The road safety toolkit – a free online tool to assist practitioners in developing countries

Turner, B. (ARRB Group) & Smith, G. (iRAP)
Email: blair.turner@arrb.com.au

Abstract

Worldwide, around 1.3 million people die each year on the roads, and as many as 50 million people are injured. Over 90% of these deaths occur in low and middle-income countries. With increased motorisation it is expected this problem will increase unless appropriate action is taken.

This paper presents an overview of the Road Safety Toolkit, which was developed for iRAP (the International Road Assessment Programme) in association with the Global Transport Knowledge Partnership (gTKP). The toolkit is a free online tool that has been produced to provide information on safety solutions to practitioners in developing countries. It is designed to assist in selecting appropriate road, vehicle and road user solutions. The toolkit uses the Safe System approach as its basis, making reference to key global road safety documents. The paper discusses why the toolkit has been developed, the process used in the development, some of the key features of the toolkit, and how it is being used internationally to achieve improvements in safety.

Introduction

Worldwide, deaths and injuries from road traffic crashes are a major and growing public health epidemic. Each year 1.3 million people die and up to 50 million are injured or permanently disabled in road crashes [1]. This equates to over 3,500 deaths per day. For developing countries, where almost 9 out of 10 road deaths and injuries occur, road trauma represents a serious and rapidly worsening public health crisis with road traffic injuries expected to increase substantially by 2020 unless some form of action is taken [2].

In addition to the human cost of bereavement, research shows that road crashes are often the factor responsible for tipping a household into financial distress. The loss of a breadwinner due to death or disability can be disastrous, leading to lower living standards and poverty [2].

The World Report on Traffic Injury Prevention [2] (issued jointly by the World Health Organisation and the World Bank) drew attention to the urgent need for action to reduce road traffic injuries globally. A key conclusion was that, in order to achieve safer roads, a "Safe System" approach was needed.

The Safe System approach (see for example [3]) provides a holistic view of the combined factors involved in road safety. The approach acknowledges that road users are likely to make errors. It also recognises that there is a limit to the physical forces that can be withstood by road users (for instance during the rapid deceleration experienced during a crash). The Safe System approach seeks to protect responsible road users from death and serious injury by taking human error and frailty into account. It requires that roads need to be designed in a way that prevents crashes from occurring, or that in the event of a crash, that serious and fatal outcomes do not result. The Safe System approach also encourages a better understanding of the interaction between the key elements of the road system: road users, vehicles, roads and roadsides, and travel speeds.

In order to achieve Safe System outcomes, better knowledge is required by those involved in road management and delivery of road safety programs. iRAP, the International Road Assessment Program, recognises the difficulties faced by those involved in delivering safety in low-income and middle-income countries. iRAP has been active in raising the profile of road safety in these countries, by identifying high risk locations and in providing effective road safety engineering based solutions. iRAP is active in more than 50 countries and more than 300,000km have now been assessed by Road Assessment Programmes. For further information on iRAP see [4] and www.irap.org.

It was recognised by iRAP that in order to deliver effective road safety outcomes to low-income and middle-income countries, an information tool is required. Together with ARRB Group and gTKP (the Global Transport Knowledge Partnership), a Road Safety Toolkit has been developed by iRAP to meet this objective. The Toolkit builds upon a concept first developed for Australian road authorities, through

Austroads (the Austroads Road Safety Engineering Toolkit, available at www.engtoolkit.com.au, fulfils a similar purpose to this website, although is aimed at Australian and New Zealand practitioners specifically, and is aimed at providing engineering based treatments).

The iRAP Road Safety Toolkit

The Road Safety Toolkit is a free website (http://toolkit.irap.org) that provides information on measures that can be taken to improve safety on the road. It is designed to assist in providing solutions to specific types of crashes, or in response to collisions involving specific road user groups. The title screen for the toolkit can be seen in Figure 1.

Figure 1: Title screen from the Road Safety Toolkit

The Toolkit allows users to search for information on specific types of crashes, or road users using drop down menus at the top of the home page (see Figure 2). If users are already aware of possible treatments that might be used, they can also select these directly from this same screen. Information has been recently added on road safety management issues, including crash costing, data systems, and road safety management.

