Clear Zones and Environmental Wealth – the Asset Manager's Dilemma

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Abstract

The *National Road Safety Strategy 2011–2020* states that each year road crashes kill about 1,500 Australians and hospitalise another 30,000. The total estimated cost to society is $27 billion. Run-off-road crashes typically involving a single vehicle, account for about 30 per cent of all serious casualties, and a higher proportion of fatalities.

This is a major concern for Local Government which is responsible for in excess of 80% of the total road network. Around 45% of the total annual fatalities also occur on the local road network.

Councils are responsible for the design and management of their networks. However many parts of the network were designed for bullock teams and did not envisage use by current vehicles.

Austroads Has adopted a standard suggesting appropriate clear zones for use on all classes of road. Local Government is unable to meet these suggested clear zones because of a number of competing requirements: the need for minimal speed restrictions; the environmental value of flora within the road corridor; and the shortage of resources to maintain infrastructure assets in a satisfactory condition.

The IPWEA (NSW) Roads & Transport Directorate has carried out research into these issues and provided input into a number of Austroads projects.

This presentation explains the dilemma facing local government engineers and the attempts being made to address the issues, both within individual councils and more broadly through Austroads' current Safe System Projects.

Keywords

Clear zones, safe systems, local road safety, risk management, safe speeds, environmental value

Introduction

Road asset managers are faced with a 'wicked' problem in managing roadside vegetation. Simply stated, each road manager must attempt to balance the need for clear zones along all roads in the network against the significant (and sometimes high) environmental value of vegetation growing in the road reserve. Decisions must be made in an atmosphere where the political, environmental, asset management and road safety aspirations of the community are at best hazy and prone to change in emergent circumstances.

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This presentation will explain the dilemma facing local government engineers and the attempts being made to address the issues, both within individual councils and more broadly through Austroads' current Safe System Projects.

A Wicked Problem

Wikipedia[i] defines a wicked problem as:

> *… a phrase originally used in social planning to describe a problem that is difficult or impossible to solve because of incomplete, contradictory, and changing requirements that are often difficult to recognize. Moreover, because of complex interdependencies, the effort to solve one aspect of a wicked problem may reveal or create other problems.*

The Commissioner's Foreword to the Australian Public Service Commission publication *Tackling Wicked Problems A Public Policy Perspective*[ii] counsels:

> *It is important, as a first step, that wicked problems be recognised as such. Successfully tackling wicked problems requires a broad recognition and understanding, including from governments and Ministers, that there are no quick fixes and simple solutions.*
>
> *Tackling wicked problems is an evolving art. They require thinking that is capable of grasping the big picture, including the interrelationships among the full range of causal factors underlying them. They often require broader, more collaborative and innovative approaches. This may result in the occasional failure or need for policy change or adjustment.*

This suggests a possible approach to solving the road manager's problem.

The Road Safety Context

The Australian Transport Council's *National Road Safety Strategy 2011–2020*[iii], summarises the national road safety problem as:

> *Each year, road crashes kill about 1,400 Australians and hospitalise another 32,500. The total estimated cost to society is $27 billion and the direct human impacts are devastating: in addition to the many lives cut tragically short, debilitating injuries often result in*

lifelong pain, grief and suffering among road crash victims, their families and communities.

and

Run-off-road crashes, typically involving a single vehicle, account for about 30 per cent of all serious casualties (and a higher proportion of fatalities).

This is a major concern for Local Government which is responsible for in excess of 80% of the total road network. Around 45% of the total annual fatalities also occur on the local road network.

Clear Zones

A large percentage of motor vehicle accidents on rural roads are single vehicle run-off-road incidents with a significant number resulting in vehicle rollovers or collision with roadside objects such as trees or poles.

