Safe System Roads for Local Government

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Abstract

The Safe System approach to road safety has been in place in Australasia for over a decade, but understanding and application by local road practitioners remains limited. The Austroads project *Safe System Roads for Local Government* (ST1769) is seeking to develop guidance for local government practitioners on how to assess sites of concern and identify how they can be best treated using the principles of the Safe System approach. The project is ongoing but nearing completion; this paper provides an overview of the approach developed from this project.

Through crash data analysis and consultation with the project working group of Australian jurisdictions and the NZ Road Controlling Authorities forum, this paper discusses the significance of local government roads and their contribution to road trauma in both countries. It provides an understanding of the challenges faced by local government to address safety on local roads, discussing the funding challenges, network responsibilities and sets out key focus areas for high severity crashes in a range of relevant environments.

This paper highlights practical tools that have or are being developed, including the benefits of using GIS spatial analysis, mapping network risk based on iRAP risk measures to optimise safety efforts, giving an understanding of network risk, identifying high priority sites and achieving effective prioritisation.

Finally, using a case study example, the paper outlines the Safe System assessment method intended to be available to local government practitioners, detailing example interventions, their relevant application and Safe System focus.

The guide specifically looks to provide a practical, cost effective toolkit of interventions that will assist Local Government to move towards providing a safe system on their road networks.

The Project

Safe System Roads for Local Government is an Austroads project (ST1769) which seeks to identify and investigate cost effective measures and innovative treatments that improve road safety on locally controlled roads. The goal of ST1769 is to assist local government in Australia and New Zealand to implement road safety measures that will allow them to work towards achieving a Safe System on their local road network.

ST1769 seeks to deliver a Safe System approach through a practitioner's guide for local government, that is practical, readily accessible, affordable (low cost) and entirely relevant for local roads.

It is envisaged that this guide will form part of a practitioner's existing toolkit and support a council's overall safety management system.

The practitioner's guide will provide a structured method for assessing road safety hazards and risk at a project site, identify potential treatment options and evaluate the effect of these potential options.

The Safe System Approach

The Safe System approach is a guiding philosophy that is adopted by leading road safety nations. It is a foundation for road safety strategies and action plans adopted in both Australia and New Zealand.

The Safe System approach operates on the principle that it is not acceptable for a road user to be killed or seriously injured if they make a mistake and its success is measured in these terms. The approach aims to create a forgiving road system based on the following four principles (New Zealand Transport Agency 2014):

1. People make mistakes – People make mistakes and some crashes are inevitable.

2. People are vulnerable – Our bodies have a limited ability to withstand crash forces without being killed or seriously injured.

3. We need to share responsibility – System designers and people who use the roads must share responsibility for creating a road system where crash forces do not result in death or serious injury.

4. We need to strengthen all parts of the road transport system – We need to improve the safety of all parts of the system, roads and roadsides, speeds, vehicles, and road use so that if one part fails, other parts will still protect the people involved.

The Safe System approach in Australia and New Zealand has four pillars where action can be taken to fulfil the above principles. There are a number of conceptual representations of the Safe System approach available; the framework below illustrates the connection between the adopted vision, the pillars and the underlying principles in the Australian and New Zealand strategies.

