Abstract
The Austroads Road Safety Engineering Toolkit is a free, on-line reference tool created for road infrastructure and road services practitioners. It draws together the wealth of road safety engineering knowledge, including the latest solutions adopted by various Australian and New Zealand jurisdictions. The Toolkit has been put together with state and local government road authorities in mind, where staff need easy and quick access to information on crashes and road safety deficiencies.

The Toolkit outlines the best-practice, low cost, high return road safety engineering treatments to achieve a reduction in the number and the risk of crashes.

Provision of safer roads and roadsides is a major area of gain under the National Road Safety Strategy 2001–2010, which aims to reduce the number of fatalities per 100,000 population by 40% by 2010. This aim has been backed by Austroads funded research reviews, which have been used to provide up-to-date information contained in the Toolkit.

The Toolkit may be a useful tool in preparing Black Spot Program funding applications, provision of general advice to public and in community consultation. It provides assistance in crash site analysis and in the treatment selection. It also assists in the treatment of road locations, where high risk of crashes has been identified by public, practitioners or road safety audits.

The Toolkit can be found at: www.engtoolkit.com.au
Introduction
Reduction of crashes involving road environment factors is a major area of gain under the National Road Safety Strategy 2003–2010 and an Austroads strategic priority research area.

A challenge faced by Austroads member agencies and local governments is ensuring that decisions regarding road environment safety treatments are sound and will result in the most cost effective safety outcome. The Road Safety Engineering Toolkit (the ‘Toolkit’) is the only stand-alone product in the Australasian context which succinctly outlines low cost, high return treatments which can be easily implemented to address crashes and safety deficiencies.

A number of existing technical documents advise on various aspects of road safety management, including the design of engineering measures and schemes. This project draws together that existing advice as far as possible into one document, and updates it based on the recent experience of local and state government agencies, and on the Road Safety Engineering Risk Assessment research results.

The Road Safety Engineering Toolkit is free to use and can be found at:  www.engtoolkit.com.au

The Toolkit is intended for road practitioners of all types and levels of professional experience, including: traffic and transport engineers, road maintenance engineers, asset managers, town planners, landscape architects, civil designers and community road safety officers. The Toolkit is intended to provide fundamental information regarding crashes and road features to suit those with less road safety experience, while detailed referencing of technical texts and new treatments will be of interest to more experienced practitioners.

The structure of the Toolkit allows practitioners to approach a given road safety problem from two distinctive angles: crash problem investigation and a road safety deficiency issue. Either way, practitioners are presented with a selection of treatments most likely to address the particular safety problem at hand.

Although the primary objective of this Toolkit is to focus on engineering-based treatments, the document also takes a holistic view on road safety, identifying issues such as enforcement, road user education and media campaigns.

The Toolkit has been developed progressively since 2004. This Toolkit is a ‘living’ document; it is intended to be maintained and updated regularly, so that new successful safety solutions can be captured and disseminated to practitioners. It is undergoing further development in 2007-08 financial year with content expansion and new features.

Toolkit
The current structure of the Toolkit is shown schematically in Figure 1. This structure has a two-dimensional approach to road safety problem analysis and treatment selection, as identified by the initial consultation with Austroads stakeholders and practitioners in 2004-05. The structure has evolved from these original concepts to provide more clarity in the use of the Toolkit. A third analytical approach, by road user, is being developed during 2007-08.
Thus, the user may follow the conventional black spot analysis approach by selecting the dominant crash types found at a site and exploring the information until the most appropriate treatment type for that crash type is identified. The treatment types relevant to the given crash type are listed in order of ascending cost (per typical site). Figure 2 shows a crash type scree layout.

There are 17 different crash types listed and described in the Toolkit. The types broadly follow the DCA/RUM groupings used by all Australasian jurisdictions. Each crash type provides a brief description of the crashes included in the type, discussion on the kinetics involved, the main contributing human factors and factors influencing the crash severity. There is also a listing of most common road-related deficiencies contributing to a given crash type. The user may decide to explore these deficiencies in more detail or to proceed directly to the listing of treatment types likely to reduce the frequency and severity of the crash type.
Figure 2 – crash type screen

By selecting an individual treatment type, the user may learn more about its features, benefits and implementation issues. A 'ball park' cost figure is provided along with an expected treatment life (these will vary from jurisdiction to jurisdiction, and depend on the size and quality of the individual treatments).

Figure 3 shows a typical layout of a typical treatment type.
The individual treatment types provide the expected casualty crash reduction factors. These are based on the recent overview of published road safety literature on crash countermeasures. This review was carried out under the Austroads Road Safety Engineering Risk Assessment research program between 2004 and 2007.

The Toolkit provides photographic examples of individual treatments from around Australia, New Zealand and some overseas locations.

For most treatments, there are technical references provided, some with links to internet sites containing the documents. This section is being in expanded in 2007-08 to cover all jurisdictions.

In total, the Toolkit contains 62 treatment types.

Safety deficiency approach is an alternative path for analysing on-site road safety problems. This approach focuses on identified road features, which when missing or deficient are known to contribute to increased crash risk. These are grouped by themes, e.g. curves, traffic signals, linemarking, pedestrians, signalised intersections, cyclists, etc.

For each selected safety deficiency type there is a short physical description of the deficiency and a discussion on how it impacts road user behaviour resulting in increased risk. Some discussion on factors contributing to the crash severity is also provided. The user may explore the shortlist of relevant treatment types, in order of ascending costs, which may help to remedy the deficiency and thus to reduce the crash risk.

Each safety deficiency has a number of photographic examples to assist the practitioners with its on-site identification. At any time, the user may move 'sideways' by selecting and exploring a crash type related to the given safety deficiency. Figure 4 shows a typical safety deficiency screen layout.
In total, there are 45 safety deficiencies presented in the Toolkit.

**Toolkit Uses**

The Toolkit has been developed with a broad range of road industry practitioners in mind, but is not intended to replace the current Austroads road safety publications as a source of in-depth policy and technical information. The focus on ease of use makes the Toolkit of added benefit to practitioners for whom road safety is not the main area of expertise. Those practitioners with extensive knowledge and understanding of road safety issues will benefit from the references section contained within each treatment type.

One of the key uses of the Toolkit is in black spot treatment selection. The crash type path allows navigation through various treatment types which may be applicable to treat the dominant crash problem at an intersection or a road section.

The safety deficiency path is of use in the Road Safety Audit process, where auditors can learn about information relating to the road safety issues identified at the audited project or site. Other uses of this approach include:

- network level risk assessments (e.g. NetRISK, RSRM)
- road user feedback driven investigations
- road design
where practitioners may base decisions regarding individual road features on the information provided in the Toolkit.

Further Development

In 2007-08 ARRB continues to develop the Toolkit to increase its relevance to a broader range of road practitioners. It is intended to expand its technical, research and standards references, provide practical case studies, and to add new treatment types and photographs.

A number of user interface feature improvements are being implemented, such as:

- more emphasis on road user safety driven analysis (the third approach, parallel with crash type and safety deficiency)
- new section on road safety problem diagnosis and crash site analysis
- new mechanism for a two-way exchange of best-practice case studies in road safety engineering.

Further development will also bring the Toolkit into line with the Austroads Guide to Road Safety, Part 8 – Treatment of Crash Locations scheduled for completion in 2008.