Table 4.1: Clear zone distances from edge of through travelled way

Design speed (km/h)	Design ADT	Clear zone width (m)					
		Fill batter			Cut batter		
		6:1 to flat	4:1 to 5:1	3:1 and steeper(2)	6:1 to flat	4:1 to 5:1	3:1 and steeper(2)
≤ 60	< 750	3.0	3.0	(2)	3.0	3.0	3.0
	750 – 1500	3.5	4.5	(2)	3.5	3.5	3.5
	1501 – 6000	4.5	5.0	(2)	4.5	4.5	4.5
	> 6000	5.0	5.5	(2)	5.0	5.0	5.0
70 – 80	< 750	3.5	4.5	(2)	3.5	3.0	3.0
	750 – 1500	5.0	6.0	(2)	5.0	4.5	3.5
	1501 – 6000	5.5	8.0	(2)	5.5	5.0	4.5
	> 6000	6.5	8.5	(2)	6.5	6.0	5.0
90	< 750	4.5	5.5	(2)	3.5	3.5	3.0
	750 – 1500	5.5	7.5	(2)	5.5	5.0	3.5
	1501 – 6000	6.5	9.0	(2)	6.5	5.5	5.0
	> 6000	7.5	10.0(1)	(2)	7.5	6.5	5.5
100	< 750	5.5	7.5	(2)	5.0	4.5	3.5
	750 – 1500	7.5	10.0(1)	(2)	6.5	5.5	4.5
	1501 – 6000	9.0	12.0(1)	(2)	8.0	6.5	5.5
	> 6000	10.0(1)	13.5(1)	(2)	8.5	8.0	6.5
110	< 750	6.0	8.0	(2)	5.0	5.0	3.5
	750 – 1500	8.0	11.0(1)	(2)	6.5	6.0	5.0
	1501 – 6000	10.0(1)	13.0(1)	(2)	8.5	7.5	6.0
	> 6000	10.5(1)	14.0(1)	(2)	9.0	9.0	7.5

Note: The footnotes to this table have not been reproduced here.

The risk of collision is reduced by providing a clear zone distance from the edge of the traffic lane to the object with a trafficable batter slope. Current, generally accepted clear zone distances are set out in the Austroads Guide to Road Design Part 6 - Roadside Design, Safety and Barriers Section, Table 4.1[iv], reproduced above.

It shows that a clear zone of 5.5 meters is required for a 100km/hr road with a fill batter slope of 6:1to flat and carrying less than 750 vehicles per day. This is true for State and Local Roads including unsealed roads. Since many road reserves are only 20.1 meters wide removal of all significant vegetation from the road reserve would be required. This is clearly not achievable.

Local Roads

Councils in New South Wales are responsible for the management of in excess of 143,000 km of regional and local roads. A large proportion of these roads are constructed in a road reserve 1chain wide. (1Chain = 66 feet = 20.1 meters).

The standard of construction varies considerably and is largely dependent on the function and importance of the road in the local road hierarchy. Many roads are unsealed with maintenance being carried out on a frequency determined by the need to maintain access. Other roads have sealed traffic lanes and in recent times some of the more important regional roads have sealed shoulders. Almost without exception, however, these roads do not have clear zones meeting the standard set out in the Austroads Design Guide.

Photo 1. Typical unsealed local road.

Photo 2. Typical sealed local road.

The two photographs above show two typical regional local roads. Both have 100km/h speed limits and have relatively flat runoff areas. Both have significant trees within about 1 meter of the pavement edge.

Environmental Context

In NSW the Roadside Environment Committee has produced a guideline for the development of Roadside Management Plans. This document also lists some of the NSW legislation which must

be taken into consideration in assessing the impact of works carried out within road reserves. The list includes:

- Environmental Planning and Assessment Act 1979
- Local Government Act 1993
- National Parks and Wildlife Act 1974
- Native Vegetation Act 2003
- Noxious Weeds Act 1993
- Roads Act 1993
- Rural Fires Act 1997
- Rural Lands Protection Act 1998
- Threatened Species Conservation Act 1995
- Environment Protection and Biodiversity Conservation Act 1999 (Cwlth)

The generic environmental considerations arising from these Acts could be summarized by Section 3 of the Native Vegetation Act 2003 which states:

The objects of this Act are:

(a) to provide for, encourage and promote the management of native vegetation on a regional basis in the social, economic and environmental interests of the State, and

(b) to prevent broadscale clearing unless it improves or maintains environmental outcomes, and

(c) to protect native vegetation of high conservation value having regard to its contribution to such matters as water quality, biodiversity, or the prevention of salinity or land degradation, and

(d) to improve the condition of existing native vegetation, particularly where it has high conservation value, and

(e) to encourage the revegetation of land, and the rehabilitation of land, with appropriate native vegetation, in accordance with the principles of ecologically sustainable development.

The thrust of this legislation is to retain and enhance native vegetation. Coupled with the fact that a considerable proportion of existing native vegetation occurs within road reserves, these provisions create a major management issue for road authorities.