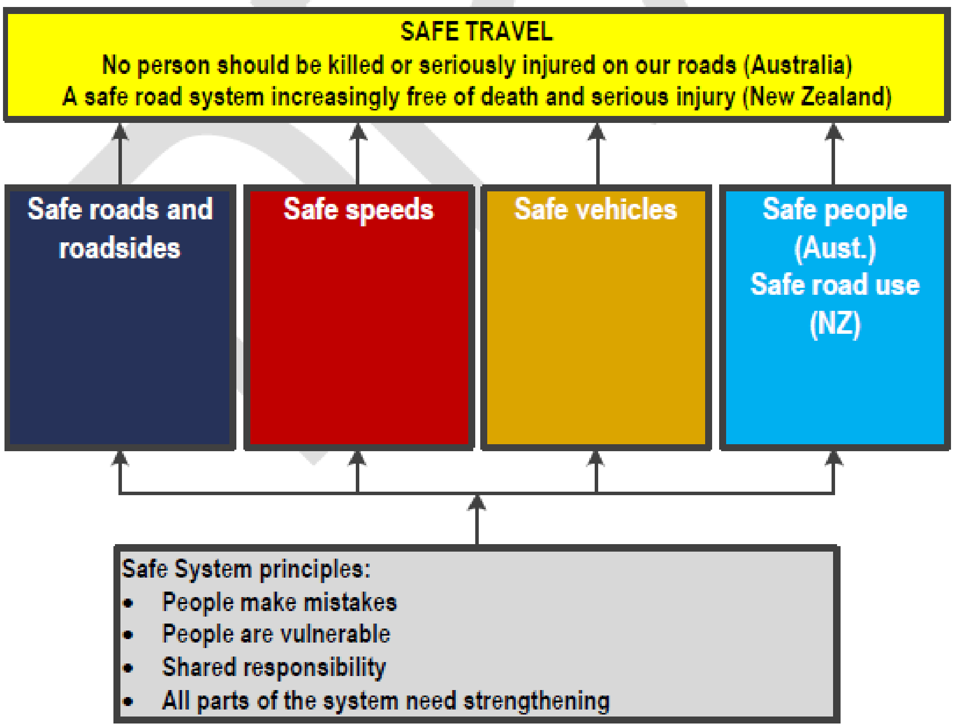

Figure 1. Safe System Approach Framework (Source ARRB Group)

The Safe System approach to road safety aims to eliminate fatal and serious road injuries (FSI). Key strategies for achieving Safe System objectives that are readily available to local governments are through road network improvements. These most directly relate to the Safe roads and roadsides and Safe Speeds pillars.

However, ST1769 aims to assist local government to move towards the Safe System approach by taking a much broader and integrated view of road safety and managing risk by identifying actions in all four pillars.

Why Focus on Local Roads?

The Austroads project *Road Safety on Local Government Roads* (Austroads 2010), investigated local government road safety, focussing on Australian and New Zealand roads. The analysis undertaken for that project established that the local government road network is vast, with local government managing approximately 82% of the public road network in Australia, and 88% in New Zealand.

Although the length of the local road network is significant, Austroads (2010) indicates that local roads carry considerably lower amounts of traffic than the state road networks. It is estimated that over 70% of the Australian road network serves less than 10% of the vehicle kilometres travelled (vkt), or conversely over 90% of the travel occurs on less than 30% of the network length. A similar situation is experienced in NZ with over 50% of the vkt occurring on the SH network, being only 11-12% of the total network length.

Austroads (2010) goes on to conclude that:

> *'In Australia, around half of all casualty crashes, and around 40% of all fatal crashes occur on roads managed by local authorities. The figures are higher in New Zealand (65% of casualty crashes and 46% of fatal crashes). Given the volumes of traffic using these roads, the risk to a driver of being involved in a casualty crash is higher on local government roads (between 1.5 and 2 times) than on state roads, and for some specific road types is likely to be substantially higher.'*

It is the responsibility of local government in both countries to manage road safety on their networks, and it is vital that local government contribute to the delivery of national and jurisdictional road safety outcomes on their networks if stated targets are to be achieved. It is therefore important that local government is supported in this endeavour through not just funding but, importantly, guidance and appropriate tools.

Challenges

Given the vast networks and low traffic volumes it is often challenging for local authorities to firstly understand where the greatest risks are on their networks and then how to best spend their limited investment dollars to achieve the greatest gains in road safety.

This can be compounded for local authorities with smaller populations dispersed over large lengths of road network, often resulting in limited funds to manage the safety and upkeep of the network.

In these circumstances, local government may not be able to deliver best practice, Safe System solutions; however they may well be better placed to make incremental improvements towards achieving a Safe System.

For ST179, the key question to be resolved was how then, can local government practitioners seek to deliver incremental Safe System road safety outcomes on their road networks?

Key Crash Types on Local Roads

The crash analysis undertaken as part of ST1769 evaluated the total number of injury crashes associated with each crash type and the percentage of crashes resulting in FSI outcomes for each crash type.

Admittedly this is a high level assessment with regional and local variances anticipated, however from this analysis the key crash trends presented for both urban and rural environments, for each country, are as follows;

Table 1. Primary crash types contributing to fatal and serious injuries on local roads.

Urban		**Rural**	
Australia	**New Zealand**	**Australia**	**New Zealand**
Pedestrian	Pedestrian	Pedestrian	Pedestrian
Off path on straight	Off path on straight	Opposing direction	Opposing direction
Overtaking	Overtaking	Overtaking	Overtaking
Off path on bend	Off path on bend	Intersection	Intersection
		Off path on straight	Manoeuvring

Understanding the key crash types commonly occurring on local roads permitted a targeting of local road locations and road environments and the shortlisting of potential treatment options for the case study guidance.

