest roads in the world. The Australian National Road Safety Strategy 2011-2020 aims to achieve at least a 30% reduction in the number of road fatalities and serious injuries by 2020.

Figure 3.3 The Australian Safe System Framework (The Australasian College of Road Safety 2010).



3.3.1 Brief description of the Australian Road Safety Strategy

The national strategy also shares similar principles and key targeted elements as the WA Towards Zero Strategy

Principles:

1. People make mistakes.
2. Human physical frailty.
3. A ‘forgiving’ road transport system.
4. Shared responsibility.

Key targeted elements:

1. Safe Roads
2. Safe Speeds
3. Safe Vehicles
4. Safe People (called ‘Safe Road Use’ in the WA Toward Zero strategy)

The priorities for intervention under the national strategy are:

1. Adopting a results focus for the implementation of the strategy.
2. Ensuring effective coordination of activity among all key players.
3. Ensuring rules are in place to back the commitment to road safety.
4. Identifying funding and prioritising the allocation of resources to safety.
5. Promoting a shared responsibility for road safety.
6. Monitoring and evaluating road safety progress.
7. Investing in research and development, and knowledge transfer.

(The Australasian College of Road Safety 2010)

The national priorities for intervention may not, and shall not be the same as that of States or territories. This is because each State/territory is unique in terms of population, geography and thus, road safety issues. Nevertheless, the actions that should be taken to achieve the ‘Safe System’ vision are not clearly stated in the National road safety strategy (Turner and Cairney 2010; Turner, Cairney et al. 2010). It

should be noted that the National Road Safety Strategy 2011-2020 is currently under review.

3.3.2 South Australia

The new road safety strategy in South Australia (SA) is called 'Towards Zero Together' (Road Safety Advisory Council 2011). The main vision of the strategy is that all South Australians work together to address road trauma, regardless of the people or conditions involved in crashes. This strategy is almost identical to the national strategy in terms of principles and key targeted elements. The SA Towards Zero Together strategy also covers a 10-year period of 2011-2020. It aims to achieve less than 80 road fatalities and less than 800 serious injuries on SA roads by 2020, which is equivalent to the national target of at least 30% reduction in severe road trauma compared to last decade (ATC 2011).

Principles:

1. Human factors
2. Human Frailty
3. Forgiving Systems
4. Shared Responsibility

Key elements:

1. Safer Roads
2. Safer Speeds
3. Safer Vehicles
4. Safer People

(Road Safety Advisory Council 2011)

The SA Towards Zero Together strategy highlights the importance of increasing the involvement of local government in building a 'Safe System', which is less addressed in other States' strategies. It also mentions the need to decrease the dependence of Adelaide on private motor vehicles in order to increase safety benefits in the coming

decades, although this is not listed as a key principle like in the WA strategy. A review of the SA Towards Zero Together strategy is planned so that progress can be assessed and necessary adjustments made in a timely manner.

One weakness of the SA Towards Zero Together strategy is the lack of practical methods to engage the community in road safety. While legislation and regulation changes may offer disincentives to the public to undertake unsafe road behaviours, these may not encourage people to actively engage in road safety. Another limitation is that current initiatives in the strategy are not all integrated as a 'Safe System'.

3.3.3 Tasmania

The 'Our Safety, Our Future' strategy highlights the key message of Tasmanian Road Safety Strategy for the period of 2007-2016 (Department of Infrastructure Energy and Resources). This strategy corresponds to 'Tasmania Together', a long term social, economic, and environmental plan set up by the Tasmanian Government' (Community Leaders Group 2001; Tasmania Together Progress Board 2004). The Our Safety, Our Future strategy aims to reduce serious injuries and fatalities on Tasmanian Roads by 20% by 2010, compared to 2005. It also aims to reduce the number by 20% by 2015 as compared to 2010 and again by 20% by 2020 as compared to 2015. However, the key principles and targeted elements of the Tasmanian strategy are slightly different from other States. Tasmania's proposed road safety initiatives are detailed in an Action Plan, which covers the period of 2007-2010. The detailed measures and potential benefits of each initiative are all covered by the Action Plan.

Principles:

1. A shared responsibility: the whole community needs to recognise that road safety as a shared responsibility and that everyone has a part to play.
2. Targeted responses to achieve maximum injury reductions: considering the limited resources and geographic areas, initiatives that are evidence-based, achievable and that will be likely to reduce the most serious injuries and fatalities on the roads should be prioritised.

Key elements:

1. Safer Travel Speeds
2. Best Practice Infrastructure
3. Increased Safety For Young Road Users
4. Enhanced Vehicle Safety

(Tasmania Together Progress Board 2004)

One of the advantages of the Tasmanian Road Safety Strategy is its provision of strategic directions to guide road safety activities. This may guide local governments in applying initiatives in their local areas. Also, the proposed initiatives are broken into several stages to cover the whole 10-year period. The progress can be regularly reviewed at each stage and the program can be adjusted accordingly. In addition, this strategy clearly states who is responsible for measuring performance and reporting achievements.

The disadvantages of the Tasmanian strategy are also significant. The strategy specifically targets safety for young road users, who accounted for a third of serious road trauma between 1996 and 2005. However, the policies directed at young drivers may not be applicable to other road users, such as motorcyclists and older drivers, who have also contributed to a significant proportion of road trauma in Tasmania (Department of Infrastructure Energy and Resources). In addition, these proportions are likely to increase in the near future (Brennan 2009; Ross, Anstey et al. 2009). While resources are limited in Tasmania, initiatives that target both groups, such as monetary incentives for younger and older people to use public transport, may help achieve the strategy's targets. The Tasmanian road safety strategy only addresses one 'Safe System' principle of shared responsibility. This means it is unlikely to build a road transport system which tolerates human errors and considers human frailty. This may need to be altered in future to make the current strategy more consistent with the 'Safe System' approach.

3.3.4 Queensland (QLD)

The Queensland Government implemented the 'Safe4life' State road safety strategy, for the period of 2004 to 2011 (Queensland Transport 2003). This strategy aims to prevent road trauma, and is based on a belief that all road users can travel safely regardless of who and where they are. By the end of 2011, this strategy aims to reduce the road toll to below 5.6 deaths per 100,000 population. Unlike other State's road safety strategies, this strategy is more 'Cause Problem-Solving' oriented. Nevertheless, the key principles and key targeted elements have many similarities to other States.

Principles:

1. Evidence based: to ensure the identification of road safety issues and solutions are evidence based.
2. Equitable: to ensure the road safety practice to cater all road users, regardless of transport mode and geography, and reduce or remove the disadvantages where possible.
3. Innovative: to develop new road safety initiatives that have potential to reduce road trauma.
4. Collaborative: to establish, grow and maintain alliances with a wide range of groups or individuals that potentially involved in road safety, and work together to deliver integrated solutions.
5. Responsive: to educate all Queenslanders to realise that it is everyone's responsibility to identify, understand, share, and solve road safety issues.
6. Accountable: to regularly monitor and evaluate evidence based performance indicators for each initiative
7. Proactive: to recognise the research and understanding are needed to implement timely and appropriate initiatives for future challenges in road safety.
8. Broad based: to seek influence as broad as possible.
9. Cost effective: to ensure the initiatives are cost-effective to reduce road trauma.

Key Elements:

1. Road Users: Safe attitudes and behaviours and optimal health outcomes in the event of a crash.
2. Roads: Safe roads, safe road environments, and safe management of traffic.
3. Vehicles: Safe vehicles that reduce injury severity and maximise the chance of avoiding a crash.
4. Community: A community that values road safety as a priority.
(Queensland Transport 2003)

Compared to other State strategies, the Queensland Save4life strategy covers a shorter period (2004 to 2011), but its principles are considerably broader and more advanced. Particularly, the 'Equitable' principle highlights the need to cater to all road users, and to remove disadvantages, which is not observed in any other States' strategy. Evidence-based and cost-effective initiatives as well as collaboration are also important principles that are only found in the Queensland Save4life strategy. Safe Speeds is not one of the targeted key elements in the Queensland Safe4life strategy. However, the strategy focuses strongly on community and this corresponds to the main theme of the 'Safe System' approach, which is to change the way the whole community thinks about road safety.

The Queensland Safe4life strategy does not mention human errors and human frailty or the establishment of a forgiving road system. This indicates that this strategy is not strictly a 'Safe System' approach, although the Safe4life strategy may help improve road safety in Queensland. As this strategy will end in 2011, it would be worthwhile to examine its outcomes and gain an understanding of the effectiveness of the Cause Problem-Solving model. These outcomes could be compared to other States using the 'Safe System' approach.

3.3.5 Victoria

Victoria was one of the first two States to introduce the 'Safe System' approach into the State road safety strategy (The Australasian College of Road Safety 2010). The strategy

is called Arrive Alive, and it covers the period of 2008 to 2017 (VicRoads ; Howard 2004). This strategy aims to create a much safer road environment and to ensure that road users do not lose their lives or become permanently disabled in the event of a crash. The strategy aims to reduce fatal and serious injury crashes by 30% by 2017, which equates to 100 lives and over 2,000 serious injuries. This achievement will rely on taking a holistic view of the factors involved in road safety, and building a road transport system that tolerates human error and manages crash forces to survivable levels when crashes occur. The strategy's principles are undoubtedly based on the 'Safe System' approach.

Principles:

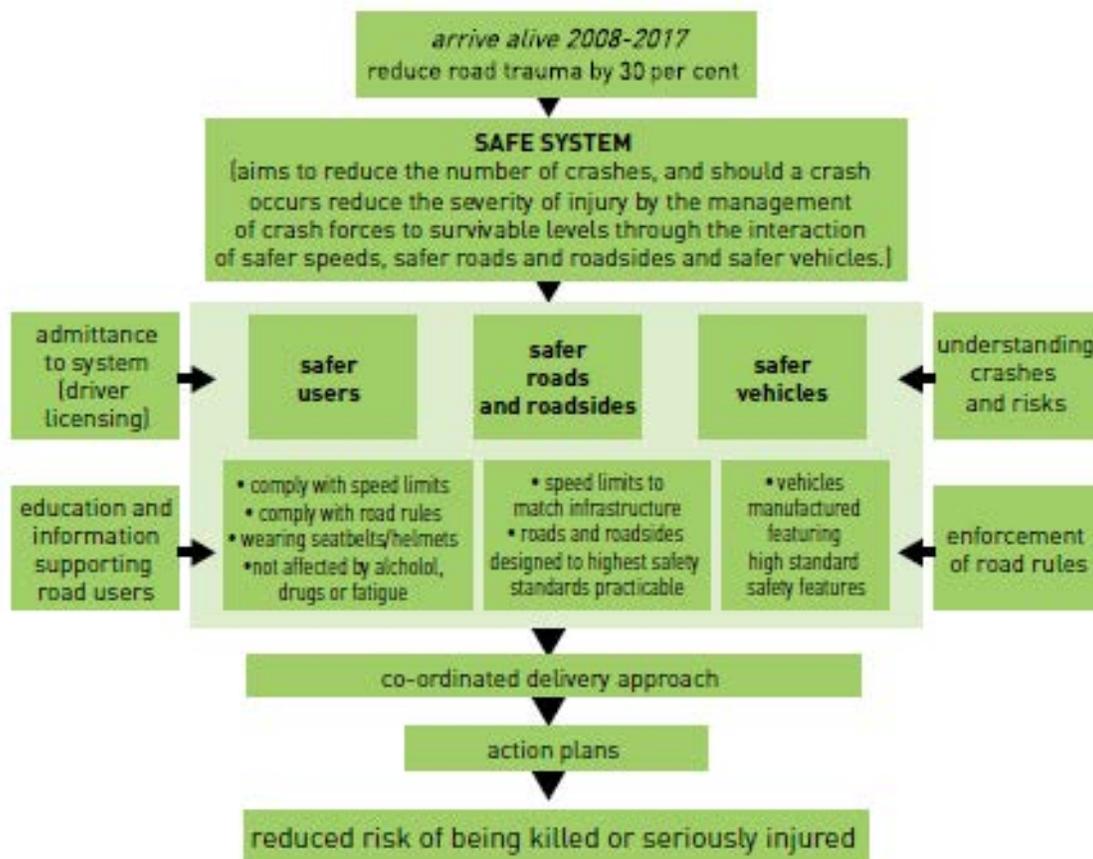
1. A forgiving road transport system
2. Tolerate human errors
3. Shared responsibility
4. Manage crash forces
5. Understand the interactions between the key elements of the road system

Key elements:

1. Improve the safety of Victoria's roads and roadsides
2. Increase the safety of vehicles on Victoria's Roads
3. Improve the safe behaviour of Victorian road users
(VicRoads)

It is believed that, with the 'Safe System' approach in place, the Arrive Alive strategy will reduce fatal and serious injuries in the coming decade by managing all components of the transport system that impact on safety. Figure 3.4 illustrates the main components of the system and relationships.