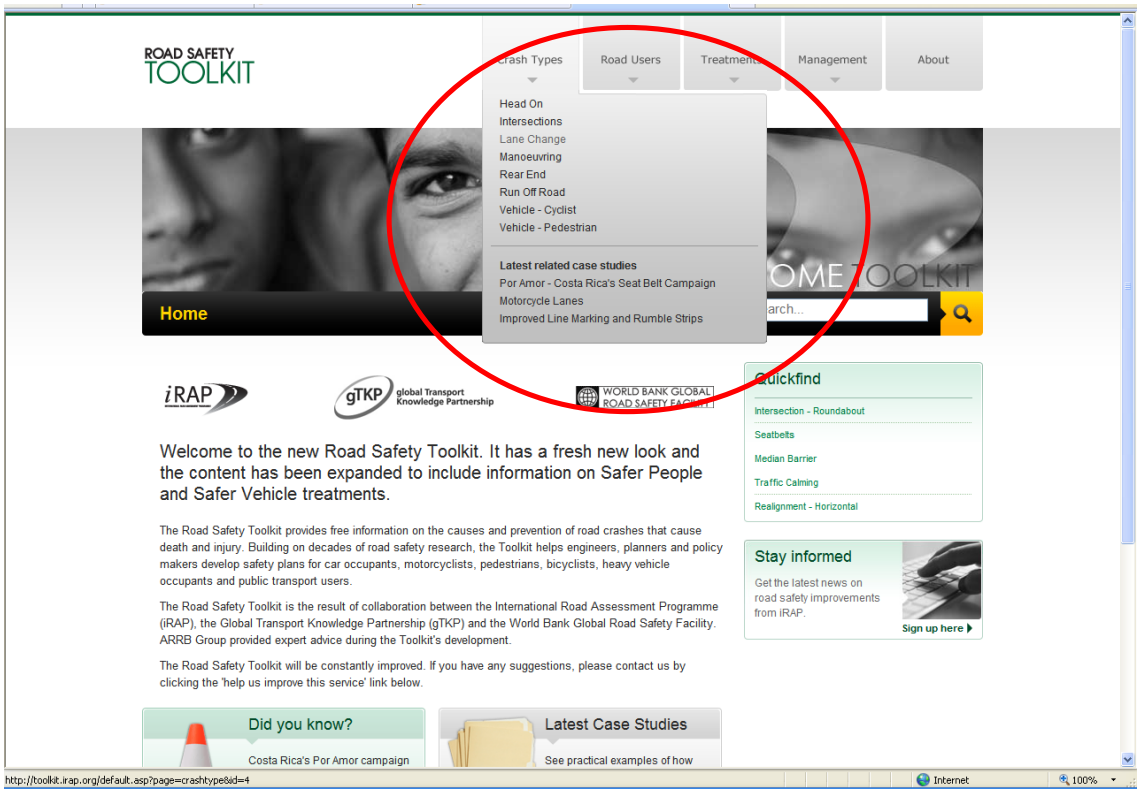


Figure 2: Search screen from the Road Safety Toolkit

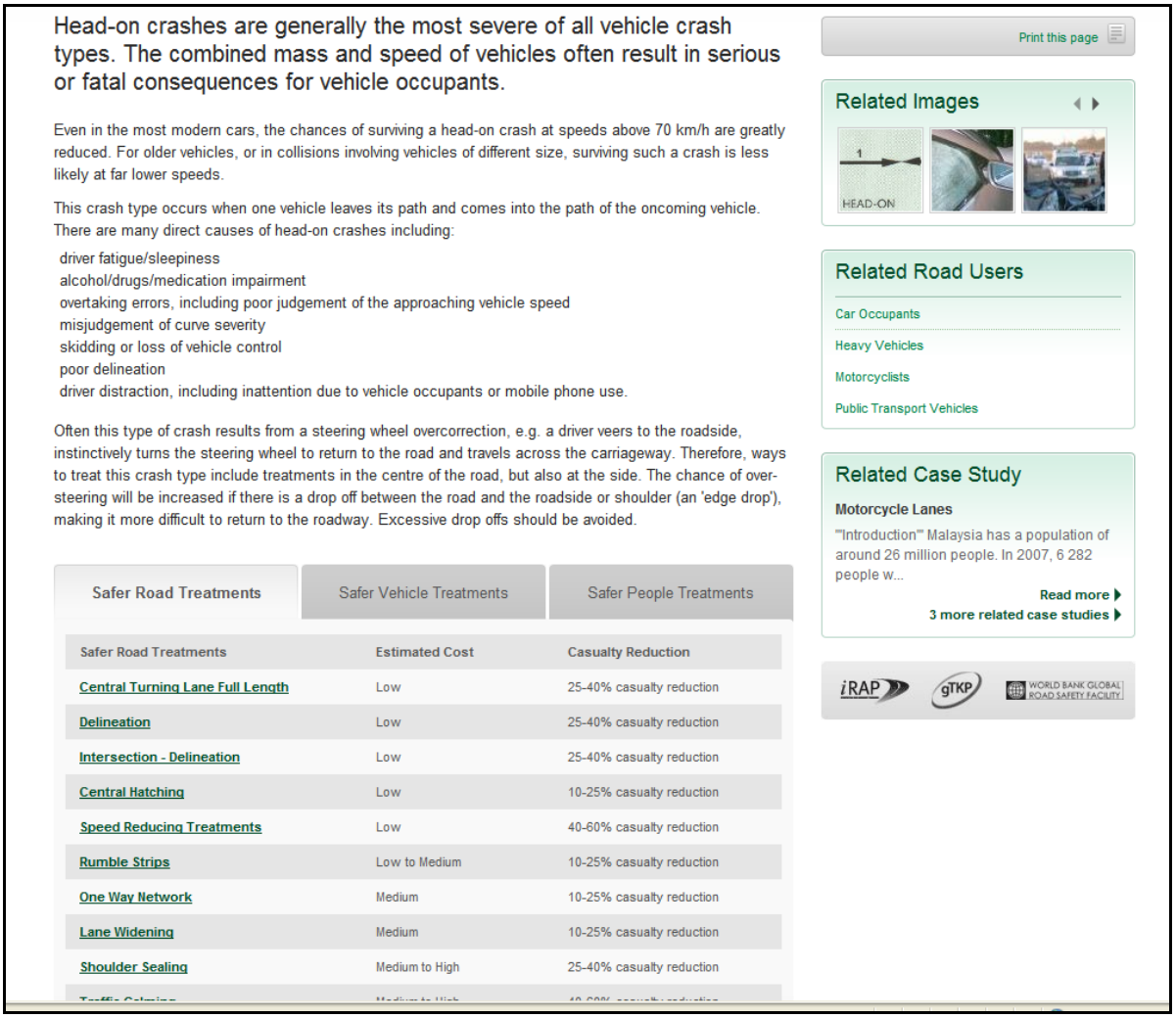
Crash types have been grouped into the following major categories:

- Head-on
- Intersections
- Lane Change
- Manoeuvring
- Rear end
- Run off road
- Vehicle – cyclist
- Vehicle – pedestrian

Safety issues relating to the following road user groups can also be selected:

- Car occupants
- Cyclists
- Heavy vehicles
- Motorcyclists
- Pedestrians
- Public transport vehicles

When a crash type or road user type is selected, information is displayed about that specific issue (see Figure 3). This information includes details about the major causes of that crash type as well as the types of treatments that can be used to address that problem.



Head-on crashes are generally the most severe of all vehicle crash types. The combined mass and speed of vehicles often result in serious or fatal consequences for vehicle occupants.

Even in the most modern cars, the chances of surviving a head-on crash at speeds above 70 km/h are greatly reduced. For older vehicles, or in collisions involving vehicles of different size, surviving such a crash is less likely at far lower speeds.

This crash type occurs when one vehicle leaves its path and comes into the path of the oncoming vehicle. There are many direct causes of head-on crashes including:

driver fatigue/sleepiness
alcohol/drugs/medication impairment
overtaking errors, including poor judgement of the approaching vehicle speed
misjudgement of curve severity
skidding or loss of vehicle control
poor delineation
driver distraction, including inattention due to vehicle occupants or mobile phone use.