Identifying Risk Locations on Local Roads

ST1769 does not provide guidance on identifying or managing network risk; given the challenges identified, it is recognised that authorities will need to put systems in place for managing this and targeting locations of higher risk FSI crashes. This risk management approach will form an essential part of achieving a safe road system, and will greatly assist local government to get the best (safety) returns on their investment.

In terms of assessing and identifying network level risk, there are a number of tools available or under development. One example, developed by GHD, is the Safety Management App.

The Safety Management App assesses safety performance measures and enables local authorities to lead with risk based decision making, fundamentally critical for responsible and efficient network safety management.

In terms of determining the exposure risk with regards to safety, this is traditionally developed at an individual site level but ultimately the overall risk should be managed at a network level. In order to do this effectively GHD have devised their own (mostly automated) process to generate Risk Maps to capture the combined risk arising from the interaction of road users, vehicles and the road environment. The maps provide an objective view of where people are being killed or seriously injured and where their crash risk is greatest. GHD's web based spatial analysis evaluates the intersection type, speed environment, traffic volume and collision type at a site level and then calculates the crash density and the crash rate of each site. This is performed for both intersections and road lengths separately and generally follows the methods adopted by the International Road Assessment Programme (iRAP).

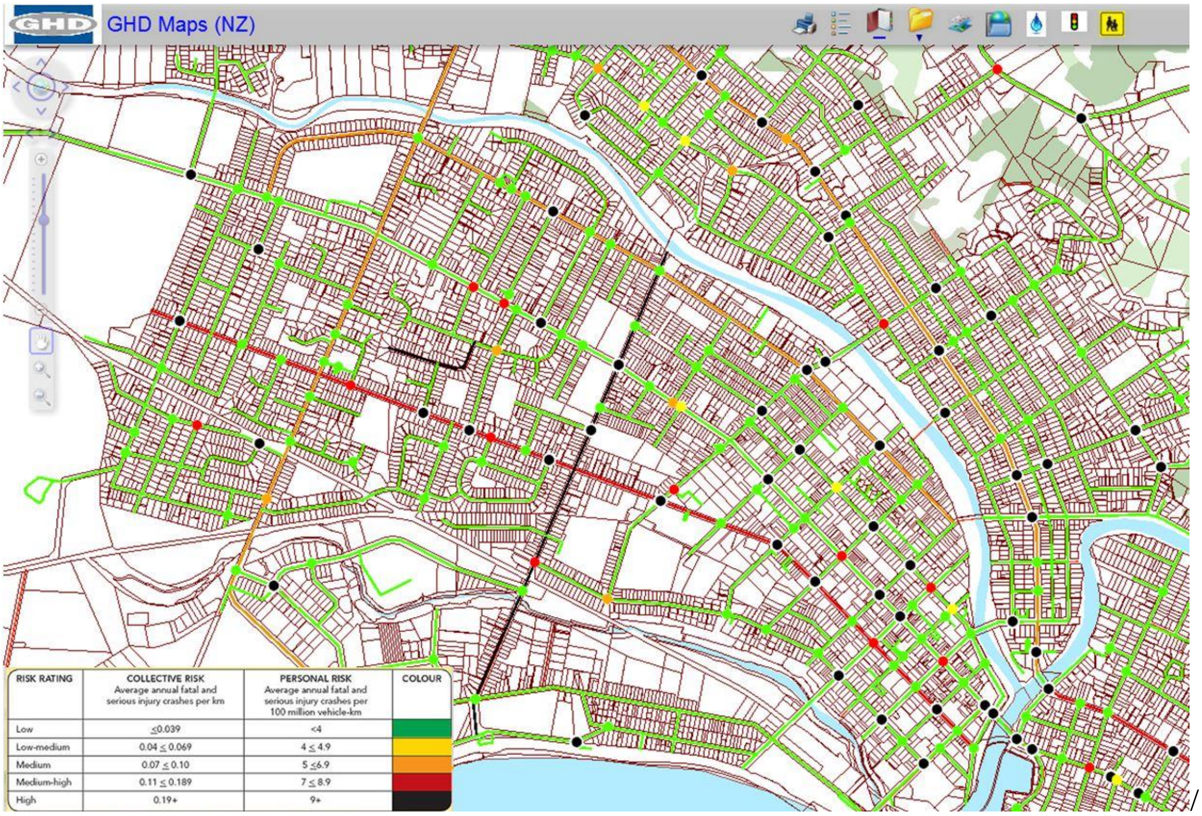

Figure 2. GHD's Geospatial Safety Risk Maps

We comment on the relevance of this type of spatial / network tool, given the earlier relationships established between network length, vkt, cash densities and the corresponding challenges many local authorities have in identifying and managing safety on their respective networks. The benefits of employing systems like this are;