Figure 3.4 Safe System approach under the Victorian Arrive Alive strategy 2008-2017



Instead of listing Safe Speed as a key area within Victoria’s Arrive Alive strategy, speed and inappropriate travel speed are targeted within the area of Safer Road Users. Several crucial issues involved in managing travel speeds are well-documented, including infrastructure, vehicle technology, education and enforcement. The way that the Victoria Arrive Alive strategy treats ‘Safe Speeds’ may provide another perspective on tackling the problem of speeding, which is to manage speeding behaviour as one kind of risk behaviour and address it within the Safer Road Users area, under the ‘Safe System’ approach. This may help better allocate resources to particular groups that are at risk of speeding. In addition, the Victorian Arrive Alive strategy also initiates some new actions, such as a requirement that all vehicles manufactured after 31 December

2010 be fitted with electronic stability control and head protecting technology (VicRoads).

The most difficult part of adopting a 'Safe System' approach may be developing initiatives that incorporate more than one element of the road transport system. This is evident as most initiatives or actions only focus on one particular road safety issue. In light of this, the Victoria Arrive Alive strategy lists understanding the interactions between key elements of the road transport system as a key principle. This is not documented in any other States or territories' road safety strategies. Initiatives that do not consider interactions between key elements may be less effective. Another advantage of the Victorian Arrive Alive strategy is the step by step plans and clear time frames for turning initiatives into practice and the monitoring of performance indicators accordingly.

One possible limitation of the Victorian Arrive Alive strategy may be the intricate details. This may cause difficulties for local governments in actually putting strategies in place. A best practice framework may help solve such difficulty.

3.3.6 New South Wales

No specific State road safety strategy was found for New South Wales (NSW). Nevertheless, other sources reveal that the NSW Government also uses the 'Safe System' approach to manage road safety issues. For example, the Centre for Road Safety was established in 2007 to implement the government's State priorities of safer roads and improved driving behaviours (RTA 2009). There are four divisions within the Centre, and three of them reflect the key targeted elements of the 'Safe System'. NSW aims to reduce road fatalities to 4.9 per 100,000 population by 2016 (NSW Government 2010).

Principles:

None

Key elements (four divisions under the Centre for Road Safety):

1. Safer Roads
2. Safer People
3. Safer Vehicles
4. Business Strategy and Strategic Projects (including road safety technology)

Like Victoria and Queensland, ‘Safer Speeds’ is not listed as a key area in NSW. However, management of excessive speed is a priority in NSW. The method of managing speed is very similar to the Victorian road safety strategy, which treats speeding as an unsafe behaviour and manages it within the element of ‘Safer People’. The lack of a State road safety strategy in NSW may make it difficult for NSW local governments to identify concepts, principles, or approaches of the ‘Safe System’.

3.3.7 Australian Capital Territory

The Australian Capital Territory’s (ACT) upcoming road safety strategy also called ‘Towards Zero’, is based on Sweden’s ‘Vision Zero’ strategy. (ACT Government 2010). The ACT has a well designed road system, a mostly urban environment and a small population. As a result, the ACT has the best road safety record in Australia and also one of the best records worldwide (about 4 deaths per 100,000 population) (Office of Road Safety 2009). The concept of the ACT’s Towards Zero strategy is to achieve zero deaths or serious injuries following a crash within the road transport system. The principles and key targeted elements are also almost identical to the national strategy.

Principles:

1. Humans make errors
2. Road design should be based on human physical and mental capabilities
3. Human tolerance is taken into consideration
4. Shared responsibility

Key elements:

1. Safer Speeds
2. Safer Roads and Roadsides
3. Safer Vehicles
4. Safer Road Users and Safer Behaviours

(ACT Government 2010)

The ACT also outlines a strategy for applying these key elements. This is based on an integrated approach using the ‘4 Es’ of road safety—Education, Encouragement, Engineering, and Enforcement, which is illustrated below.

Figure 3.5 The 4 Es of Road Safety in the ACT

STRATEGIC GOALS	STRATEGIC OBJECTIVES	Education	Encouragement	Engineering	Enforcement
Road trauma rates continue to be reduced despite increases in population and travel	Safer speeds	●	●	●	●
	Safer roads and roadsides			●	
	Safer vehicles		●	●	●
The community shares the responsibility for road safety	Safer road users and safer behaviours	●	●		●
Road safety coordination and support arrangements are improved	Improved coordination and consultation processes	Support measures			
	Improved support processes	Support measures			

The ACT’s Towards Zero strategy, like the South Australian strategy, is aligned with the National Road Safety Strategy 2011-2020. This may be advantageous in that it may help reduce workload and save costs and resources. The ACT strategy also clearly presented how the 4 Es of road safety could be integrated into the ‘Safe System’

approach, which is another advantage. Whilst information on ACT's Towards Zero strategy was retrieved from a 2010 discussion paper, this paper neither mentions how this strategy will be evaluated nor lists the performance indicators. This needs to be clearly documented so adjustments can be made whenever there is a need.

3.3.8 The Northern Territory

Compared to other States of Australia and other Organisation for Economic Co-operation and Development (OECD) countries, the Northern Territory (NT) has a very poor road safety record (NT Police 2008). To reduce road trauma, the NT Government proposed a road safety strategy based on a Cause-Problem Solving model covering 2008 to 2013. The theme for the NT strategy is 'Working in partnership to reduce road trauma and increase safer road use'. It acknowledges the need to change the road safety culture in society in order to reduce the road toll in the NT. However, this strategy is not led by the 'Safe System' concepts, principles or approach.

Principles:

None

Key elements:

1. Build intelligence-led traffic policing capacities.
2. Educate vulnerable road users
3. Drink/Drug driving enforcement
4. Excessive speed enforcement
5. Irresponsible/unsafe road use enforcement
6. Monitoring and Reporting
7. NT Police capacity building
8. Build strategic road safety partnerships.

(NT Police 2008)

The NT Government does not use the 'Safe System' approach as a basis of its road safety strategy. This is not surprising because the NT has very different conditions to

other States/territories in Australia. It is possible that in the NT, other steps need to be taken before adopting the 'Safe System' approach. While issues including speeding, drink and drug impaired driving, use seatbelts/restraints, fatigue, and distraction, contribute to the majority of road fatalities in the NT, like in other States, it has been reported that more people in the NT have poor attitudes to road safety. This may explain why working in partnership with individuals and road safety agencies to tackle road safety issues is the first priority in the NT. It is likely that the 'Safe System' approach may not be the most cost effective option in the NT.

3.3.9 Conference papers

Within Australia, two conferences have been held to help better understand the 'Safe System' approach. One was held in 2006 in Melbourne, Victoria for Victorian local governments and the other one was national and held in 2010 in the ACT (2010). To help local governments conceptualise the 'Safe System' approach, ARRB held another workshop after the national conference to facilitate the dissemination of the 'Safe System' approach into local practice (McTiernan, Turner et al. 2010). Austroads also published a guide book for road safety, which illustrates how the 'Safe System' is used as a framework to guide road safety management (Cairney 2009).

A series of conference papers have been identified which address the process of adopting the 'Safe System' approach into different States as well as the national road safety strategy. They are listed below under the targeted key elements of the road transport system.

1. Safer Roads and Roadsides

Effective use of clear zones and barriers in a safe system's context (Doecke and Woolley 2010).

Non-motor vehicle related pedestrian injury on and near the road: implications for the safe system approach to road safety (Frith and Thomas 2010).

Measuring the value of community road safety in the safe system framework (Smithson 2009).

Safe system infrastructure: national roundtable report (Turner, Tziotis et al. 2009).

2. Safer People

Assessing and managing older drivers' crash risk using Safe System principles (Langford and Oxley 2006).

Using the safe system approach to keep older drivers safely mobile (Langford and Oxley 2006).

Incorporating Safe System in learner driver handbooks (Pyta and Cairney 2009).

3. Safer Speeds

Setting speed limits for a safe system (Fildes, Langford et al. 2006).

Speed limits in the safe system concept (Jurewicz 2010).

Speed setting principles in the safe system context (Jurewicz and Hall 2009).

4. Safer Vehicles

Safer vehicles: the market driven approach in Victoria (Healy, Passmore et al. 2007).

The papers listed below assist in understanding the 'Safe System' approach or building a road transport system based on the 'Safe System' concepts, principles and approach.

1. Data systems for the effective implementation of a safe system approach (D'Elia and Newstead 2010).
2. Implementation of a Road Safety Package to Address the NSW Road Toll (Fernandes, Graham et al. 2010).
3. Achieving road safety targets under the safe system (Hay 2009).
4. Road safety strategies: A comparative framework and case studies (Loo, Hung et al. 2005).
5. The safe systems approach to road safety (Smart, Job et al. 2010).
6. Australia's new approach to road safety: how is the safe system approach being implemented? (Turner and Cairney 2010).
7. What is the Safe System? (VicRoads 2006).

8. Safe system: a more global perspective (Williams and Howard 2006).
9. Understanding driving culture: safe system and the ACT: a report on a systematic literature review and research scoping project (Wright, Rickwood et al. 2010).