The Roadside Environment Committee (REC)

The NSW Roadside Environment Group is a group of community and government organisations with an interest in roadside management. The Committee is funded by Roads and Maritime Services (RMS) and involves the following organisations:
Rural Fire Service
NSW Department of Lands
Country Energy

Local Government & Shires Association of NSW
Institute of Public Works Engineering Australia
Department of Environment and Climate Change (NSW)
Nature Conservation Council of NSW
Livestock Health and Pest Authorities
Roads and Traffic Authority
Rail Infrastructure Corporation
Catchment Management Authorities

Its aim[v] is:

> *.. to encourage better management of the State's roadsides and other linear reserves for the benefit of the people and the environment of NSW. We aim to provide support, advice and resources to develop the capabilities of the State's roadside managers.*

This Fact Sheet also describes the importance of roadsides as follows:

> *The roadside environment is important because it is a large area, used by almost everyone, with a variety of ecological, economic and social values. According to the NSW Roads and Traffic Authority there are more than 181 000 kilometres of public road in the State, with roadside environments making up about five per cent of the total land area of NSW. While five per cent doesn't sound very much, if you imagine putting the land surrounding our roadways, travelling stock routes and reserves together, you come up with an area equal to all of our NSW National Parks combined.*
>
> *Importantly, for many parts of NSW the roadside is the only place where native vegetation remains. These native remnants often act as habitat for plant and animals species as well as helping to prevent soil erosion and land degradation problems. The roadside can have important conservation values, especially in areas which have been extensively cleared. For example, one rural landcare group estimates that while only three per cent of original native vegetation remains in their area, 60 per cent of it survives along the roadside.*
>
> *Roadside environments are increasingly being seen by land managers as an important economic resource to help slow the effects of land degradation in rural areas. Travelling stock use the roadside as an important area for grazing, especially in times of drought. Travelling Stock Routes (TSR's) and reserves are particularly valuable when farmers must move stock over long distances to find feed. During the recent drought more than 120,000 cattle and 170,000 sheep were sustained by TSR's and reserves managed by Livestock Health and Pest Authorities (LHPA).*
>
> *The roadside provides fire fighters with strategic space for bushfire control, while council workers throughout the State also utilise the area surrounding roads as storage space for development works. It provides valuable space for public utilities such as electricity, gas and telecommunications equipment as well as opportunities for billboard advertising.*
> *Finally, the roadside has important social and cultural uses. It contains valuable heritage landmarks such as historic markers, bridges, tree plantings and Aboriginal sites. It provides space for beekeeping and collecting firewood and enables motorists to enjoy*

views of the landscape. Travellers see the roadside environment as a valuable recreational resource which also helps reduce driver fatigue.

Given all these competing and conflicting values, how is an asset manager expected to negotiate a workable solution?

A Decision Support Tool

In 2005 the REC engaged arrb to develop a tool to assist asset managers in carrying out environmental and road safety assessments of a road segment. A project report titled *Environmental clear zones on rural roads*[vi] was produced by arrb in October 2005.

In addition to the report this project developed an Excel Spreadsheet which produced a Environmental Value-Safety Risk Matrix as shown in Fig. 1.

