

The Road Safety Risk Manager – Software to Prioritise, Manage and Track Road Safety Issues on your network.

Session: Safer Roads – Investigation Tools

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1 INTRODUCTION

1.1 Background

The management of the road network to provide safe road transport is a key performance indicator for all road authorities. Its importance has been amplified by the High Court's decision that removed immunity from road authorities where an unknown deficiency on the road network may have contributed to the occurrence of a road crash or its severity. The judgement, however, recognises that duty of care does not mean that a road must be in a perfect state of repair. The key issue for road authorities is that they need to be aware of the condition of the road network, and that they should act reasonably. The factors that need to be considered by road authorities in the management of their road network relate to:

- the availability of funds
- the condition of the road network
- the need to assign priorities to projects
- the need to manage outstanding road safety issues on the road network
- ensuring that reasonable steps are taken in a reasonable time to correct and road deficiencies that may have been identified.

Significant levels of expenditure are dedicated to improving the safety of road infrastructure using engineering countermeasures. Most authorities implement a range of initiatives to improve road safety. The challenge faced by asset managers is where to direct funding so that the maximum road safety trauma reductions are achieved and the risks associated with road use are minimised.

When road safety concerns have been identified the authority requires a systematic method to prioritise the treatments identified. A difficulty facing many authorities is that

available budget provisions will often not allow for the completion of all the outstanding issues. The challenge for a road authority therefore is to plan, manage and take action to maximise the road safety return from the budget.

1.2 Benefits of pro-actively treating hazardous locations

Traditionally “engineering” road safety programs have focused on a reactive implementation of engineering safety solutions at locations that had a demonstrated crash problem (ie. Hazardous Road and Mass Action programs).

To determine the safety benefits that may be derived from pro-active road safety auditing programs, ARRB TR carried out major study for Austroads to identify and measures this benefit. The results (AP-R209¹) revealed that proposed actions emanating from audits of existing road resulted in the following:

- the analysis of a range of existing road safety audits indicated BCRs of implementing the proposed actions between 2.4:1 and 84:1.
- the BCRs of individual proposed actions within the existing road audits ranged between 0.003:1 and 460:1.
- over 78% of all proposed actions had BCRs >1.0.
- approximately 47% of all proposed actions had BCRs > 5.0.
- approximately 95% of proposed actions with a cost less than \$1,000 had BCRs >1.0.

A key element in maximising the outcomes identified through road safety audit process is to determine the order in which the deficiencies may be addressed so as to maximise the safety outcomes attainable with a constrained budget.

The Road Safety Risk Manager was subsequently developed, in association with Austroads, to be used as a tool by practitioners to prioritise the order in which road deficiencies may treated, thus ensuring that monies spent pro-actively on road safety measure will achieve optimal outcomes.

1.3 Expected RSRM Benefits

The application of the risk assessment knowledge will be expected to result in:

- reductions in the risk of road crashes / road trauma
- reductions in the risk of fatal and serious injury crashes
- economic benefits to the community as a result of fewer road crashes

¹ AP-R209. ARRB TR Report for Austroads, *Evaluation of the proposed actions emanating from Road Safety Audits* (2002).

- reductions in the risk of successful legal action against road authorities that may result from road crashes
- development of “safe road system” which will not tolerate fatal or serious crash injury outcomes, irrespective of the circumstances that lead to the occurrence of the incident.

2 THE ROAD SAFETY RISK MANAGER

The Road Safety Risk Manager software has been developed to meet these needs. The focus of the software is to provide road safety professionals with a tool to pro-actively assess road safety hazards and treatments for the purpose of prioritising actions (see Figure 1). The tool adopts a risk management approach, with the ultimate aim of maximising the risk reduction on the road network for a given budget. The software also provides a means to track the status of outstanding issues and provide managers with user friendly reporting options.