Table 3.1 Comparison of road safety strategy frameworks between States of Australia

State	Title	Year covered	Vision	Objectives	Targets	Principles	NOTE
WA	Towards Zero: getting there together	2008-2020	To build a road transport system where crashes resulting in death or serious injury are virtually eliminated	Based on the Safe System, strategies targeted to four cornerstones: 1. Safe Road Use 2. Safe Roads and Roadsides 3. Safe Speeds 4. Safe Vehicles	By 2020, 40% reduction in fatal and serious injury crashes compared to 2005-2007 (about 11,000 people).	1. The limits of human performance 2. The limits of human tolerance to violent forces 3. Shared responsibility 4. A forgiving road system 5. Increased use of public transport	Increased use of public transport Safe System oriented
SA	Towards Zero Together	2011-2020	SA community work together to address the deaths and serious injuries caused by everyday use of the roads, no matter the people or circumstances involved	Based on the Safe System, strategies targeted to 1. Safer Roads 2. Safer Speeds 3. Safer Vehicles 4. Safer People	At least 30% reduction in severe road trauma compared to 2010	1. Human factors 2. Human Frailty 3. Forgiving Systems 4. Shared Responsibility	Local government involvement is the key; Safe System oriented

TAS	Our Safety, Our Future	2007-2016	The elimination of fatalities and serious injuries caused by road crashes in Tasmania.	Based on model similar to Safe System, strategies targeted to: 1. Safer Travel Speeds 2. Best Practice Infrastructure 3. Increased Safety For Young Road Users 4. Enhanced Vehicle Safety	Compared to 2005, a 20% reduction in fatal and serious injured crashes by 2010; Compared to 2010, a 20% reduction in fatal and serious injured crashes by 2015; Compared to 2015, a 20% reduction in fatal and serious injured crashes by 2020; (Tasmania Together)	A shared responsibility—the whole community needs to recognise that road safety is a shared responsibility and that everyone has a part to play. Targeted responses to achieve maximum injury reductions—considering the limited resources and geographic areas, initiatives that are evidence-based, achievable and that will be likely to reduce the most serious injuries and fatalities on the roads should be prioritised.	Principles are different from the Safe System, although key elements are similar. Young drivers are the only focus. Not strictly a Safe System approach
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QLD	Safe4Life	2004-2011	A desire to prevent road trauma, and a belief that all road users are entitled to safe travel regardless of who and where they are	Based on the problem-solving model, strategies targeted to: 1. Safe attitudes and behaviours and optimal health outcomes in the event of a crash 2. Safe roads, safe road environments, and safe management of traffic 3. Safe vehicles that reduce injury severity and maximise the chance of avoiding a crash 4. A community that values road safety as a priority.	Less than 5.6 deaths per 100,000 people by 2011	1. Evidence based 2. Equitable 3. Innovative 4. Collaborative 5. Responsive 6. Accountable 7. Proactive 8. Broad based 9. Cost effective	Not strictly a Safe System approach. Speed is not specifically mentioned; but targeted elements are more or less the same as the Safe System approach.
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VIC	Arrive Alive	2008-2017	To create a much safer road environment in which alert and responsible road users should not lose their lives- or be permanently disabled--as a result of a crash on our road system	Based on the Safe System, strategies targeted to: 1. Improve the safety of Victoria's roads and roadsides 2. Increase the safety of vehicles on Victoria's Roads 3. Improve the safe behaviour of Victorian road users	At least 30% reduction in severe road trauma by 2017.	1. A forgiving road transport system 2. Tolerate human errors 3. Shared responsibility 4. Manage crash forces 5. Understand the interactions between the key elements of the road system	Safe speeds is managed within the Safe Road Users area; Understanding the interactions of key elements is an essential principle
NSW	None	2007-2016	None	1. Safer Roads 2. Safer People 3. Safer Vehicles 4. Business Strategy and Strategic Projects (including the road safety technology)	By 2016, to reduce the road fatality rate to 4.9/100,000.	None	No road safety strategy was found; Appears Safe System oriented

ACT	Towards Zero	2011-2020	Proactive and continuous improvement of Safe System elements in an attempt to ultimately eliminate crashes causing death and serious injury	Based on the Safe System, strategies targeted to: 1. Safer Speeds 2. Safer Roads and Roadsides 3. Safer Vehicles 4. Safer Road Users and Safer Behaviours	None	1. Humans make errors 2. Road design should be based on human physical and mental capabilities 3. Take human tolerance into consideration 4. Shared responsibility	Only a discussion paper was identified, no strategy; Safe System oriented.
NT	Working in partnership to reduce road trauma and increase safer road use	2008-2013	To establish key principles for effective Road Safety through specifically planned and targeted action.	The Cause Problem Solving model is used to address main issues 1. Build intelligence-led traffic policing capacities. 2. Educate vulnerable road users 3. Drink/Drug driving enforcement 4. Excessive speed enforcement 5. Irresponsible/Unsafe road use enforcement 6. Monitoring and Reporting 7. NT Police capacity building 8. Build strategic road safety partnerships.	None	None	Not a Safe System approach; Cause Problem-solving model

3.4 International road safety strategies

Along with the ‘Safe System’ approach, many similar methods have been used worldwide by all leading road safety countries to effectively reduce serious road crashes. Internationally, many countries have used road safety strategies that aim to build failure tolerant road transport systems and follow general ‘Safe System’ principles. However, these strategies have used various different names and terminology.

3.4.1 Europe

a. Austria

The Austrian Government used the principle of building a failure tolerant road safety system to set up their road safety strategy for 2002 to 2010 (BMVIT 2009). This strategy assumes that road safety is a complex management process which must be planned, implemented and evaluated according to market-oriented principles. The strategy aims to reduce road fatalities by 50% by 2020. While its principles are not directly taken from the ‘Safe System’ approach, the overall approach and key elements are similar.

Principles:

1. Engaging support from political decision-makers to guarantee efficiency of programs
2. Providing an ongoing measure of effectiveness to strengthen successful initiatives or adjust failed programs.
3. Ensuring broad support by the public, decision-makers and professionals at all levels (shared responsibility)

Key elements:

1. Human behaviour
2. Infrastructure
3. Vehicles
4. Transport Policy and Legal Framework

(BMVIT 2009)

The Austrian road safety strategy highlights the importance of gaining broad support to make the strategy succeed. This is very similar to the principle of Shared Responsibility in other strategies that use a 'Safe System' approach. However, this strategy does not specifically address forgiving roads, human error or human frailty and this may be a weakness when building road transport systems.

b. Denmark

In Denmark, the vision for the current road safety strategy is 'Every accident is one accident too many- road safety starts with you' (The Danish Ministry of Transport 2000). This strategy covers the period of 2001 to 2012. It aims to reduce Danish road fatalities to less than 300 and road injuries to less than 2,443 by 2012. The principles and key elements are listed below.

Principles:

1. Road Safety starts with you: All stakeholders and players within road safety must work actively to involve individual road users in road safety efforts
2. Private and public sector efforts: Private and public enterprises are called upon to prepare special enterprise plans for road safety and to enter into agreements with their employees and suppliers to reduce the number of road accidents.
3. Local road safety efforts must be strengthened: Local authorities, counties, and local road safety committees are encouraged to adopt the vision and to use it when preparing action plans on road safety and carrying out specific and concrete efforts to promote road safety on the basis of their own problems, needs and resources.
4. Four central and visible key elements: Road safety efforts are to concentrate on four central and highly visible key elements
5. New knowledge on road safety: Research, development and accumulation of knowledge on road safety and road user behaviour.

Key elements:

1. Speeding

2. Alcohol
3. Cycling
4. Junctions

(The Danish Ministry of Transport 2000)

Although the key elements of the Danish strategy are different from the 'Safe System' approach, there are 62 initiatives within the strategy addressing aspects of Safe Vehicles, Safe Roads, and Safe People. This may provide practitioners with specific direction for tackling road safety issues. Similar to Austria and other countries, the engagement of society in road safety seems to be prioritised in the Danish road safety strategy. This approach may pool the wisdom of the masses in order to form better programs and facilitate the implementation of new initiatives.

c. Finland

The Finnish Government uses Vision Zero to guide their current road safety strategy covering 2006 to 2010 (Finland 2001). Their main vision is to design a road transport system in which no one dies or is seriously injured. It aims to reduce road fatalities to less than 250 by 2010, and to less than 100 by 2025.

Principles:

None

Key elements:

1. Better co-operation
2. EU co-operation
3. Reducing head-on collisions on main roads
4. Reducing pedestrian and cyclist accidents in population centre
5. Speed control
6. Reducing accidents involving intoxicants
7. Reducing accidents in professional transport
8. More effective driving tuition and license sanctions

(Finland 2001)

From the limited information located, it cannot be established whether the Finnish road safety strategy is based on the 'Safe System' approach. However, their vision is identical to other strategies adopting a 'Safe System' approach.

d. Sweden

In 1997, Sweden adopted the systematic, proactive 'Safe System' approach to road safety and initiated the Vision Zero concept. This is the vision that eventually, no-one will be killed or seriously injured within the road transport system (Elvik and Amundsen 2000). The success of Vision Zero in Sweden has guided road safety strategies around the world (Breen, Howard et al. 2008). The Vision Zero concept now is being used to manage road safety in many countries including Australia. Sweden's current road safety strategy maintains 'Vision Zero' as its main theme and covers the period of 2007 to 2020. The 'Safe System' approach provides the framework for Sweden's road safety strategy. It promotes an approach to road design that tolerates human frailty and errors, and states that road design should be 'forgiving' to this. Responsibility for road crashes is ascribed to the whole society rather than just the road authority (Elvebakk 2007). Principles and key elements of the Swedish road safety strategy are detailed below.

Principles:

1. Human life and health are paramount so no one should be killed or seriously injured as a result of a crash.
2. Life and health should not be allowed in the long run to be traded off against the benefits of the road transport system, such as mobility.
3. Vision Zero is an ethical approach to safety and mobility.
4. The emphasis is to move away from enhancing the ability of road users to cope with an imperfect system.
5. Traffic accidents cannot always be avoided, since people make errors sometimes.

6. Accidents must be prevented from leading to fatalities and serious injuries by designing roads, vehicles and transport services in a way that human can tolerate the crash forces, without being killed or severely injured.
7. Everyone shares responsibility for making traffic safer.
8. Road safety targets are an integral part of the philosophy.

Key elements:

1. A focus on the most dangerous roads: Concentrate on the most dangerous stretches of road.
2. Safer traffic in built-up elements.
3. Emphasis on the responsibilities of road users
4. Safe bicycle traffic
5. Quality assurance in transport work
6. Winter tyre requirement
7. Making better use of Swedish technology
8. Responsibilities of road transport system designers
9. Public responses to traffic violations
10. The role of voluntary organisations
11. Alternative forms of financing for new roads

The new Swedish Vision Zero also highlights the following:

1. The designers of the system are always ultimately responsible for the design, operation and use of the road transport system and thereby responsible for the level of safety within the entire system.
2. Road users are responsible for following the rules for using the road transport system set by the system designers.
3. If road users fail to obey these rules due to lack of knowledge, acceptance or ability, or if injuries occur, the system designers are required to take necessary further steps to counteract people being killed or seriously injured.

(Elvebakk 2007; Breen, Howard et al. 2008)

Sweden has one of the best road safety records in the world, and this is likely attributed to their advanced road safety strategy, specifically Vision Zero. Although setting a target of zero deaths or serious injuries on roads may be slightly unrealistic, it aims to push everyone to work harder to achieve this ultimate goal. Consequently, many countries have started to use this philosophy to manage road safety.

e. Switzerland

Switzerland adopted the Vision Zero philosophy in 2000, and used it to form the basis of the Federal road safety policy, aiming achieve no deaths or serious injuries on Swiss roads (FEDRO 2005). The current Swiss road safety strategy, the Via Sicura covers the period of 2005 to 2020. Its vision is to reconstruct Swiss roads so that they forgive driving errors and that the roads should only be used by drivers who have received the necessary level of instruction and possess the full physical and mental capacity required to drive a motor vehicle. It aims to halve the number of deaths and serious injuries over a 10 year period (2006-2015). The strategy's principles and key elements are listed below.