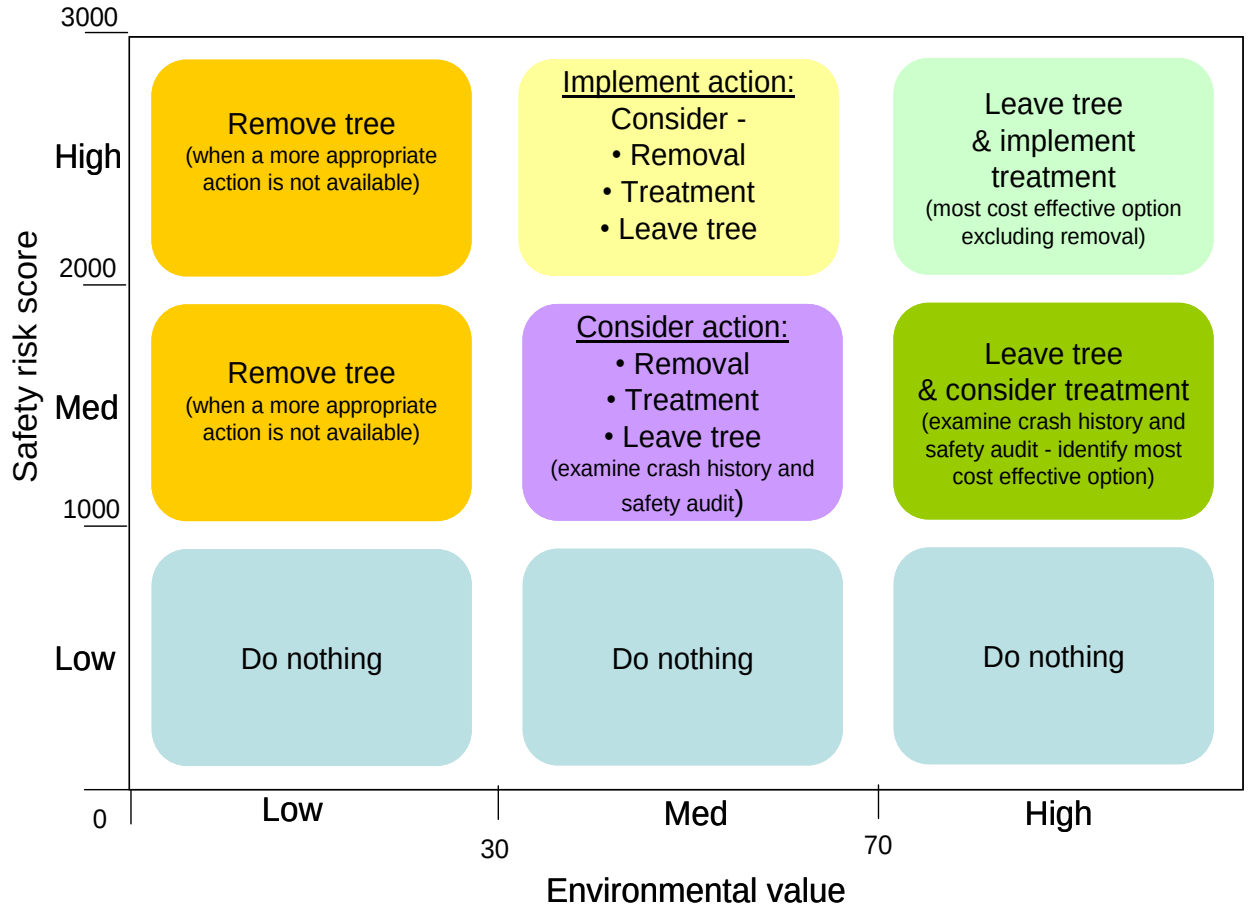

Figure 1. Environmental Value-Safety Risk Matrix

The model used to calculate the outcome within this matrix had not been field tested by arrb at the time the original report was completed. It was recommended that such testing be carried out as part of further research.

In 2010 the Roads & Transport Directorate in conjunction with four regional councils carried out an initial trial of the spreadsheet. The outcome of that research was to show that the model provides a starting point for development of a decision support system to deal with the tradeoff between environmental considerations and road safety but that more research is needed to determine an equitable balance that will be acceptable to both the community and the courts.

Safe Systems Approach

The Safe Systems approach to road safety encompasses four essential elements:

- Safe road use (behaviour)
- Safe roads and roadsides
- Safe speeds
- Safe vehicles

The road asset manager is concerned with managing two of these four elements, Safe Roads and Safe Speeds. Safe vehicles may have an impact on what is appropriate road design and a safe roadside. However the introduction of new vehicle technology has a long lead time and is only likely to provide marginal improvement in accident outcomes in the short to medium term. Safe road use, or safe road users is also outside the realm of influence of the road asset manager. The remaining two elements of the Safe System approach do not provide a solution to our original problem since there are still a number of competing considerations.

A simple solution to the problem is achievable by removal of sufficient vegetation to provide adequate clear zones OR reduce the speed limit to a speed which will result in no deaths. Simple? Not at all when our communities complain bitterly about even a modest reduction in speed limit AND if road managers propose any action to remove vegetation from the roadside. This in turn generates a political environment supportive of community views rather than technical advice.

Other tools available to manage this issue depend on the availability of adequate resources. Individual stands of trees can be protected by the installation of crash barrier or wire rope barriers. The local road network would require hundreds of kilometers of barrier to produce a significant result. How is this to be funded given that asset managers are currently only spending about half of what is needed to keep the network in its present condition? Not only does the initial capital cost have to be found but increased maintenance funding is required over the life of the barrier.

A more palatable solution is likely to result from a combination of vegetation removal and speed reduction viewed as part of a risk minimisation approach to the problem. Application of a risk model allows other factors to be taken into consideration. For example, for two physically identical roads, the risk for the road carrying 700 vehicles per day is much greater than for the road carrying 70 vehicles per day. A reduced standard of clear zone may therefore give a satisfactory outcome while minimising the need to remove extensive amounts of environmentally valuable vegetation.

Austroads Projects

The issues raised in this paper have been identified as being of concern to all road authorities across Australia and New Zealand. Austroads is currently involved in three projects dealing with Safe Systems and risk management. The dilemma facing local government asset managers has been submitted for consideration within each of these projects.

The Austroads projects can be summarised as:

Project ST1427 Improving Roadside Safety

This project is in the final year of a four year programme. The project aims to improve the safety performance of roadsides by investigating the effectiveness of:

- providing more forgiving roadside hazards, such as frangible poles
- safety barrier selection and placement including retrofitting of safety barriers for improved motorcycle safety
- protecting against impacts with roadside hazards through clear zone selection.