Often this type of crash results from a steering wheel overcorrection, e.g. a driver veers to the roadside, instinctively turns the steering wheel to return to the road and travels across the carriageway. Therefore, ways to treat this crash type include treatments in the centre of the road, but also at the side. The chance of over-steering will be increased if there is a drop off between the road and the roadside or shoulder (an 'edge drop'), making it more difficult to return to the roadway. Excessive drop offs should be avoided.

Safer Road Treatments | Safer Vehicle Treatments | Safer People Treatments

Safer Road Treatments	Estimated Cost	Casualty Reduction
Central Turning Lane Full Length	Low	25-40% casualty reduction
Delineation	Low	25-40% casualty reduction
Intersection - Delineation	Low	25-40% casualty reduction
Central Hatching	Low	10-25% casualty reduction
Speed Reducing Treatments	Low	40-60% casualty reduction
Rumble Strips	Low to Medium	10-25% casualty reduction
One Way Network	Medium	10-25% casualty reduction
Lane Widening	Medium	10-25% casualty reduction
Shoulder Sealing	Medium to High	25-40% casualty reduction

Print this page

Related Images

Related Road Users

Car Occupants
Heavy Vehicles
Motorcyclists
Public Transport Vehicles

Related Case Study

Motorcycle Lanes

"Introduction" Malaysia has a population of around 26 million people. In 2007, 6 282 people w...

Read more
3 more related case studies

iRAP gTKP WORLD BANK GLOBAL ROAD SAFETY FACILITY

Figure 3: Information on head-on collisions

The Road Safety Toolkit includes detailed information about the road engineering measures that might be used to address the problem. These correspond with the countermeasures used in iRAP projects (see [4] for more information).

Each engineering measure that could be used to treat that crash type is listed in order from lowest cost to highest cost. Information is also provided on the expected effectiveness in terms of crash reduction (i.e. the expected percentage reduction in casualty crashes). This information is based on an extensive review of research by Austroads [5].

From the available list, users are able to select specific treatments, whether they be Safer Road, Safer People or Safer Vehicle based. A full list of currently available treatments is provided in Tables 1 to 3, while Figure 4 provides an example of a treatment page (delineation).