Principles:

1. Shared responsibility
2. Forgiving Roads

Key elements:

1. Awareness of social problems: Road safety is seen as being as important as mobility in society, politics and the economy.
2. Behaviour of road users
3. Safety of motor vehicles and road infrastructure.
4. Performance and quality of the rescue services: Accident victims are rescued quickly and professionally.

(FEDRO 2005)

Although human error and frailty are not mentioned in the Via Sicura, the principle of forgiving roads may take this into account. A better emergency medical service is not always considered for many advanced countries with safer roads. However, it is an essential component for managing crashes at the post-crash stage in according to the Haddon matrix (Figure 3.7). This may need to be taken into account in WA where the majority of fatal crashes occur in rural areas. It is also a strength of the Swiss Via Sicura that it acknowledges the importance of raising awareness about road safety.

Figure 3.6 Application of Haddon Matrix to road safety

	Human	Vehicle/Equipment	Physical Environment	Social/Economic
Pre-Crash	Poor vision or reaction time, alcohol, speeding, risk taking	Failed brakes, missing lights, lack of warning systems	Narrow shoulders, ill-timed signals	Cultural norms permitting speeding, red light running, DUI
Crash	Failure to wear seat belt	Malfunctioning seat belts, poorly engineered air bags	Poorly designed guardrails	Lack of vehicle design regulation
Post-Crash	High susceptibility, alcohol	Poorly designed fuel tanks	Poor emergency communication systems	Lack of support for EMS and trauma systems

f. The Netherlands

The Netherlands, another world leader in road safety, initiated their Sustainable Safety vision in 1992 (Wegman and Mulder 2000). Although Sustainable Safety has been used to create measures for a safer road infrastructure, the vision, in fact, covers the interactions between ‘human’, ‘vehicle’, and ‘road’. Like Sweden and Norway, the

Netherlands has also adopted the proactive 'Safe System' approach to road safety through their Sustainable Safety vision. Recently, Sustainable Safety was taken to the next level with The Netherlands' 'Advancing Sustainable Safety' strategy covering the period 2005 to 2020. (Wegman, Aarts et al. 2008). This new vision focuses on how to prevent human errors and how to ensure that the crash conditions are such that the human tolerance is not exceeded and severe injury is practically excluded.

Principles:

1. Functionality of Roads;
2. Homogeneity of mass and/or speed and direction;
3. Predictability of road course and road user behaviour by a recognisable road design
4. Forgivingness of the environment and of road users
5. State awareness by the road user

Key elements:

1. Infrastructure
2. Vehicles
3. Intelligent Transport System
4. Education
5. Regulations and their enforcement
6. Special issues: speeding; drink and drug driving; young and novice drivers; cyclists and pedestrians; motorised two-wheelers; heavy goods vehicles

(Wegman, Aarts et al. 2008)

With the introduction of Sustainable Safety, the Sustainable Safety Indicator (DV-meter) was developed. This indicator uses quantitative scores to indicate the extent to which the characteristics of the road design correspond with the 'Safe System' requirements (Institute for Road Safety Research 2007). This notion may help other countries to manage transform their road transport systems into 'Safe System'.

g. United Kingdom

In the United Kingdom (UK), a new strategic framework for road safety has just been initiated and covers the period of 2011 to 2030 (Department for Transport 2011). Targets have been divided into three stages and by 2020, 2025, and 2030, the framework aims for a 50%, 60%, and 70% reduction in fatal and serious injury in road accidents, respectively. Principles and key elements are listed below.

Principles:

1. Making it easier for road users to do the right thing.
2. Better education and training for children and learner and inexperienced drivers.
3. Remedial education for those who make mistakes and for low level offences which this may be more effective than financial penalties and penalty points.
4. Tougher enforcement for the small minority of motorists who deliberately chose to drive dangerously.
5. Extending this approach to cover all dangerous and careless offences, not just focusing upon speeding.
6. Taking action based upon cost benefit analysis, including assessing the impact on business.
7. More local and community decision making from decentralisation and providing local information to citizens to enable them to challenge priorities.
8. Supporting and building capability by working with the road safety community on better tools to support road safety professionals.

Key elements:

1. Improving Road Safety together
2. Education—developing skills and attitudes
3. Targeted Enforcement and Sanctions

(Department for Transport 2011)

The new UK strategic framework may look less comprehensive than other countries' strategies as the key elements are significantly different from those of the 'Safe System' approach. However, this does not necessary mean the new UK strategy will be less

effective than the others. It may actually be the case that this strategy is more advanced than other countries and takes the next step by focusing on issues not covered in previous road safety strategies. The UK's new strategic framework aims to continuously improve safety on UK roads.

h. Norway

Norway has a similar road safety strategy to Sweden. The Norwegian Government also takes a holistic view towards road safety and has a vision of no road fatalities or crashes causing lifelong injury (Ministry of Transport and Communications 2002). The current strategy covers the period of 2002 to 2011. There is no specific goal stated in this strategy, but the final goal is to achieve no accidents, no deaths or injuries.

Principle:

Safety is an important responsibility for anyone involved in transport, whatever mode.

Key elements:

1. Improving the coordination of road safety work
2. Safer Roads
3. Measures to regular behaviour
4. Enforcement
5. Emphasis on police surveillance
6. Improved traffic education and information
7. Emphasis on knowledge-building
8. Accident analysis of the road network

(Ministry of Transport and Communications 2002)

Similar to Austria and Denmark, the principle of the Norwegian strategy is the notion that road safety is everyone's responsibility. Nevertheless, this notion may need other principles of the Safe System to achieve the final goal. The Norwegian strategy also places emphasis on police surveillance to facilitate the implementation of initiatives.

This may need to be considered in WA, given that police enforcement may be the strongest way to execute policy.

3.4.2 North America

a. Canada

The Canadian Government aims to build the ‘Safest Roads in the World’, which has been used as the title of their national road safety strategy since 1996. The upcoming national strategy covers the period of 2011 to 2015 (CCMTA 2010). The vision of the strategy is to strive towards being a world leader in road safety, and to achieve the best possible road safety outcomes for all Canadian jurisdictions. It is envisaged that if the strategy is followed, by 2015, the road fatality rate in Canada could be reduced to 5 or less per 100,000 population. The principles and key elements as well as the strategic objectives of the strategy are listed below.

Principles (key elements):

1. Downward Trends
2. Safer Systems Concept
3. Five-Year timeframe
4. Statistical Reporting
5. Best Practices

Key elements:

1. Safer Road Users
2. Safer Road infrastructure
3. Safer Vehicles

Strategic objectives:

1. Raising public awareness and commitment to road safety;
2. Improving communication, cooperation and collaboration among all stakeholders;
3. Enhancing enforcement;
4. Improving road safety information in support of research and evaluation;

(CCMTA 2010)

There are several strengths to the Canadian road safety strategy. For instance, the ‘best practice’ principle may guide local governments in adopting best practices depending on their suitability, feasibility and acceptability. The ‘Safe System’ concept is only one of the principles guiding the Canadian road safety strategy, which indicates there may be other important aspects to road safety. Safer Speeds is also not considered as a key priority in the Canadian strategy, which differs from that of the ‘Safe System’ approach.

b. United States of America (USA)

In the United States of America (USA), Toward Zero Deaths is the new national strategy for highway safety and it ultimately aims to achieve zero deaths by 2030 (Neuman and Hill 2007; ATSSA 2008; Federal Highway Administration 2010). The first priority of the strategy is to change the culture toward road safety and the second priority is to build the foundation of safety. Although the key elements targeted by the strategy are similar to other countries that use a ‘Safe System’ approach, the principles of the ‘Safe System’ are not strictly observed in the USA strategy.

Principles:

None

Key elements:

1. Safety Culture
2. Safer Vulnerable Road Users
3. Safer Drivers
4. Safer Vehicles
5. Infrastructure
6. Emergency Medical Services (EMS)

Based on unofficial tracking, there are 15 US States using the Toward Zero Deaths vision, such as Utah (Moving Towards Zero Fatalities), Minnesota (Towards Zero Deaths), Oregon (Vision Zero Oregon), Kentucky (Towards Zero Deaths), and Washington (Target Zero). However, the principles of their strategies are not clearly stated. The USA strategy specifically focuses on emergency medical services which may be an important element for WA to adopt due to its vast areas classified as rural and remote.

3.4.3 New Zealand

The New Zealand (NZ) road safety strategy entitled ‘Safer Journeys’ covers the period of 2010 to 2020 (Ministry of Transport 2009; Eyre 2010). The vision of the strategy is to build a safe road system increasingly free of death and serious injury, while recognising that it is impossible to prevent all crashes on the roads. The Safer Journeys strategy adopted the ‘Safe System’ approach.

Principles:

1. Minimise the level of unsafe road user behaviour
2. Make the road transport system more accommodating of human error
3. Manage the crash forces that injure people in a crash to a level that human body can tolerate without serious injury
4. Road safety is everyone’s responsibility

Key elements:

1. Safe Roads—that are predictable and forgiving of mistakes. Self-explaining in their design to encourage safe travel speeds.
2. Safe Speeds—travel speeds suit the function and level of safety of the road. People understand and comply with the speed limits and drive to conditions.
3. Safe Vehicles—that prevent crashes and protect road users, including pedestrians and cyclists, in the event of a crash

4. Safe Road Use—road users who are skilled and competent, alert, and unimpaired. They comply with road rules, take steps to improve safety, and demand and expect safety improvements.

(Ministry of Transport 2009)

The NZ Government also determines priority areas to be addressed across the elements of the ‘Safe System’, which is illustrated in Figure 3.6. Unlike other countries aiming to achieve a national target, the NZ Government sets up detailed performance indicators and monitors and evaluates them separately.

It is clear that the NZ Safe Journeys strategy thoroughly adopts the ‘Safe System’ approach. It also incorporates strategies from The Netherlands ‘Sustainable Safety’ strategy such as self-explaining roads. This indicates that the NZ Safe Journeys is able to integrate those advanced initiatives into their road strategy. A set of detailed and comprehensive performance indicators used in the NZ strategy is a strength and may help to monitor and evaluate the progress and implementation of the Safe Journeys strategy. One weakness of the strategy, like many others using the ‘Safe System’ approach, is that not all strategies consider the interactions among key elements.