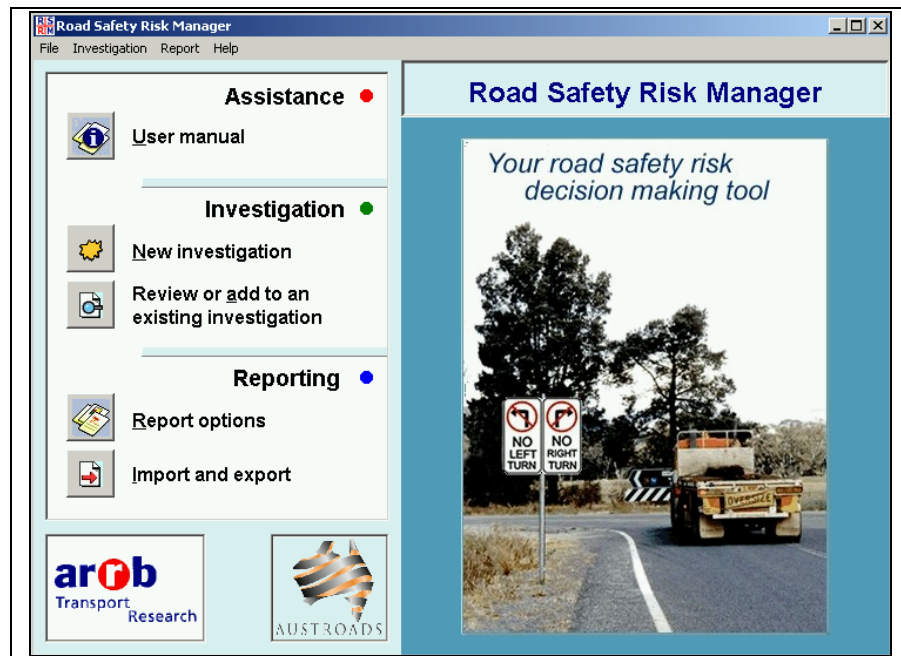


Figure 1: The Road Safety Risk Manager software

The process is based on the measurement of risk as a function of exposure, likelihood and severity, and provides users with the ability to analyse the hazard risk and the treatment risk reduction for 57 different types of deficiencies, across a variety of different road types and severity outcomes. Following inclusion of treatment costs, the derived risk reduction cost ratio forms the basis of prioritising the proposed works.

Application of the Road Safety Risk Manager is well suited to a wide range of safety issues. As an example, the findings of a road safety audit can be assessed, potential treatments prioritised and a program of works developed within the budget constraints of the authority.

Other areas where the Road Safety Risk Manager may provide assistance are:

- the prioritisation of a mass action program of works (eg guardrail; line marking; right turn lanes)
- assessment and prioritisation of safety related routine maintenance and routine inspections
- assessment and prioritisation of safety projects as part of a wider blackspot program
- in tracking the status of any safety issue and recording of any action taken (closing the loop).

2.1 The Key Components of the Process

The key components of the software include recording and analysis of:

Investigation Details

- information on the site, assessor and other project details (see Figure 2).

The screenshot shows a software window titled "Investigation Summary" with two tabs: "Investigation Details" (active) and "Hazard Summary". The form contains the following fields and buttons:

- Client:** Transport Australasia
- Study Area:** Safety Street from Lower Risk Road to Keepoutta Court
- Road Name/s and Road Number table:**

| Road Name/s | Road Number |
|------------------|-------------|
| 1. Safety Street | 3162 |
| 2. | |
| 3. | |
| 4. | |
- Purpose of Assessment:** Existing road audit or safety review
- Investigation Team:** Ben Digo, George Town, Gerald Ton, Byron Bay and Mary Borough
- Date:** 21/06/2002
- Project Ref.:** Safety-007
- Other Details:** Audit of existing road. Undulating terrain on road from mountain range towards coast. 2 crashes in last 9 months. Minister has written to us.