- Ability to evaluate and visualise safety risk at a network level
- Provide a spatial representation of the safety levels on the network and indicate areas of high, medium and low concern.
- Establishing either local risk thresholds or align with national safety standards
- Enabling the authority, stakeholders, customers etc. to understand isolated risk in context of the network, which serves improved communication, planning and prioritisation of safety programmes.
- Identify sites of interest to advance for treatment investigation.

This is an initial process used in safety management, effectively screening the network to establish sites of concern. Once established, more detailed investigations and treatment options can be considered. It is here that the guidance developed by the Austroads project, are applied by practitioners.

Developing a Safe System Hierarchy of Control – Site Risk Assessment

ST1769 is a multi-staged project that is ultimately seeking to develop practitioner guidance for assessing the road safety problems at sites on local roads in a Safe System context. The guidance and assessment tools proposed will include:

- A review of Austroads Guides to provide greater direct relevance and guidance in local government-related issues.

- A new technical guide/report presenting case study applications of Safe System assessments for local roads

- Expansion/updating of the Austroads Road Safety Engineering Toolkit, which is a free on-line reference tool created for road infrastructure and safety practitioners, to incorporate Safe System risk assessments relevant to local government practitioners and case study treatments identified through this project (www.engtoolkit.com.au).

From the guidance and assessment tools to be developed, cost effective treatment options can be identified and selected that may be considered either best practice Safe System (primary) treatments or which may provide incremental safety improvements (secondary treatments) across each of the Safe System pillars.

Primary treatments are defined as best practice and satisfy the Safe System principles and have the potential to deliver zero FSI crashes. Supporting treatments are measures that provide incremental benefits towards achieving a Safe System. In both instances primary and secondary treatments may vary considerably in cost; typically primary treatments tend to be medium to high cost options, while supporting treatments tend to be regarded as lower cost, yet are considered to still be effective road safety treatment options.

Safe System Hierarchy of Control Case Study Example

The following simple example is provided to demonstrate the Safe System hierarchy of control assessment process being developed via ST1769.

The Site

The example case study site is a local road (Bay Street) passing through a busy shopping precinct. Bay Street has a number of low traffic side roads intersecting with it; Bay Street forms a left in/left out intersection which connects to a busy state road into the City CBD, see Figure 3.

Bay Street is a 50 km/h speed limited road and has a high local road traffic volume; it has a constant flow of pedestrians crossing traffic at a formal refuge island crossing, but also at other locations. There is a constant pedestrian flow crossing a side street (Grose Street), which is used by delivery vehicles and traffic as a short-cut to bypass the left out restriction with the state road.

The Safety Problem

There are concerns for the safety of pedestrians crossing Bay Street and Grose Street from through vehicle movements. Further, the pedestrian traffic interrupts traffic flow, creating uncertainty for drivers as some stop unexpectedly to wave pedestrian through while others do not.

There has been a series of vehicle-pedestrian collisions and near-misses and vehicle rear-end and t-bone type crashes.

Council has embraced the Safe System approach to guide action on its road network and is looking to identify the options available to improve pedestrian and vehicle safety along Bay Street.

A Safe System Hierarchy of Control Assessment

Several potential conflict points have been identified, which are indicated in red in Figure 3. Some conflicts may lead to more severe consequences than others, with the most significant being vehicles turning into Grose Street, impacting with a crossing pedestrian.

Figure 3. Example conflict diagram - Bay and Grose Street Intersection

With the use of the guide, a practitioner completes an assessment of safety issues using the Safe System hierarchy of control table as a framework to identify potential treatment options for each Safe System pillar and identifying if that option might eliminate, isolate, control etc. the risk/hazard.

This framework has been applied for the Bay Street case study example in Table 2. It should be noted that Table 2 presents an extract only of the range of potential conflicts and identified treatment options to provide an illustration of the approach. A more comprehensive assessment is presented in the project report that will form the practitioner guide.

It is not expected that treatment options will always be readily identified for every pillar, and it is acknowledged that not every option will eliminate the risk/hazard. It is important, however, that a broad view of the Safe System approach is adopted. The purpose of the framework is to switch on the thinking of the practitioner, to raise their appreciation to the potential that might be available, and to optimise Safe System performance which must include the Safe Vehicles pillar.