Figure 3.7 Areas of concern and action across the Safe System in New Zealand’s Safer Journeys strategy

AREAS OF CONCERN WE WILL ADDRESS	WHERE WE WILL TAKE ACTION ACROSS THE SAFE SYSTEM			
	SAFE ROADS AND ROAD-SIDES	SAFE SPEEDS	SAFE VEHICLES	SAFE ROAD USE
Areas of high concern				
Reducing alcohol/drug impaired driving			✓	✓
Increasing the safety of young drivers	✓	✓	✓	✓
Safe roads and roadsides	✓			
Safe speeds	✓	✓	✓	
Increasing the safety of motorcycling	✓	✓	✓	✓
Areas of medium concern				
Improving the safety of the light vehicle fleet			✓	✓
Safe walking and cycling	✓	✓	✓	✓
Improving the safety of heavy vehicles	✓	✓	✓	✓
Reducing the impact of fatigue	✓	✓	✓	✓
Addressing distraction	✓		✓	✓
Reducing the impact of high risk drivers		✓	✓	✓
Areas of continued and emerging focus				
Increasing the level of restraint use			✓	✓
Increasing the safety of older New Zealanders	✓	✓	✓	✓

3.4.4 Asia

a. Japan

The Japanese Government aims to construct the safest roads in the world. As a result, the program ‘Actualising the world’s safest roads’ was established to achieve this ambition in 2005 (Highway Industry Development Organization 2006). This program covers the period of 2006 to 2012. The ultimate goal is to achieve less than 5,000 road fatalities by the end of this program. The program’s principle and key elements illustrate the focus of the Japanese strategy on information technology (IT) to facilitate the interaction between people, vehicles, and road infrastructure.

Principle:

To drive forward the structural reformation of IT, Includes the key IT policy of implementing systems for assisting safe driving by infrastructure-vehicle cooperation.

Key elements:

1. Advanced Cruise-Assist Highway Systems: provide precise information about accident-prone road sections, traffic restrictions, end of queue of vehicles, etc, in real time to travelling vehicles to free drivers from danger;
2. Advanced Safety Vehicle projects: deploy parts of the inter-vehicle communication type driving support system to achieve road safety;
3. Providing appropriate information during disasters;
4. Advanced road management to improve safety and safe driving;
5. Probe information to enable effective measures to be provided;
6. Assisting safe driving with easy-to-drive maps;
7. Installing drive recorders.

(Highway Industry Development Organization 2006)

The Japanese strategy provides a good example of how to tackle road safety issues with advanced IT to assist drivers. IT can be used to inform drivers of road conditions as well as posted speed limits, which may prevent drivers from making errors. However,

this strategy is not 'Safe System' oriented as shared responsibility is not embedded into the strategy.

3.4.5 Other countries

Many other countries have adopted elements of the 'Safe System' approach into their road safety strategies. However, these strategies cannot be reviewed because they are not printed in English. For example, these countries include:

- Hong Kong (Zero accidents on the road - Hong Kong's Goal) (Road Safety Research Committee 2004)
- Germany (Vision Zero) (Research in Germany 2010)

3.4.6 Summary

Table 3.2 provides a summary of the road safety strategies of the countries discussed above.

Table 3.2 Comparison of road safety strategy frameworks from around the world

Country	Year covered	Vision	Objectives	Targets	Principles	NOTE
Australia	2011-2020	No person should be killed or seriously injured on Australia's roads	<ol style="list-style-type: none"> 1. Safe Roads 2. Safe Speeds 3. Safe Vehicles 4. Safe People 	By 2020, a 40% reduction in road fatality rate compared to 2010	<ol style="list-style-type: none"> 1. People make mistakes. 2. Human physical frailty. 3. A 'forgiving' road transport system. 4. Shared responsibility. 	National Road Safety Strategy; Safe System oriented
Austria	2002-2010	Every death and serious injury resulting from road accidents is one too many; The effective safety work in the rail aviation and work safety sectors should serve as a model for road transport; A health economy has, on pure economic grounds alone, to reduce accident costs.	<ol style="list-style-type: none"> 1. Human behaviour 2. Infrastructure 3. Vehicles 4. Transport policy and legal framework 	By 2010, a 50% reduction in fatal crashes and 20% in injury crashes.	<ol style="list-style-type: none"> 1. Engaging supports from political decision-makers to guarantee the efficiency of program 2. Providing an ongoing measure of effectiveness to strength successful initiatives or adjust failed programs. 3. Ensuring a broad support by the public, decision-makers and professionals at all levels (shared responsibility) 	Austrian Road Safety Programme; Similar to Safe System: a failure tolerant road safety system

Canada	2011-2015	Canada will have the safest roads in the world	<ol style="list-style-type: none"> 1. Raising public awareness and commitment to road safety; 2. Improving communication, cooperation and collaboration among all stakeholders; 3. Enhancing enforcement; 4. Improving road safety information in support of research and evaluation; 	5 fatalities or less per 100,000 population	<ol style="list-style-type: none"> 1. Downward Trends 2. Safer Systems Concept 3. Five-year timeframe 4. Statistical Reporting 5. Best Practices 	Safest Roads in the World; Safe System oriented
Denmark	2001-2012	Every accident is one too many	<ol style="list-style-type: none"> 1. Speeding 2. Alcohol 3. Cycling 4. Junctions 	No more than 300 deaths and 2443 serious injuries by 2012; at least 40% reduction in road fatalities and serious injuries by 2012.	<ol style="list-style-type: none"> 1. Road Safety starts with you 2. Private and public sector efforts 3. Local road safety efforts must be strengthened 4. Four central and visible key elements: speeding, alcohol, cyclists, and junctions. 5. New knowledge on road safety 	Every accident is one accident too many—road safety starts with you; Safe System oriented

Finland	2006-2010	Nobody needs to die or be seriously injured on Finnish roads	<ol style="list-style-type: none"> 1. Better cooperation 2. EU cooperation 3. Reducing head-on collisions on main roads 4. Reducing pedestrian and cyclist accidents in population centre 5. Speed control 6. Reducing accidents involving intoxicants 7. Reducing accidents in professional transport 8. More effective driving tuition and license sanctions 	Less than 250 road fatalities by 2010; Less than 100 road fatalities by 2025.	None	Vision Zero; Not Safe System oriented.
Germany	None	None	None	None	None	Vision Zero; Safe System oriented.
Hong Kong	2004-?	To move towards a Hong Kong with zero accidents	<ol style="list-style-type: none"> 1. Safer Road User 2. Safer Vehicles 3. Safer Road infrastructure 	None	None	Zero Accidents on the road, Hong Kong's Goal; Appears to only adopt the vision of Safe System approach

Japan	2006-2012	To make the Japanese highways among the safest in the world.	<p>Focus on :</p> <ol style="list-style-type: none"> 1. Advanced Cruise-Assist Highway Systems: provide precise information about accident-prone road sections, traffic restrictions, end of queue of vehicles, etc, in real time to travelling vehicles to free drivers from danger; 2. Advanced Safety Vehicle projects: deploy parts of the inter-vehicle communication type driving support system to achieve road safety; 3. Providing appropriate information during disasters; 4. Advanced road management to improve safety and safe driving; 5. Probe 	Less than 5000 road fatalities by 2012	To drive forward the structural reformation of IT, includes a key IT policy of implementing systems for assisting safe driving by infrastructure-vehicle cooperation.	Toward 2007 Smartway: Actualising the world's safest roads; Not strictly a Safe System
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			<p>information to enable effective measures to be provided;</p> <p>6. Assisting safe driving with easy-to-drive maps;</p> <p>7. Installing drive recorders.</p>			
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Norway	2002-2011	A vision of no road fatalities or road accidents causing lifelong injury is set out for the long-term road safety effort	<ol style="list-style-type: none"> 1. Improving the coordination of road safety work 2. Safer Roads 3. Measures to regular behaviour 4. Enforcement 5. Emphasis on police surveillance 6. Improved traffic education and information 7. Emphasis on knowledge-building 8. Accident analysis of the road network 	No accidents, no deaths or injuries.	Safety is an important responsibility for anyone involved in transport, whatever mode.	Road Safety in Norway Strategy; Not strictly a Safe System approach
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NZ	2010-2020	A safe road system increasingly free of death and serious injury	<ol style="list-style-type: none"> 1. Safe Roads 2. Safe Speeds 3. Safe Vehicles 4. Safe Road Use 	<p>Reduce fatality rate (per 100,000 populations):</p> <ol style="list-style-type: none"> 1. Young drivers: from 21 to 13. 2. Alcohol/Drug impaired driving: from 28 to 22. 3. Motorcyclists: from 12 to 8. 4. Elders: from 15 to 11. <p>Achieve</p> <ol style="list-style-type: none"> 1. Safer roads and roadsides; 2. Safer Speeds 3. Safer walking and cycling <p>Improve the safety of</p> <ol style="list-style-type: none"> 1. light vehicle fleet 2. Heavy vehicles <p>Reduce the impact of</p> <ol style="list-style-type: none"> 1. Fatigue and 	<ol style="list-style-type: none"> 1. Minimise the level of unsafe road user behavior 2. Make the road transport system more accommodating of human error 3. Manage the crash forces that injure people in a crash to a level that human body can tolerate without serious injury 4. Road safety is everyone's responsibility 	Safer Journeys; Safe System oriented
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				distraction 2. high risk drivers Increase the use of restraint.		
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Sweden	2007-2020	To achieve a safe system where no one is at risk of getting fatally or severely injured while using the road transport system.	<ol style="list-style-type: none"> 1. A focus on the most dangerous roads 2. Safer traffic in built-up areas 3. Emphasis on the responsibilities of road users 4. Safe bicycle traffic 5. Quality assurance in transport work 6. Winter tire requirement 7. Making better use of Swedish technology 8. Responsibilities of road transport system designers 9. Public responses to traffic violations 10. The role of voluntary organisations: 11. Alternative forms of financing for new roads 	50% reduction in road fatalities and 25 % reduction in severely injured between 2007-2020.	<ol style="list-style-type: none"> 1. Human life and health are paramount so no one should be killed or seriously injured as a result of a crash. 2. Life and health should not be allowed in the long run to be traded off against the benefits of the road transport system, such as mobility. 3. Vision Zero is an ethical approach to safety and mobility. 4. The emphasis is to move away from enhancing the ability of road users to cope with an imperfect system. 5. Traffic accidents cannot always be avoided, since people make errors sometimes. 6. Accident must be prevented from 	Vision Zero; Safe System oriented.
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					<p>leading to fatalities and serious injuries by designing roads, vehicles and transport services in a way that human can tolerate the crash forces, without being killed or severely injured.</p> <p>7. Everyone shares responsibility for making traffic safer.</p> <p>8. Road safety targets are an integral part of the philosophy.</p>	
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Switzerland	2005-2020	Swiss roads need to be constructed so that they forgive driving errors and should only be used by drivers who have received the necessary level of instruction and possess the full physical and mental capacity required to drive a motor vehicle	<ol style="list-style-type: none"> 1. Awareness of social problems: Road safety is seen as being as important as mobility in society, politics and the economy. 2. Behaviour of road users 3. Safety of motor vehicles and road infrastructure 4. Performance and quality of the rescue services: Accident victims are rescued quickly and professionally. 	<p>To reduce the annual number of traffic fatalities to under 300 and seriously injured to under 3,000 by 2010.</p> <p>The number of deaths and serious injuries to be reduced by at least 30% in every subsequent ten-year period.</p>	<ol style="list-style-type: none"> 1. Shared responsibility 2. Forgiving Roads 	Via sicura; Safe System oriented; Systematic development of the action program: from aims and visions to a package of initiatives
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The Netherlands	2005-2020	how to prevent human errors, and how to ensure that the crash conditions are such that the human tolerance is not exceeded and severe injury is practically excluded	<ol style="list-style-type: none"> 1. Infrastructure 2. Vehicles 3. Intelligent Transport System 4. Education 5. Regulations and their enforcement 6. Special issues: speeding; drink and drug driving; young and novice drivers; cyclists and pedestrians; motorised two-wheelers; heavy goods vehicles 	None	<ol style="list-style-type: none"> 1. Functionality of Roads; 2. Homogeneity of mass and/or speed and direction; 3. Predictability of road course and road user behaviour by a recognisable road design 4. Forgivingness of the environment and of road users 5. State awareness by the road user 	Advancing Sustainable Safety; Safe System oriented
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UK	2011-2030	To ensure that Britain remains a world leader in road safety	<ol style="list-style-type: none"> 1. Improving Road Safety together 2. Education—developing skills and attitudes 3. Targeted Enforcement and Sanctions 	<p>By 2020, a 50% reduction in road fatalities and serious injuries;</p> <p>By 2025, a 60% reduction and by 2030, a 70% reduction in road fatalities and serious injuries.</p>	<ol style="list-style-type: none"> 1. Making it easier for road users to do the right thing and going with the grain of human behaviour. 2. Better education and training for children and learner and inexperienced drivers. 3. Remedial education for those who make mistakes and for low level offences where this is more effective than financial penalties and penalty points. 4. Tougher enforcement for the small minority of motorists who deliberately chose to drive dangerously. 5. Extending this approach to cover all dangerous and careless offences, 	Strategic Framework for Road Safety; Not strictly a Safe System approach
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					<p>not just focusing upon speeding.</p> <p>6. Taking action based upon cost benefit analysis, including assessing the impact on business.</p> <p>7. More local and community decision making from decentralisation and providing local information to citizens to enable them to challenge priorities.</p> <p>8. Supporting and building capability by working with the road safety community on better tools to support road safety professionals.</p>	
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USA	none	Federal, State and local governments will unite with private industry toward a single overarching goal- - To annually reduce roadway fatalities until we reach the goal of Zero Deaths on America's roadways	<ol style="list-style-type: none"> 1. Safety Culture 2. Safer Vulnerable Road Users 3. Safer Drivers 4. Safer Vehicles 5. Infrastructure 6. Emergency Medical Services (EMS) 	Ultimately, zero deaths.	<ol style="list-style-type: none"> 1. Cultural Change 2. Building the Foundation of Safety 	Towards Zero Deaths; Not strictly a Safe System approach; Example States: Utah (Moving Towards Zero Fatalities); Minnesota (Towards Zero Deaths); Oregon (Vision Zero Oregon); Kentucky (Towards Zero Deaths); Washington(Target Zero);
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4. DISCUSSION