On the right side of the window, there are three sections of buttons:

- Hazard Assessment:** New hazard, Review existing, Duplicate record
- Investigation Details:** Edit
- Return to Home Page:** OK

A "Help !" icon is located at the bottom right of the window.

Figure 2: Investigation Summary screen

Exposure

- the number of vehicles that are exposed to the hazard and associated treatment.

Likelihood

- the length of the hazard and associated treatment
- an assessment of the general crash risk at the location
- an assessment of the risk posed by the hazard and associated treatment
- an assessment of the degree to which other factors (eg weather, skid resistance) influence the risk at the site.

Severity

- the severity of a crash if it does occur.

Treatment Cost and Risk Reduction Cost Ratio

- the initial, ongoing and any salvage costs associated with the treatment
- calculation of the risk reduction cost ratio of the treatment.

Action Taken

- details on the status of the issue (eg pending / completed)
- actual works planned or undertaken.

Reporting and Budget Analysis

- a budget analysis tool to assess changes in treatment order
- different reporting and ranking options suitable for technical review through to management summaries.

Exporting and Importing

- the ability to transfer records between users for overall program management.

The individual hazard and treatment summary (see Figure 3) provides information of all the key data entered in the hazard and treatment assessment. The appropriateness of the data entered can be reviewed from this form, and any updates to action taken recorded. All assumptions made as part of the assessment can also be documented.

The Hazard **Centre-line is badly deteriorated** ID# **02082001_112**
 Treatment **Re line-mark centre-line** Risk ReductionCost Ratio **3.1**

Summary | Exposure | Likelihood | Severity | Cost | Assumptions | Action Taken

The Hazard **Centre-line is badly deteriorated**
 Location **From 300m south of Memory Lane to Emu Downs**
 Issue Type **Line Marking: Centreline**
 Treatment **Re line-mark centre-line**

| HAZARD | | TREATMENT | |
|------------------------|---------|---------------------------|---------|
| Length | 3.20 km | Length | 3.20 km |
| Exposure | 4,500 | Exposure | 4,500 |
| Likelihood | 2.311 | Likelihood | 1.849 |
| Severity | 2.80 | Severity | 2.80 |
| Hazard risk score | 29,107 | Treatment risk score | 23,285 |
| Hazard risk score / km | 9,096 | Treatment risk score / km | 7,277 |
| | | Initial Cost | \$5,000 |
| | | Life | 3 years |
| | | Risk Reduction Cost Ratio | 3.1 |

Help !

Edit Hazard | Edit Treatment | Close and save | Cancel

Figure 3: The Individual Hazard and Treatment Summary form

2.2 Application of the Road Safety Risk Manager

These components are built into the Road Safety Risk Manager with simple wizards, look-up tables and help functions to provide a user friendly system that can be used by auditors, investigators, project managers and asset owners. Following the collection of site information, the tool allows the assessment of individual hazards and treatments in 5-10 minutes. With the reporting and budget analysis tools provided, the software can meet the specific needs of risk identification, risk management and the development of remedial treatment programs. Exporting and importing functions also allow the development of local area programs at the regional level, which can be easily incorporated into a state-wide or federal program such as the 'black-spot' initiatives. This allows the comparison and prioritisation of actions in a consistent manner across the program, providing a targeted approach to funding those engineering treatments most likely to maximise the reduction in road trauma. The software also provides a simple way to track the status of any issue or record any actions taken.

The road authority is primarily interested in treating the hazard by a range of methods including a reduction in the exposure, removing or limiting the impact of the hazard, or reducing the severity of the crash if it should occur. The cost of treatment is also an important consideration in the analysis.

The process developed provides a means of assessing the risk of the hazards before and after treatment thus providing a RISK SCORE prior to treatment and a RISK SCORE after treatment.