Table 1: Current Safer Road treatments in Toolkit

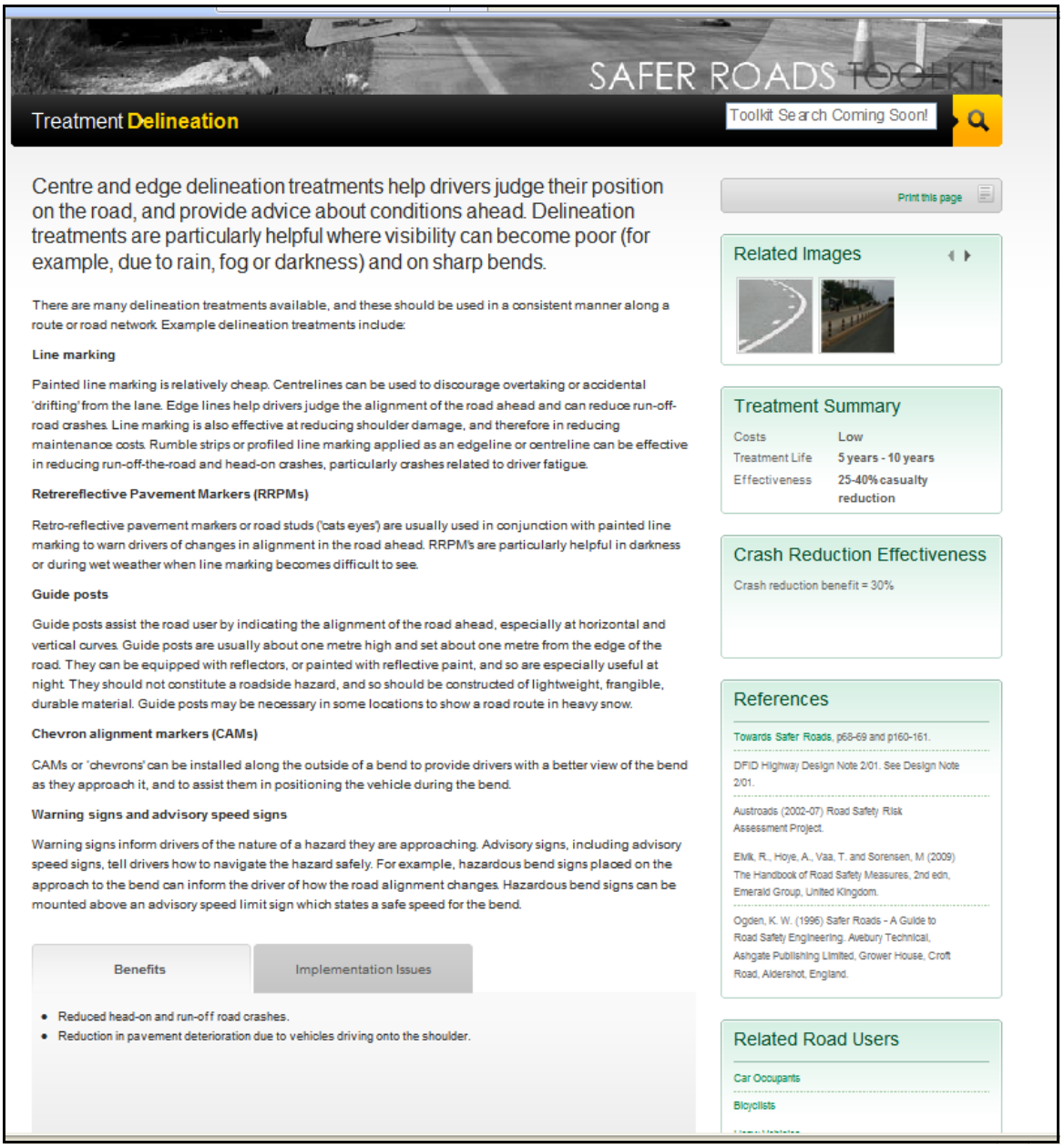
Additional lane (includes overtaking lane)	Pedestrian refuge island
Bicycle Facilities (on- and off-road)	Pedestrian crossing - unsignalised
Central Hatching	Pedestrian crossing - signalised
Central turning lane full length	Pedestrian Footpath
Delineation	Railway Crossing
Duplication	Realignment - horizontal
Intersection - delineation	Realignment - vertical
Intersection - grade separation	Regulate roadside commercial activity
Intersection - right turn lanes (signalised)	Restrict/combine direct access points
Intersection - right turn lanes (unsignalised)	Road Surface Upgrade
Intersection - roundabout	Roadside Safety - Barriers
Intersection - signalise	Roadside Safety - Hazard Removal
Lane widening	Rumble strip / flexi-post
Median Barrier	Service Road
Motorcycle Lanes	Shoulder treatment
One way network	Speed Management
Parking improvements	Traffic Calming
Pedestrian crossing – grade separation	

Table 2: Current Safer Vehicle treatments in Toolkit

Motor vehicle standards
New car assessment program
Used car safety ratings
Vehicle features and devices
Vehicle road worthiness

Table 3: Current Safer People treatments in Toolkit

Addressing alcohol and other drugs	Helmets and protective clothing
Child safety initiatives	Licensing
Education	Publicity
Emergency response	Seatbelts
Enforcement	Speed management
Fatigue management	



SAFER ROADS TOOLKIT

Treatment **Delineation**

Toolkit Search Coming Soon!

Centre and edge delineation treatments help drivers judge their position on the road, and provide advice about conditions ahead. Delineation treatments are particularly helpful where visibility can become poor (for example, due to rain, fog or darkness) and on sharp bends.

There are many delineation treatments available, and these should be used in a consistent manner along a route or road network. Example delineation treatments include:

Line marking

Painted line marking is relatively cheap. Centrelines can be used to discourage overtaking or accidental 'drifting' from the lane. Edge lines help drivers judge the alignment of the road ahead and can reduce run-off-road crashes. Line marking is also effective at reducing shoulder damage, and therefore in reducing maintenance costs. Rumble strips or profiled line marking applied as an edgeline or centreline can be effective in reducing run-off-the-road and head-on crashes, particularly crashes related to driver fatigue.

Retreflective Pavement Markers (RRPMs)

Retro-reflective pavement markers or road studs ('cats eyes') are usually used in conjunction with painted line marking to warn drivers of changes in alignment in the road ahead. RRPM's are particularly helpful in darkness or during wet weather when line marking becomes difficult to see.