Significant findings from the review are discussed below.

4.1 Variations of the Safe System approach

The ‘Safe System’ approach has been adopted by many world leaders in road safety. This review of road safety strategies revealed that this approach has become the main stream and will be the predominant approach that guides road safety advancements over the next decade. The ‘Safe System’ approach has also been adopted in many States of Australia and guides the National Road Safety Strategy 2011-2020 (ATC 2011). While strategies based on the ‘Safe System’ approach vary slightly across States of Australia and internationally, the main components of the strategies remain the same. Table 4.1 summarises the main components of the ‘Safe System’ and details the differences in terms of vision, principles, and key elements.

Table 4.1 Similarities and differences between road safety strategies using the Safe System approach

	Similarities	Differences	Comments
Vision	1. Long-term 2. A road transport system which tolerates human error and crashes resulting in zero deaths or serious injuries	1. Road trauma reduction (TAS, NT) 2. Protect responsible road users (VIC) 3. Become world leader in road safety (Canada, Japan, UK)	The ultimate goal is to achieve zero deaths or serious injuries in the road transport system, but not all consider forgiving roads, human error, and human frailty.
Time period covered	Early 2000 to 2020: In Australia, most policies cover 10 years.	Policy covering until end of 2011: QLD, Austria, Finland, Norway (new version not found via this search)	10 years seems appropriate as policies may be out-of-date and inappropriate after 10 years. Monitoring and evaluation systems required.

<p>Principles</p>	<ol style="list-style-type: none"> 1. Human error 2. Human frailty 3. A forgiving road system 4. Shared responsibility 	<p>Additional principles:</p> <p>Within Australia:</p> <ol style="list-style-type: none"> 1. Increased use of public transport(WA) 2. Targeted responses to achieve maximum injury reduction (TAS) 3. Understanding the interactions between key elements of the road system (VIC) <p>Outside of Australia:</p> <ol style="list-style-type: none"> 4. Engaging support from political decision-makers (Austria) 5. Ongoing monitoring and evaluation, and adjustment if programs fail (Austria, Canada) 6. Best Practices framework (Canada, UK) 7. Strengthening local road safety efforts (Denmark, UK) 8. Research on road safety (Denmark, UK) 10. Interaction of vehicles and infrastructure (Japan) 11. Education and training (UK) 12. Enforcement (UK) 13. Cultural Change in road safety (USA) 	<p>While strategies reviewed presented principles in different orders, the four main principles were always included.</p> <p>Cultural change in road safety sometimes was listed as a key targeted area rather than a principle.</p>
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<p>Key elements</p>	<ol style="list-style-type: none"> 1. Safe Roads and Roadsides 2. Safe Vehicles 3. Safe People (Road Users) and Behaviours 4. Safe Speeds 	<p>Additional targeted elements:</p> <ol style="list-style-type: none"> 1. Cultural change in road safety (QLD, Canada, Switzerland, UK, USA) 2. Transport policy and legal framework (NSW, Austria, Canada) 3. Enforcement (Canada, the Netherlands, UK) 4. Improving road safety information to support research and evaluation (Canada) 5. Focusing on key road safety issues (NT, Denmark, Finland, Sweden, the Netherlands) 6. Improving coordination and cooperation in road safety work (Canada, Finland, Sweden) 7. Quality assurance in transport work (Sweden) 8. Better use of technology (NSW, Japan, Sweden, the Netherlands) 9. Emergency Medical Services (Switzerland, USA) 10. Education (the Netherlands, UK) 	<p>Safe Speeds was sometimes included under the Safe Behaviours element</p>
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4.2 Similarities and differences in road safety strategies across States of Australia

From the review of the WA Towards Zero strategy, it can be observed that the strategy is based on the 'Safe System' approach and contains all the main components of this approach. (Office of Road Safety 2009). Despite variations in terminology used, it is clear that the road safety strategies of SA, TAS, VIC, and the ACT are similar to WA and are also based strongly on the 'Safe System' approach. On the other hand, QLD and the NT base their road safety strategies on the Cause Problem Solving Model, which focuses on the most significant road safety issues first. It is difficult to comment on the NSW road safety strategy as only limited information was located.

Vision

Road safety strategy visions are almost identical across States of Australia that use the 'Safe System' approach. The visions of the SA, TAS, QLD, ACT, and WA strategies focus on preventing any deaths or serious injuries on the roads, without indicating the road user's responsibility. However, the Victorian strategy uses a slightly modified vision, stating that the road transport system protects road users who are responsible or behave well. This vision highlights the responsibility of individual road users towards road safety, suggesting that the road transport system does not tolerate irresponsible road users or risky driving behaviours. The 'Safe System' approach supports this notion of the responsibility of the individual. Victoria's strategy suggests that individuals need to drive responsibly in order to be protected by the road system.

The priority of TAS and the NT road safety strategies remains trauma reduction. This difference is most likely due to different geography, unique road environments and sometimes limited resources of these two States. Resources and efforts are targeted at the road safety areas that can potentially save the most lives in TAS and the NT. The vision of NSW is not able to be identified as the State road safety strategy is not available.

Time period

Most road safety strategies in Australia cover a 10-year period. WA's Towards Zero strategy covers the longest period of time from 2008 to 2020 (13 years) where as the NT and QLD strategies cover only six and eight years respectively. State policies do not always correspond to the period covered by the National Road Safety Strategy (2011-2020). This lack of synchronisation across State and National strategies may pose an issue for resource management and allocation. However, due to the nature of bureaucracy in Australia (multiple States with various needs and priorities), this issue may not be able to be ruled out.

Principles

The principles of the road safety strategies that are based on the 'Safe System' approach are similar across the States of Australia (WA, SA, VIC and ACT). However, shared responsibility is the only 'Safe System' principle that is specifically acknowledged by the road safety strategies of all States and Territories. In addition to the four main 'Safe System' principles (human error, human frailty, a forgiving road system and shared responsibility), increased use of public transport and understanding the interaction between key elements of the road system are listed as principles in the WA and VIC strategies respectively.

Increasing the use of public transport would reduce crashes by limiting the number of vehicles on the road and providing better protection to road users. Although some States encourage the use of public transport in their strategies, the importance of increasing public transport use is considerably underestimated. It may be useful for other States to consider listing this as a key principle of their road safety strategy, especially those with well-designed public transport systems such as NSW. Understanding the interaction between key elements of the road system is acknowledged in the VIC strategy, however this is not emphasised in most other States' strategies. Understanding these interactions is key to the 'Safe System' approach and can assist in the development of multi-dimensional initiatives, such as self-explaining roads where travel speeds are lowered automatically as a function of the road design.

Understanding the interactions between elements of the road system may be important to include in other States' road safety strategies.

The principles of the Tasmanian road safety strategy differ from those adopting the 'Safe System' approach. This is mainly due to limited resources and different road safety needs in Tasmania. Therefore, best practice measures for other States of Australia are not necessarily suitable or cost-effective for Tasmania. While the Tasmanian strategy adopts the principle of shared responsibility, other key principles focus on initiatives that achieve maximum injury reductions. The Northern Territory strategy's principles are somewhat similar to Tasmania's as they are based on a problem solving model. The NSW strategy could not be obtained.

Key elements

The road safety strategies in Australia incorporate the 'Safe System' key elements of the road system, with slight variations. Most States and Territories include the key elements of Safer Roads and Roadsides, Safer Vehicles, Safer Road Users (Safer People or Safer Road Behaviours), and Safer Speeds. However, some States manage speeding issues under the Safer Road Users element. This may be because speed cameras and speeding infringements, one of the most effective speed management strategies, originates from the road user element. The 'Safe System' approach, on the other hand, tends to separate speeding from Safer People or Safer Road Behaviours and manages it within the road system. For example the self-explaining roads initiative manages speed by reconfiguring road design and creating an environment that automatically makes drivers reduce their speed and makes the road safer for pedestrians (Weller, Schlag et al. 2008; Charlton, Mackie et al. 2010). Current data supports the effectiveness of self-explaining roads on speed reduction, indicating that examining speeding from the vehicle and road perspective may be another worthwhile strategy. However further research is required to determine the effect of self-explaining roads on crashes or road trauma.

The QLD road safety strategy addresses the issue of bringing about a cultural change towards road safety within society. This is somewhat consistent with the ‘Safe System’ key element of Shared Responsibility. Only a few strategies specifically aim to change the way the community thinks about road safety, so there is a need for the development of effective initiatives that facilitate community involvement and responsibility for road safety.

The Centre for Road Safety, NSW has a division called Business Strategy and Strategic Projects, which includes road safety technology as a part of their business. Although this division has a variety of tasks, the development and use of road safety technology is similar to other advanced countries, such as Japan and Sweden.

4.3 Similarities and differences between Australian and international road safety strategies

Like Australia, the majority of international road safety strategies reviewed are based on the ‘Safe System’ approach. It is clear that it is widely recognised that best practice in road safety is to build a road transport system that can tolerate human errors, considers the frailty of the human body and limits the possibility of being severely injured or dying in the event of a crash. Although Canada, Japan and the UK state their road safety vision as building the safest roads in the world, the principles and ideas behind these road safety strategies are similar to Australia.