In essence, the desirable treatment for a road authority to undertake is that which will provide the greatest reduction in risk for each dollar spent. Projects are ranked from those that provide the greatest reduction in risk per dollar spent, to those where the risk reduction per dollar spent is minimal (refer Figure 4 for a sample report from the Road Safety Risk Manager).



| Multiple Hazard and Treatment Report Executive Summary | | | | | | |
|--|--|--|--|--------------|-----------------|--|
| | | | | | |   |
| Report generated on 19 Jul 2002 17:03 by Rob McInerney | | | | | | |
| Road Name | The Hazard | Hazard Location | Proposed Treatment | Initial Cost | Risk Cost Ratio | Status |
| Safety Street | Badly deteriorated line-marking (centreline) | Gum tree flat from Koala Corner to Wombat Drive | Upgrade centreline (with reflective beads) | \$ 3500 | 8.509 | Action Pending |
| Safety Street | Badly deteriorated line-marking (edge lines) | Gum tree flat from Koala Corner to Wombat Drive | Repaint edgelines with reflective beads | \$ 7000 | 2.250 | Action Pending |
| Safety Street | Steep embankment on edge of road | Windy Road Pass - 63.8km mark on "Snake Corner" | Install guard-rail 0.5m from travelled lane | \$ 11000 | 1.532 | Action Complete |
| Safety Street | Poor skid resistance | Next to boggy swamp corner Ch 23.4 | Resurface with high skid resistant 14mm | \$ 6000 | 0.289 | Action Pending |
| Safety Street | Sharp horizontal S bend curves | The hazard is at RRD 32.47, 2 km north of Animal Farm Rd | Realign curves and have straight section of road | \$ 175000 | 0.203 | Action Pending |
| <i>Road Safety Risk Manager version 2.02.01 Copyright 2002. ARRB Transport Research Ltd. Rob McInerney</i> | | | | | | |

Figure 4: A sample report from the Road Safety Risk Manager

3 THE RESEARCH AND DEVELOPMENT BACKGROUND

The research underlying the process commenced in 1998 and involved the following activities:

- a review of current methods for prioritising works resulting from road safety audits within Australia and New Zealand
- a review of road safety audit literature from around the world; consideration of the risk management approaches utilised in non-road industries such as health, defence and nuclear power generation
- the analysis of completed audits from around Australasia to determine the range of deficiencies identified in the road safety audit process
- investigation and analysis of the various methods and approaches to estimating risk, based on the range of deficiencies identified
- development and testing of a theoretical framework for prioritising works

- completion of two workshops with Australasian road safety experts to refine and confirm the theoretical process developed
- an extensive literature review of road safety related crash countermeasures and their effect on crash reductions. This information was used to develop the risk profile for each deficiency type.
- investigation of state and national crash rates and valuations of crash costs to enable an appreciation of base-line crash risk and typical crash severity
- finalisation of the theoretical process, and calibration of the models developed.

To facilitate a trial of the process a spreadsheet based prototype was developed by ARRB Transport Research and provided to Australian and New Zealand road authorities. This early version of the software provided a quick and simple means of applying the method to a particular road safety hazard or treatment. This version was trialled for a period of 18 months to ensure the risk based approach was appropriate for the issues being considered. Feedback from these trials was incorporated into the method and comments on the prototype software used to help develop the final Road Safety Risk Manager software.

4 SUMMARY

Formal analysis of potential road safety treatments or audit recommendations in conjunction with sound management practices and well planned remedial programs will make a positive contribution to improving safety and may also assist authorities to meet their duty of care in a responsible and transparent manner.

The Road Safety Risk Manager represents a new and innovative approach to managing safety issues on the road network and prioritising a wide range of road safety treatments. With appropriate training and use the Road Safety Risk Manager will provide road safety professionals and asset owners with a highly useful operational and management tool enabling greater confidence in road safety decision making. This will help focus the work of road asset managers to improve safety and ensure that the maximum reduction in road trauma is achieved from the investment in road infrastructure.