6 Developing solutions

Refer to Austroads Pt 4, chapter 9 for additional information on developing solutions.

6.1 Selecting countermeasures

Having identified the elements of the road and traffic environment or driver behaviour, which may have contributed to the crashes, it is now time to consider countermeasures. There are no 'general' road safety solutions; for a solution to be effective, it must be applied to a particular problem, which it is known to affect. It must be an *effective countermeasure.*

Although a large proportion of crashes are deemed to be a result of driver error, with engineering measures, it is possible to:

- modify driver behaviour
- modify the road and environment that led to the error
- make the environment more accepting of human error.

The most important aspect of developing solutions is to link the specific countermeasures to the specific problems identified. The countermeasures could include engineering, enforcement and education. Enforcement and education recommendations need to be forwarded to the appropriate agencies for programme development and implementation.

There are various sources available for identifying countermeasures that target the problems identified and showing their potential effectiveness. These include:

- Land Transport NZ monitoring analysis reports
- prior knowledge and experience of the CRS team
- Austroads Pt 4, tables 9.1–9.4
- Transit *Accident countermeasures literature review research report no 10,* 1992
- Transportation Research Board Special report 214. *Designing safer roads practices for resurfacing, restoration and rehabilitation* (1987)

- various other road safety text books and websites (as set out in Appendix A).

There are many organisations undertaking research into effective road crash reduction countermeasures. The available range of road safety engineering improvements will develop further. If a countermeasure is shown to reduce crashes overseas in conditions similar to those in New Zealand, then it may be considered for trial in New Zealand. Team leaders should contact road safety experts who have successfully used such a countermeasure and Land Transport NZ regional engineers for approval before recommending countermeasures new to New Zealand.

Typically, a CRS has focused on low to medium cost engineering solutions and these have proven to be very effective with excellent economic returns. However, in some cases a significant crash reduction may only be achieved through larger scale, more substantial improvements. If this is the case, the CRS team would generally recommend a more detailed study be carried out to investigate these more substantive options rather than to delay the overall study pending more detailed analysis.

The degree to which these more substantive solutions are developed is dependent upon the CRS brief. The RCA may widen the study brief to include consideration of medium to high cost options. The expertise of the team members may need to be broadened to accommodate this and other aspects such as traffic flow, environmental impact, mobility, accessibility and sustainability.

6.2 Estimating crash savings

Estimating the crash reductions or effectiveness of the countermeasures can be undertaken by:

- subjective assessment of crash reduction based upon knowledge and prior experience

- assessing which crashes in the crash history would be influenced by the treatment and subjectively estimating the number of crashes that might be saved

- utilising a vast amount of the national and international data available. Sources include:
  - Land Transport NZ monitoring analysis reports
  - Austroads Pt 4, tables 9.5 and 9.6
  - PEM, Appendix A6
  - Transit *Accident countermeasures literature review report no 10,* 1992
  - various road safety text books, papers and websites
  - Austroads road safety risk manager software: ARRB.

- reducing the over-represented crash numbers or rate to the national average. This would assume that the countermeasures remove the anomalies associated with the location and would not generate or leave any other abnormal crash potential.

Calculating the reduction in crashes can be undertaken by computing:

(i) a percentage reduction in the targeted crashes or crash types only

(ii) a weighted average reduction for the entire location based upon percentage reductions for each crash type and possibly potential increases in some lesser severity crash types

(iii) adjusting the severity of crashes only, eg a barrier may reduce severe injury crashes but increase minor or non-injury crashes

(iv) using the crash rate analysis to calculate the reduction of injury crashes. Crash rate models for various intersection and road forms are given in PEM, Appendix A6.

Whichever methodology is adopted, it is important that the team agree on the estimated crash savings and that they are not over-estimated. A reason for over-optimistic predictions of crash reduction could be crash migration (where the crash occurs at some other site on the network – recognising that human error may still be present).

6.3 Estimating cost of treatment

Typically, the engineering estimates within a CRS are normally of a rough order cost (ROC) or preliminary assessed cost (PAC). It is normally based upon a concept sketch for the treatment, not detailed design plans. In Transit's terms, this may be a feasibility estimate (FE) or an option estimate (OE). More detailed estimates are usually prepared at subsequent phases such as the detailed design phase or scheme assessment for larger scale projects. The estimate requirements may be linked to the source of implementation funding, eg signs and markings implemented through maintenance budgets may require little or no estimating whereas larger scale treatments requiring specific project funding may ultimately go through various stages of estimating.

The following items should be separately estimated for inclusion in the overall project cost (where appropriate):

- professional services fees for survey, design, supervision and project management if required

- construction of drainage, kerbing, pavement, sealing, traffic islands, footpaths, grassing and landscaping
- installing crash barriers, chevron boards, traffic poles, signs and signals
- moving or installing new cables, street light poles and lanterns
- traffic management during construction
- removal of existing markings
- placement of new markings and delineation
- hazard removal (eg lay new electricity cable and remove power poles)
- visibility improvement (eg trim or remove vegetation)
- land procurement costs
- on-going maintenance costs.

The project cost specified in the CRS report does not normally identify on-going maintenance costs unless they are likely to be significantly different to the do-nothing option.

6.4 Treatment ranking

Ranking of the recommended treatments within a CRS can assist an RCA to determine where limited resources are best assigned.

Various methodologies exist with RCAs for the ranking of minor safety works.

The process may be outlined in the SMS and could include:

- benefit to cost ratios
- utilising Austroads road safety risk manager software programme
- some form of subjective analysis on risk potential based on likelihood and outcome.

The RCA may require the CRS team to assist with ranking the recommendations although this is usually undertaken outside of the study as the RCA fits these within its work programme. A simple benefit cost ratio (BCR) can assist to demonstrate the worth of the project, the potential economic return to society and where the project should rank within other resource demands.

6.5 Treatment ranking economic assessment

The need for an economic assessment is dependent upon the funder's or the RCA's requirements, although as stated above it can assist with project ranking and demonstrating the value of the work.

In terms of Land Transport NZ's funding requirements:

- minor treatments funded from roading maintenance or minor safety projects categories do not require an economic evaluation

- larger or more expensive projects (requiring specific project funding requests) do require an economic evaluation undertaken in accordance with the PEM. Depending upon the value of the project, it may require either the simplified procedures or full procedures formats.

Notwithstanding the above, RCAs may require BCRs to be calculated to ensure that the recommended works are justifiable and/or to assist in the prioritisation of the works.

In most CRS economic evaluations, the emphasis is usually on the crash savings and it may not be necessary to calculate the travel time or vehicle operating costs. Exceptions are where travel speeds or intersection control strategies are altered and as a result, the safety benefits are achieved, but significant dis-benefits are also generated.

Appendix E outlines a simple economic assessment procedure that would suffice for the majority of low to medium cost CRS recommendations. The assessment period is dependent upon the likely duration of the mitigation measure. Whilst 25 years is Land Transport NZ's requirement for larger roading projects, a shorter (five or 10 year) duration may be appropriate for low-cost measures recognising the potential for future significant, environmental or traffic changes. Ongoing maintenance costs could be ignored unless they are deemed to be significant, or as a guide, the discounted present value (PV) would amount to more than 30 percent of the project cost.