The road safety strategies reviewed cover periods of five to 15 years. The Australian National road safety strategy covers the 10 year period between 2011 and 2021. This length has been deemed as appropriate as it allows for policies to be adapted and adjusted over time. Internationally, strategies that cover longer periods of time set shorter interim timeframes so that adjustments can be made accordingly. For example, although the UK strategy has the goal of reducing road fatalities by 30% by 2030, two interim goals are set so that the final goal can be achieved step by step (Department for Transport 2011). These interim goals not only allow for adjustment of policy but also set achievable goals for road authorities and individuals to work towards in the short

term. It should be noted that the Austrian, Finnish and Norwegian road safety strategies identified were either out of date or were soon to be out of date. New strategies for these countries were not located. As these countries may have made significant advances in road safety since the initiation of their previous strategies, it may not be appropriate to compare these with the current strategies of other countries.

The ‘Safe System’ approach contains both principles and key elements. It was observed that different countries used these principles and key elements interchangeably, depending on the layout of their road safety strategy. For example, the UK strategy considered police enforcement as both a principle and a key area, whereas Canada and the Netherlands list it as only a key area. Austria and Canada cited the ongoing monitoring, evaluation and adjustment of programs as a principle of their road safety strategies. However, it seems inappropriate to list this as a principle as these methods should be systematically applied to all road safety initiatives. This may also apply to principles including engaging support from political decision-makers (Austria), strengthening local road safety efforts (Denmark and UK), and investing/building research in road safety (Denmark and UK).

Canada and the UK cite setting up a best practice framework as one of their road safety strategy principles. This framework would include a variety of road safety initiatives that have been proven to be effective within Canada, the UK or other OECD countries (CCMTA 2010). Such a framework would allow local, State or Federal governments to select proven road safety initiatives that are suited to their needs. Given the wide variety of geographic and environmental conditions around Australia, setting up a best practice framework may facilitate the implementation of the ‘Safe System’ approach into different areas of Australia.

The UK road safety strategy focuses on enforcement, education and training in order to become a leader in road safety. The ‘Safe System’ approach however, focuses on safer roads, safer speeds, safer vehicles and safer road users and may use enforcement, education, engineering and encouragement (the 4Es of road safety) to minimise the

road casualties. The 'Safe System' approach advocates considering all four of these elements together for the management of road safety. Figure 3.5 illustrates how to integrate the 4 Es of road safety into the 'Safe System' approach. Japan's road safety strategy, like Victoria's places a strong emphasis on the interactions between key elements of the road system. This is a major strength of these strategies and when possible, strategies that take these inter-relationships into account should be applied.

The road safety strategies of most countries reviewed recognise that a cultural change in attitudes towards road safety is essential if they are to achieve zero deaths or serious injuries on the roads. However, bringing about this change is a difficult and quite abstract task. Currently, few strategies present practical methods for creating this attitude change towards road safety in society.

It was found that countries with excellent road safety records including Sweden and the Netherlands specifically address key road safety issues within the 'Safe System' framework. It therefore may be possible for the Northern Territory to aspire to using a 'Safe System' approach rather than the Cause Problem Solving model to address specific road safety issues. For instance, as well as conducting random breath tests on roads (targeting the safe road user element), installation of inter-lock devices into vehicles of drink driving offenders (targeting the safe vehicle element), may prevent drink driving reoffending (Willis, Lybrand et al. 2004; Lahousse and Fildes 2009).

A positive aspect of the Canadian strategy is its focus on improving road safety information and supporting road safety research and evaluation. This should be adopted by countries like Australia where research may be duplicated in different States and information on the success and failure of various initiatives is not always shared. Although national conferences are organised for the purpose of sharing information, this does not guarantee that research is not duplicated and that initiatives are based on the best available evidence. The development of a road safety best practice framework in Australia may provide a better method of exchanging information and evidence and assist with the effective allocation of resources and funding.

Japan, Sweden and the Netherlands place a strong focus on the use of technology to improve road safety, which is a positive approach to road safety. Although Intelligent Transport Systems (ITS) have been widely used in Australia to manage traffic (Doecke and Woolley 2010), these systems are now used in Japan to provide instant and precise information to drivers about dangerous sections of road and traffic restrictions (Highway Industry Development Organization 2006).

It was found that the road safety strategy of several countries listed key elements that are not specifically part of the 'Safe System' approach. For example transport policy and legal framework (NSW, Austria, and Canada), enforcement (Canada, the Netherlands, and UK), coordination and cooperation in road safety (Canada, Finland, and Sweden), quality assurance in transport work (Sweden), and education (the Netherlands and UK). These elements could all be integrated into the 'Safe System' approach where appropriate to improve the road transport system. Switzerland and the USA also make a specific mention of emergency medical services (EMS) in their strategies. This may be an important factor for the WA Towards Zero strategy to include due to WA's vast rural and remote areas and the increased rate of fatal and serious injury crashes in these areas. Enhancing emergency medical services may reduce the number of fatalities on rural roads in WA.

4.4 Strengths and Weakness of the WA Towards Zero strategy

Strengths

The WA Towards Zero strategy has two major strengths when compared to the strategies of other States and Territories of Australia.

Firstly, the principle of increasing public transport use is unique to WA's strategy, though it is briefly mentioned within the strategies of some other States. Increasing the use of public transport is a highly effective strategy for reducing crashes. Public transport decreases the number of vehicles on the road (less conflicts) and provides a mode of transport where passengers are better protected and at lower risk of crashes.

This principle could be used in the strategies of other States of Australia and well as countries around the world. For example, this may be important in India and China which are projected to contribute the majority of road fatalities worldwide in the future.

The second major strength of the WA Towards Zero strategy is the inclusion of well-developed performance indicators for each key area of the strategy. This will facilitate the implementation, monitoring and evaluation of the 'Safe System' approach in WA and guide adjustments to the strategy over time where required.

Weaknesses

While the WA Towards Zero strategy has made a strong effort to incorporate the 'Safe System' approach, it does not necessarily consider the systems approach in its listed tasks. In fact, only a few tasks listed in the WA Towards Zero Strategy actually incorporate more than one element of the road system. Examples of these include installation of alcohol interlocks (interaction between Safe Vehicles and Safe Road Use) and the use of Intelligent Transport Systems (interaction between Safe Roads and Safe Vehicles). The Victorian Arrive Alive strategy lists understanding the interactions between key elements of the road system as a key principle. It may be important for WA to also focus on this, in order to encourage the development of effective multi-dimensional initiatives that integrate two or more of the key elements of the road system.

Secondly, gaining the support of key stakeholders for road safety is important in WA. In particular, initiatives involving emergency medical services are key to managing trauma on rural and remote roads in WA. However, improving emergency medical services is not documented in the WA strategy. In addition while the WA strategy focuses strongly on shared responsibility for road safety, practical methods and effective initiatives that facilitate community involvement and build a sense of responsibility for road safety are required.

Finally, other countries are currently setting up a best practice framework as part of their road safety strategies that would compile research and evidence on the effectiveness of road safety initiatives. Unfortunately, there is no such framework in WA or within Australia. Therefore, information and best practices in roads safety may not be being optimally shared and translated into effective 'Safe System' based initiatives at the Federal, State and local level.

4.4.1 Recommendations for the WA Towards Zero strategy

The WA Towards Zero strategy, based on the 'Safe System' concept, principles and approaches, is a well-developed strategy to tackle road safety issues in WA. However, a good strategy is only the start. The difficulty lies in how to put strategy into practice, which is clearly acknowledged in the WA Towards Zero strategy. Recommendations that may facilitate the implementation and adoption of this strategy in WA are listed below.

1. A better understanding of interactions between key elements of the road system;
2. Gaining support from all stakeholders, such as policy makers, police and the community
3. An enhanced emergency medical service to reduce rural and remote road trauma;
4. A best-practice framework that is flexible and applicable to local areas;
5. A mechanism to regularly monitor and evaluate performance indicators;
6. A clear strategy for engaging the community in shared responsibility for road safety;
7. Incentives for participation in road safety;
8. Support for local governments in understanding and implementing the 'Safe System' approach to road safety into local areas;

5. CONCLUSION AND FUTURE DIRECTIONS

This review found that the ‘Safe System’ approach is widely used to guide road safety strategies within Australia as well as in countries that are world leaders in road safety. Using the ‘Safe System’ approach, the Australian road safety strategy aims to reduce road fatalities by at least 30% by 2020. Some countries, on the other hand, use only parts of the ‘Safe System’ approach. For instance, the US has adopted the vision of ‘Towards Zero Deaths’ but their initiatives are developed using the Cause Problem Solving Model. This traditional model may be useful for addressing the most pressing road safety issues when resources are competitive and limited. However, the ‘Safe System’ approach has also been applied to address specific road issues in Denmark, Finland, Sweden and the Netherlands. Overall, the main difference between the ‘Safe System’ approach to road safety and more traditional models is that the ‘Safe System’ approach considers the road, vehicle and road user as a system and considers how all these elements interact when addressing road safety issues. While taking a ‘Safe System’ approach to all road safety initiatives may not be easy, taking into account the interactions between key elements of the road system leads to more holistic and effective road safety interventions.

The WA Towards Zero strategy has two major strengths including the encouragement of public transport use and the inclusion of well-developed performance indicators for each key area of the strategy. This review however, also revealed some additional principles, elements or targeted areas from the road safety strategies of other States and countries that may be worth considering in WA. For example, WA could place more emphasis on understanding the interactions between key elements of the road system such as in Victoria and Japan. This would allow the effectiveness of new road safety initiatives to be assessed through the consideration of the multiple causes of crashes including road, vehicle, speed and road user causes. The road safety strategies of several other countries also acknowledge the importance of engaging the community in road safety as well as enforcement and education. In addition, the focus of the Swiss and US road safety strategies on strengthening emergency medical services would be

useful to apply in WA, where a large proportion of road trauma occurs on rural and remote roads.

In conclusion, the WA Towards Zero Strategy is a positive step for road safety in WA and is built on strong theoretical foundations based on the 'Safe System' approach. Putting the 'Safe System' approach into practice over the next decade will be a challenge for road safety authorities. Over the next decade, practical methods for incorporating the 'Safe System' approach into all road safety efforts at the State and local levels need to be developed. The strategy also requires regular monitoring and evaluation to ensure that performance indicators are being met and to allow timely adjustments to be made if initiatives are not successful or new evidence emerges. This flexibility is essential as roads, vehicles and policies may change during the period covered by the WA Towards Zero Strategy. Converting the 'Safe System' theory into practice, monitoring and evaluation and a flexible strategy are necessary to achieve the WA Towards Zero Strategy's ultimate goal of no deaths or serious injuries on the roads.