The most common view amongst practitioners, especially engineers, is that Safe Vehicles is not relevant to road practitioners – the traditional silo mentality sees that road managers in local government deal only with infrastructure and cannot apply vehicle based treatments. In ST1769, this view is seen as narrow and limiting the potential to address road safety with the full scope of primary and secondary Safe System solutions. Technology already exists that permits active communication between road infrastructure and vehicles and drivers; this begs the question of where does a treatment, which has a piece of road infrastructure directly informing an approaching vehicle to slow or stop due to a pedestrian crossing a road, fit within the Safe System pillars? Intelligent transport systems (ITS), intelligent speed adaptation (ISA), vehicle activated signs (VAS) and more break the traditional three E's view (Engineering, Education and Enforcement) of road safety – noting that each of these high-tech approaches rely on road infrastructure informing the road user (is that the driver or the vehicle?) – about what needs to occur to ensure a safe outcome.

While the application of high-tech options is currently limited to application along state road networks, there will be a point in the future when they become common place, affordable and readily applicable to local roads. The mindset of local government practitioners needs to be open to the opportunities now, so road safety can improve into the future.

Outputs

The outputs of the assessment process will be the identification of all the identifiable treatment options, with a description of the effectiveness to treat the particular hazard/risk (i.e. eliminate, substitute etc.). The treatment options will be associated with a Safe System pillar and how well it achieves the Safe System principles (i.e. primary or secondary treatment). Along with indicative costs, maintenance responsibilities and expected effectiveness of interventions, practitioners will have the necessary information to develop treatment interventions under a Safe System funding program, an area that state jurisdictions are moving towards as a means of meeting national road safety strategy objectives.

The Safe System hierarchy of control framework will also assist practitioners to communicate the effectiveness of treatment options to elected officials and the community; if an elimination of the problem is required, the framework indicates what is needed. With costs assigned, the elected and community representatives can more clearly understand the implication on budgets.

Conclusion

Based on the large vast networks, low traffic volumes, often dispersed crashes and limited funds, it was recognised that there are some very real challenges that often preclude local government from moving towards a Safe System on local roads.

It is noted that in situations of high crash density, it can be cost effective to implement a high cost solution and the appropriateness of the treatment will be dependent on the nature and scale of the crash patterns being addressed. However from overall cost, effectiveness, practicality and an ease of implementation viewpoint, supporting treatments, may be more accessible by local governments to achieve an overall incremental improvement on the network.

Whilst the practitioner case study guide that will be the final output of ST1769 is still in development (due for publication in 2016), the knowledge gained via the project thus far, including the site assessment framework, is considered to be of current value to local road authorities. The approach identifies key focus areas which are contributing to the FSI trauma incurred on these networks and it establishes a method for developing treatment responses.

In the meantime, it is recommended that practitioners continue to use existing methods such as risk maps and the Austroads Road Safety Engineering Toolkit to manage safety on the local road network.

Table 2. Safe System Hierarchy of controls

Control Method	Hazard /Crash Type	Safe Roads	Safe Speeds	Safe People	Safe Vehicles
Elimination Remove the hazard from the road environment	• Left Turn Vehicle – Pedestrian Conflict	• Ban Left turn • Ban Pedestrian Movement			• Pedestrian detection system
	• Right turn vehicle – pedestrian conflict	• Ban right turn • Ban pedestrian movement			•
	• Rear end collision	• Ban left turn			• City brake assist
Substitution Replace one hazard with another, less severe and more controllable	• Left Turn Vehicle – Pedestrian Conflict		• Create a shared zone with 30 km/h limit		• Bonnet designs
Engineering Controls – isolation Apply design modifications to minimise road user interaction with the hazard	• Left Turn Vehicle – Pedestrian Conflict	• Apply self-explaining road principles • Change kerb alignment to reduce turning speeds • Wombat Crossing • Street Scape modifications	• Physical changes to reduce vehicle speeds to less than 30 km/h		• Collision warning alerts
Admin. Controls Provide warning/advice to seek appropriate behaviour	• Left Turn Vehicle – Pedestrian Conflict	• Zebra crossings • ‘LOOK’ stencilling in path	• Create a shared zone with 30 km/h limit	• Education and awareness campaigns about right-of-way and yield laws	• Pedestrian Detection Systems
Personal Protective Equipment Use equipment					• Seatbelts, airbags • Bonnet design

to protect road users from FSI crashes					

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