Guide posts

Guide posts assist the road user by indicating the alignment of the road ahead, especially at horizontal and vertical curves. Guide posts are usually about one metre high and set about one metre from the edge of the road. They can be equipped with reflectors, or painted with reflective paint, and so are especially useful at night. They should not constitute a roadside hazard, and so should be constructed of lightweight, frangible, durable material. Guide posts may be necessary in some locations to show a road route in heavy snow.

Chevron alignment markers (CAMs)

CAMs or 'chevrons' can be installed along the outside of a bend to provide drivers with a better view of the bend as they approach it, and to assist them in positioning the vehicle during the bend.

Warning signs and advisory speed signs

Warning signs inform drivers of the nature of a hazard they are approaching. Advisory signs, including advisory speed signs, tell drivers how to navigate the hazard safely. For example, hazardous bend signs placed on the approach to the bend can inform the driver of how the road alignment changes. Hazardous bend signs can be mounted above an advisory speed limit sign which states a safe speed for the bend.

Benefits | Implementation Issues

- Reduced head-on and run-off road crashes.
- Reduction in pavement deterioration due to vehicles driving onto the shoulder.

Print this page

Related Images

Treatment Summary

Costs	Low
Treatment Life	5 years - 10 years
Effectiveness	25-40% casualty reduction

Crash Reduction Effectiveness

Crash reduction benefit = 30%

References

Towards Safer Roads, p68-69 and p160-161.

DFID Highway Design Note 2/01. See Design Note 2/01.

Austroads (2002-07) Road Safety Risk Assessment Project.

Elvik, R., Hoye, A., Vaa, T. and Sorensen, M (2009) The Handbook of Road Safety Measures, 2nd edn, Emerald Group, United Kingdom.

Ogden, K. W. (1996) Safer Roads - A Guide to Road Safety Engineering. Avebury Technical, Ashgate Publishing Limited, Grower House, Croft Road, Aldershot, England.

Related Road Users

Car Occupants

Bicyclists

Figure 4: Information on delineation

Each treatment page describes the treatment, including information on the benefits of that treatment and any implementation issues. A summary is provided on the cost of the treatment, the treatment life (i.e. how long the treatment can be expected to continue providing a safety benefit before it will need to be renewed), and its effectiveness in terms of casualty reduction. Photos are provided showing examples of the treatment (see Figure 5), and links provided so that more detailed information can be obtained from external technical sources and manuals.