REFERENCES

- Australian Transport Council (ACT) Government (2010). 'Vision Zero' ACT Road Safety Strategy 2011-2020. Canberra, ACT Government.
- ATC (2011). The National Road Safety Strategy, 2011-2020. Canberra, ATSR.
- ATC and ATSB (2000). The National Road Safety Strategy, 2001-2010, ATSR.
- ATSSA (2008). Toward Zero Deaths: A vision for safer roads in America. Fredericksburg, Virginia The American Traffic Safety Services Association.
- ATC (2006). National Road Safety Action Plan, 2007 and 2008. Canberra, Australian Transport Safety Bureau, Canberra.
- BMVIT (2009). Department for Transport. Vienna, The Ministry for Transport, Innovation and Technology.
- Breen, J., E. Howard, et al. (2008). An independent review of road safety in Sweden, Swedish Road Administration.
- Brennan, C. (2009). 'Motorcycle Safety in Australia—Consulting with Riders and Jurisdictions Working Together.' Journal of the Australasian College of Road Safety **20**(4): 17.
- Cairney, P. (2009). Guide to road safety part 1: road safety overview Sydney, New South Wales, Australia, Austroads: 21.
- Cameron, I. (2009). Towards zero: getting there together: WA road safety strategy 2008-2020. (paper to) Road Safety 2009, Melbourne, Victoria, Australia. Sydney, New South Wales, Australia, Informa: 22.
- CCMTA (2010). Canada's Road Safety Strategy 2015. Ottawa, Ontario, Canadian Council of Motor Transport Administrators
- Charlton, S. G., H. W. Mackie, et al. (2010). 'Using endemic road features to create self-explaining roads and reduce vehicle speeds.' Accident Analysis & Prevention **42**(6): 1989-1998.
- Community Leaders Group (2001). Tasmania Together, Tasmania Together.
- Corben, B., D. Logan, et al. (2007). Progress report on the development of the Western Australian road safety strategy 2008-2020. International Road Safety Conference, 2007, Perth, Western Australia. Perth, Western Australia, Australia, Road Safety Council of Western Australia: 12.

- Corben, B., D. Logan, et al. (2008). Development of a new road safety strategy for Western Australia, 2008-2020. Clayton, Victoria, Australia, Monash University. Accident Research Centre (MUARC): 39.
- D'Elia, A. and S. Newstead (2010). Data systems for the effective implementation of a safe system approach. Australasian Road Safety Research Policing Education Conference, 2010, Canberra, ACT, Australia. Kingston, ACT, Australia, Conference Logistics: 9.
- Department for Transport (2011). Strategic Framework for road safety. London.
- Department of Infrastructure Energy and Resources Our Safety, Our Future. Tasmania, Department of Infrastructure, Energy and Resources.
- Doecke, S. and J. Woolley (2010). Effective use of clear zones and barriers in a safe system's context. Australasian Road Safety Research Policing Education Conference, 2010, Canberra, ACT, Australia. Kingston, ACT, Australia, Conference Logistics: 10.
- Elvebakk, B. (2007). 'Vision zero: Remaking road safety.' Mobilities 2(3): 425-441.
- Elvik, R. and A. Amundsen (2000). 'Improving road safety in Sweden.' TØI report.
- Eyre, D. (2010). 'New Zealand's new road safety strategy.' Journal of the Australasian College of Road Safety 21(2): 19.
- Federal Highway Administration. (2010). 'Toward Zero Deaths: A National Strategy on Highway Safety.'
- FEDRO (2005). Via sicura: Federal action programme for greater road safety. Bern, Switzerland, Federal Roads Authority, Federal Department of the Environment, Transport, Energy, and Communications
- Fernandes, R., A. Graham, et al. (2010). 'Implementation of a Road Safety Package to Address the NSW Road Toll.' Journal of the Australasian College of Road Safety 21(2): 13.
- Fildes, B., J. Langford, et al. (2006). Setting speed limits for a safe system. Saferoads: Victorian Local Government Road Safety Conference, 2006, Melbourne, Victoria, Australia. Clayton, Victoria, Australia, Monash University. Events Management Office: 11.

- Finland (2001). Government Resolution on Improving Road Safety, 18 January 2001, UN.
- Frith, B. and J. Thomas (2010). Non-motor vehicle related pedestrian injury on and near the road: implications for the safe system approach to road safety. Australasian Road Safety Research Policing Education Conference, 2010, Canberra, ACT, Australia. Kingston, ACT, Australia, Conference Logistics: 12.
- Hay, N. (2009). Achieving road safety targets under the safe system. Australasian Transport Research Forum (ATRF), 32nd, 2009, Auckland, New Zealand. Auckland, New Zealand, Convention Management. **32**: 12p (session Tues 12D).
- Healy, D., J. Passmore, et al. (2007). Safer vehicles: the market driven approach in Victoria. Australasian Road Safety Research Policing Education Conference, 2007, Melbourne, Victoria, Australia. Collingwood, Victoria, Australia, The Meeting Planners: 13.
- Highway Industry Development Organization (2006). Actualizing the world's safest roads. ITS 2006-2007 Handbook. Japan, Road Bureau, Japanese Ministry of Land, Infrastructure and Transport. **88**: 612-614.
- Howard, E. (2004). Implementing a 'safe system' approach to road safety in Victoria. Road Safety Research, Policing and Education Conference, 2004, Perth, Western Australia, Australia. Perth, Western Australia, Australia, Road Safety Council of Western Australia. **2**: 14.
- Jurewicz, C. (2010). 'Speed limits in the safe system concept.' Journal of the Australasian College of Road Safety **21**(2): 14-17.
- Jurewicz, C. and K. Hall (2009). Speed setting principles in the safe system context. Australasian Road Safety Research Policing Education Conference, 2009, Sydney, New South Wales, Australia. Sydney, New South Wales, Australia, Roads and Traffic Authority (RTA): 15.
- Lahausse, J. A. and B. N. Fildes (2009). 'Cost-benefit analysis of an alcohol ignition interlock for installation in all newly registered vehicles.' Traffic Injury Prevention **10**(6): 528-537.
- Langford, J. and J. Oxley (2006). Assessing and managing older drivers' crash risk using Safe System principles. Australasian Road Safety Research Policing Education

- Conference, 2006, Surfers Paradise, Queensland, Australia. Gold Coast, Queensland, Australia, Able Video and Multimedia: 10.
- Langford, J. and J. Oxley (2006). 'Using the safe system approach to keep older drivers safely mobile.' IATSS Research **30**(2): 97-109.
- Loo, B. P. Y., W. T. Hung, et al. (2005). 'Road safety strategies: A comparative framework and case studies.' Transport Reviews **25**(5): 613-639.
- May, M., P. J. Tranter, et al. (2008). 'Towards a holistic framework for road safety in Australia.' Journal of Transport Geography **16**(6): 395-405.
- McTiernan, D., B. Turner, et al. (2010). Local government and the safe system approach to road safety. Vermont South, Victoria, Australia, ARRB Group Ltd: 29.
- Ministry of Transport (2009). Safer Journeys. Wellington, Ministry of Transport, New Zealand.
- Ministry of Transport and Communications (2002). Road Safety in Norway Strategy 2002-2011. Oslo, Norway, Ministry of Transport and Communications.
- Neuman, T. R. and C. H. M. Hill (2007). A Vision of the Future—Safe Roads Create a Safe and Prosperous America.
- NSW Government (2010). Better Transport and Liveable Cities. NSW State Plan 2010. NSW, Australia, NSW Government.
- NT Police (2008). Road Safety Strategy: 2008-2013. NT, Australia, Northern Territory Police.
- Office of Road Safety (2009). Towards Zero-Road Safety Strategy. Perth, Australia, Office of Road Safety.
- Pyta, V. and P. Cairney (2009). Incorporating Safe System in learner driver handbooks. Australasian Road Safety Research Policing Education Conference, 2009, Sydney, New South Wales, Australia. Sydney, New South Wales, Australia, Roads and Traffic Authority (RTA): 13.
- Queensland Transport (2003). Safe4life: Queensland road safety strategy 2004-2011, Retrieved.
- Research in Germany. (2010). 'On the road to Vision Zero.' Retrieved 10/05, 2011.
- Road Safety Advisory Council (2011). Draft South Australian Road Safety Strategy 2020: Towards Zero Together. Adelaide.

- Road Safety Research Committee (2004). Hong Kong road safety review. Hong Kong, Road Safety Research Committee, Road Safety Council.
- Ross, L. A., K. J. Anstey, et al. (2009). 'Older drivers in Australia: trends in driving status and cognitive and visual impairment.' Journal of the American Geriatrics Society **57**(10): 1868-1873.
- RTA. (2009, 23 March 2011). 'About the NSW Centre for Road Safety.' Retrieved 10/05, 2011, from <http://www.rta.nsw.gov.au/roadsafety/aboutthecentre.html>.
- Smart, W., S. Job, et al. (2010). The safe systems approach to road safety. Australasian Roadmarking and Signs Conference, 2010, Twin Waters, Queensland, Australia. Dandenong South, Victoria, Australia, Roadmarking Industry Association of Australia: 6.
- Smithson, A. (2009). Measuring the value of community road safety in the safe system framework. Australasian Road Safety Research Policing Education Conference, 2009, Sydney, New South Wales, Australia. Sydney, New South Wales, Australia, Roads and Traffic Authority (RTA): 6.
- Tasmania Together Progress Board (2004). Tasmania Together 2020, Tasmania Together Progress Board.
- The Australasian College of Road Safety (2010). Safe System Approach, 2010. Journal of Australasian College of Road Safety.
- The Danish Ministry of Transport (2000). Every accident is one too many. Copenhagen, The Danish Ministry of Transport.
- Turner, B. and P. Cairney (2010). Australia's new approach to road safety: how is the safe system approach being implemented? Road Safety on Four Continents, 15th, 2010, Abu Dhabi, United Arab Emirates. Linköping, Sweden, Swedish National Road and Transport Research Institute: 124-132.
- Turner, B., P. Cairney, et al. (2010). 'Recent progress in implementing the safe system approach.' Journal of the Australasian College of Road Safety **21**(1): 17-19.
- Turner, B., M. Tziotis, et al. (2009). Safe system infrastructure: national roundtable report. Vermont South, Victoria, Australia, ARRB Group Ltd: 30.
- VicRoads Victoria's road safety strategy : Arrive Alive 2008-2017. Victoria, Australia, VicRoads, Victoria.

- VicRoads (2006). What is the safe system? Kew, Victoria, Australia, VicRoads: 1 DVD.
- Wegman, F., L. Aarts, et al. (2008). 'Advancing sustainable safety.' Safety Science **46**(2): 323-343.
- Wegman, F. and J. Mulder (2000). Sustainable safety in the Netherlands.
- Weller, G., B. Schlag, et al. (2008). 'Behaviourally relevant road categorisation: a step towards self-explaining rural roads.' Accident Analysis & Prevention **40**(4): 1581-1588.
- Williams, P. and E. Howard (2006). Safe system: a more global perspective. Saferoads: Victorian Local Government Road Safety Conference, 2006, Melbourne, Victoria, Australia. Clayton, Victoria, Australia, Monash University. Events Management Office: 4.
- Willis, C., S. Lybrand, et al. (2004). 'Alcohol ignition interlock programmes for reducing drink driving recidivism.' Cochrane Database of Systematic Reviews(4): CD004168.
- Wright, R., D. Rickwood, et al. (2010). Understanding driving culture: safe system and the ACT: a report on a systematic literature review and research scoping project. Australasian Road Safety Research Policing Education Conference, 2010, Canberra, ACT, Australia. Kingston, ACT, Australia, Conference Logistics: 9.