Project AT1691 Managing Asset Management related Civil Liability Legal Risk

Despite the positive impact of civil liability legislation enacted in most states and territories of Australia during the period 2002/03, third party (civil) claims brought by road users against road authorities remain a significant issue across Australia. The claims environment varies between jurisdictions (states and territories) and a large variation has been found in the understanding, urgency and policy responses to civil liability issues as they relate to highways.

This is a two-stage project, involving research, information gathering and the collation of current pertinent information with the objectives of:

- building on work by Austroads in 2001 following the abolition of non-feasance
- identifying policy context, case and statute law changes since 2001
- identifying any processes and measures adopted by Australian road authorities to consolidate knowledge and develop consistent understanding
- developing a detailed framework for an Austroads guidance document.

Project AT1692 Asset Management within a Safe Road System Framework

This project looks at the links between asset management and road safety. Managing road assets as an asset management discipline has become a well established practice in the last decade. However, current practice still tends to focus primarily on the physical deterioration or consumption of pavement and bridge assets. There are other aspects of road management related to the safety and wellbeing of the community that need consideration. In the field of road safety there has been a distinct shift in philosophy towards a Safe System approach. This approach is seen as the mechanism by which the ultimate elimination of death and serious injury on the road can be achieved.

A Council Approach

Berrigan Shire Council in South West NSW has addressed the wicked problem by developing a policy based on local needs and levels of service. The draft of this policy was the subject of public consultation prior to adoption by Council. In dealing with roadside trees the policy states:

> *The Austroads Guide to Road Safety – Part 9 indicates that trees of more than 100mm diameter are considered as non frangible hazards and therefore they should not be present within the area from edge of traffic lane to the required offset for minimum Clear Zone plus design lane width set out in Table 3A or within the limits of road drainage.*
>
> *There are many existing trees within this area and they should either be progressively removed or protected by guard fence. Resources will limit the amount of tree clearing and guard fencing that can be carried out and clear zone improvements will be affected by progressively working through the prioritized list, prepared following risk assessments of the road network, on a highest risk first basis.*
>
> *Other than in areas that are protected by guard fence no new trees shall be allowed to establish within the clear zone. These must be controlled by an annual inspection and spraying program.*
>
> *Areas where the road reserve is not wide enough to provide the required offset for minimum Clear Zone plus design lane width set out in Table 3A shall be progressively guard fenced with work to be prioritized on a highest risk first basis. It is likely to be many years before the low trafficked roads can be addressed.*

Table 3A provides for varying clear zone widths depending on the road classification. Local Roads generally have a clear zone width of 2 meters.

Conclusion

The seemingly simple aim of reducing traffic fatalities by reducing roadside objects presents a wicked problem for local road asset managers. The establishment of adequate clear zones on local roads requires a considerable allocation of resources and must compete for space with high environmental value remnant vegetation.

The employment of the safe systems approach provides physical solutions such a guardrail and wire rope fencing but these solutions are costly when applied to the extensive local road network. Local asset managers do not have sufficient resources to maintain the current network, the addition of new capital facilities will reduce the maintenance currently being carried out and will add to the funding requirements for the future. Extensive reduction in speed limits across the local road system might result in the desired outcome, but with little or no enforcement the community is not ready to accept this trade-off against transport efficiency.

Projects currently being undertaken by Austroads may produce further options combining the safe systems approach with a risk management framework. The outcomes of these projects will need to be reviewed to determine if a different approach can produce increased safety outcomes and acceptable environmental results within existing budget constraints.

Finally, if an improved roadside environment can produce a significant reduction in traffic deaths and serious injury there is a strong argument for allocating additional funding for this purpose on the understanding that the current cost to the community of $27 billion per year will be substantially reduced.

Inherent in these conclusions is a challenge to ACRS members to focus on this dilemma and to apply the accumulated experience of the College in suggesting possible approaches to implementing a safe systems solution to a wicked problem in a highly complex environment.

References

[i] http://en.wikipedia.org/wiki/Wicked_problem accessed 12th April 2012.

[ii] http://www.apsc.gov.au/publications07/wickedproblems.pdf accessed on 12th April 2012.

[iii] http://www.infrastructure.gov.au/roads/safety/national_road_safety_strategy/files/NRSS_2011_2020_15Aug11.pdf P. 23.

[iv] Austroads Guide to Road Design Part 6: Roadside Design, Safety and Barrier, November 2009, p.15.

[v] REC Fact Sheet Managing Roadsides 1. Assessment

[vi] *Environmental clear zones on rural roads,* arrb, October 2005.