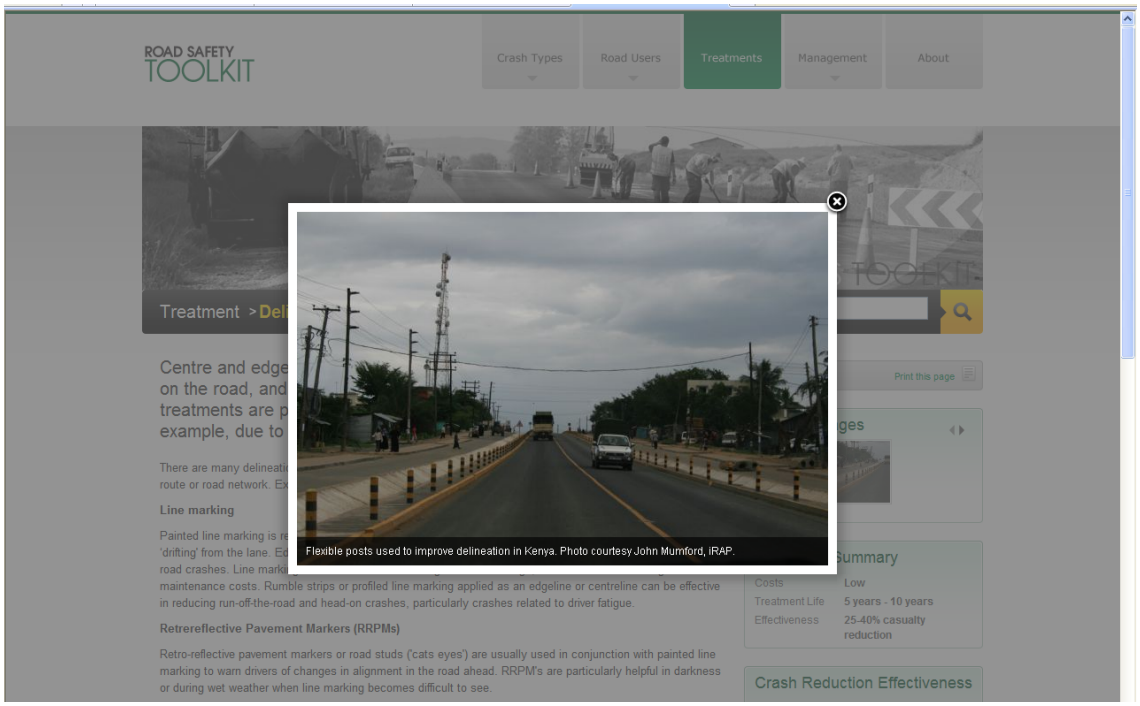


Figure 5: Photos are provided of specific engineering treatments

Data underpinning the Toolkit is derived from numerous sources. Information on crash reduction factors is primarily based on extensive research by Austroads [5], but also supplemented by other robust research, including the Handbook of Road Safety Measures [6] and Safer Roads: A Guide to Road Safety Engineering [7]. Extensive use has been made of various manuals, including:

- Towards Safer Roads [8]
- The Austroads series of Guides [9]
- GRSP guides on speed management [10] and drink driving [11].

Future Developments

In the last year the Road Safety Toolkit has been viewed by over 10,000 visitors, and has been accessed by users in more than 160 countries. It is hoped that with further refinement and additional promotion, the website will be used by an even greater number of users. The website has also been included as part of training in road safety in a number of countries, and is now included in University under-graduate courses (e.g. University of the Philippines). In line with the holistic Safe System approach, the website has been enhanced to provide detailed information on road safety solutions relating to people, vehicles and roads, in the context of travel speeds. It is hoped that in future material will be included on a broader range of issues.

The Toolkit currently has provision for the submission of case studies. Practitioners globally are encouraged to build on the limited case studies available at this stage so that the sharing of knowledge and experience occurs on a local, regional and global level. Further development will continue, with the initial priority to translate the toolkit into a number of other languages (e.g. Spanish).

Conclusions

The Road Safety Toolkit has been developed to provide comprehensive, accessible information on road safety treatments to practitioners. It is a free web-based tool that acts as a source of information on ways to improve safety specifically in developing and middle income countries. It is a 'living' document that can be easily updated in light of new treatments and methods, or to broaden the range of issues covered.

Future improvements are planned for the website, and it is hoped that these combined with additional promotion will see an increase in the usage of this important resource.

References

1. First Ministerial Global Ministerial Conference on Road Safety website, http://www.1300000.net
2. WHO 2004. World report on road traffic injury prevention. World Health Organization and World Ban. Geneva.
3. OECD 2008. Towards zero: Achieving ambitious road safety targets and the safe system approach. OECD, Paris, France.
4. McInerney, R. and Smith, G. 2009. Saving Lives through Investment in Safer Roads: The iRAP Partnership. REAAA conference paper.
5. Turner, B Imberger, K Roper, P Pyta, V & McLean, J 2010. Road safety engineering risk assessment part 6: Crash reduction factors. Austroads. Sydney, Australia.
6. Elvik, R & Vaa, T 2004, Handbook of Road Safety Measures. Elsevier, The Netherlands.
7. Ogden, K 1996, Safer Roads: A Guide to Road Safety Engineering. Avebury, Aldershot, England.
8. Ross Silcock Partnership 1991. Towards safer roads in developing countries: a guide for planners and engineers. TRRL, Crowthorne, United Kingdom.
9. see www.austroads.com.au
10. Global Road Safety Partnership 2008 Speed management: a road safety manual for decision-makers and practitioners. Global Road Safety Partnership, Geneva, Switzerland.
11. Cairney, P Collier, S Klein, R Quimby, A Shuey, R Styles, T & Taylor, R 2007 Drinking and driving: a road safety manual for decision-makers and practitioners. Global Road Safety Partnership, Geneva, Switzerland.