

ROAD SAFETY IMPACT OF ROAD SAFETY AUDITS

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1. A BRIEF STATEMENT OF THE ISSUE

The road safety audit process is designed to pro-actively improve road safety through formal independent review of road and traffic plans, and through inspection of new and existing roads and traffic operation plans. Increasingly in recent years, road authorities in Australasia have recognised road safety audits as an effective means of either preventing crashes or reducing their severity.

2. AN ASSESSMENT OF THE ROAD SAFETY ISSUE

2.1. What are road safety audits?

A road safety audit may be defined thus:

A road safety audit is a formal examination of a future road or traffic project or an existing road, in which an independent, qualified team reports on the project's crash potential and safety performance (p. 9).¹

There are several key factors in this definition:

- auditing is a formal process and not an informal check
- auditing is conducted by someone independent of the road designer and builder
- auditing is possible during design and also following construction of the road
- auditing is restricted to road safety considerations.

Checklists are used to underpin any assessment of accident potential and safety performance. The structure and content of audit checklists may vary from jurisdiction to jurisdiction, and from task to task. Six checklists are recommended by Austroads for use in Australia, for example, mainly to be used at various stages during road design and construction.

Road safety audits may be conducted from the perspective of different key road user groups (e.g. older people, pedestrians, cyclists).

2.2. The benefits of road safety audits

As road safety audits have developed in Australasia and overseas over the past decade, the process has been subject to monitoring and review. However, until recently there has been no evaluation of their expected safety benefits in Australasia. As safety practitioners seek to minimise road trauma, it is important to know what 'value for money' road safety audits can deliver. In order to identify and measure the benefits achieved by road safety audits in Australia, Austroads commissioned ARRB Transport Research to undertake a major investigation to determine their economic value.²

In evaluating the proposed actions emanating from road safety audits, a significant level of estimation has been required to predict the crash savings accrued. Individual audits also vary considerably in the number and crash cost reduction potential of the issues that are identified. As a result, the valuation of benefits identified in this project should be considered indicative and not definitive.

The evaluation of recommendations emanating from **design stage audits**, resulted in the following findings²:

- Of the nine design stage audits assessed, the overall benefit cost ratio (BCR) of implementing the recommendations from individual audits ranged from 3:1 to 242:1.
- Individual recommendations within the design audits exhibited BCRs between 0.06:1 and 2,600:1.
- This analysis indicates a wide range in BCRs for individual recommendations and considerable variation between design stage audits investigated.
- The high variance of audit results may be expected, with the outcome highly dependent on the number and type of deficiencies identified and the cost of associated recommendations in each audit.
- Over 90 per cent of all implemented recommendations had BCRs exceeding 1.0.
- Around 75 per cent of all implemented recommendations had BCRs exceeding 10.
- The majority of design audit findings required only very low-cost responses (65 per cent of recommendations had a cost of less than \$1,000). Of these low-cost responses 85 per cent had BCRs exceeding 10.

The evaluation of the proposed actions emanating from **existing road audits** resulted in the following findings²:

- The analysis of a range of existing road safety audits indicated BCRs between 2.4:1 and 84:1, when considering the value of completing the proposed actions.
- The BCRs of individual proposed actions within the existing road audits ranged between 0.003:1 and 460:1.
- The analysis also indicated a wide range of potential safety benefits within an individual audit and between different audits. This result may again be expected with the deficiencies identified (and subsequent actions) specific to individual locations.
- Over 78 per cent of all proposed actions had BCRs exceeding 1.0.
- Approximately 47 per cent of all proposed actions had BCRs exceeding 5.0.
- Over 50 per cent of all proposed actions had a cost of less than \$5,000. Eighty-seven per cent of these actions had BCRs exceeding 1.

The completion of design and existing road safety audits will also result in other qualitative benefits, including:

- identification of improved design, construction and maintenance standards that influence safety performance on an ongoing basis across the road network generally
- the role the audit plays in improving the general road safety awareness of operational staff
- the role the audit plays in providing the designer/asset owner with confidence in the safety performance of the proposed project or road network.

An audit with no deficiencies identified will still retain significant value in providing an assurance of safety.

3. CURRENT PRACTICES IN AUSTRALASIAN JURISDICTIONS

Road safety audits have been implemented differently by each road authority.

- In New Zealand, Transit New Zealand requires audits for at least 20 per cent of new state highway projects annually. Despite the absence of formal requirements, a growing proportion of local authorities also undertake audits. Transfund undertakes high-level audits of the safety performance of the existing road network in Transit NZ regions and for local authority areas.
- Queensland (Queensland Department of Main Roads) has recently drafted a Road Safety Audit Selection Matrix. In summary, new projects exceeding \$5 million are required to be audited at all stages. For projects of less than \$5 million, audits are required at Stages 2 to 5. Traffic management, crash remedial and development projects all need to be audited at the detailed design and pre-opening stages. For existing roads, broad network-level safety audits are required in each District every five years, with patterns and priority areas identified and detailed audits undertaken and responded to, as needed.
- Transport SA has a corporate procedure and operational instruction relating to road safety audits, including a requirement for Project Managers to assess the number of audits required during a project as part of a risk management process. An audit at the detailed design stage is required for any project with changes in road alignment or the erection/alteration of roadside structures. For complex projects involving high volumes of traffic, audits are required at least twice during the project cycle. Network audits have been undertaken on all sealed Transport SA roads.
- In Victoria, VicRoads is required to conduct road safety audits at all stages for projects exceeding \$5 million and at a minimum of one stage for 20 per cent of all other projects. In addition, existing route audits are required to be undertaken on the worst 30 per cent of the declared network, as part of the Road safety investigations program conducted by VicRoads.
- In New South Wales, the Road Transport Authority has a policy which sets out minimum requirements for road safety audits on road construction and reconstruction projects. Road safety audits of selected stages are required for various work types when project costs exceed the minimum level specified in the policy. For example, detailed design and pre-opening road safety audits are mandatory for road constructions and re-constructions of over \$2 million. Additional audits are also undertaken at various stages of each project.
- Main Roads Western Australia generally requires that audits are conducted for all projects exceeding \$100,000, for all new roads, at fatal crash sites (where warranted), at hazardous locations (being the worst 10 per cent by crash/injury type), and on 10 per cent of the existing road network.

- The Department of Infrastructure Energy and Resources (Tasmania) undertakes road safety audits on the designs of all major projects and blackspot projects. Audits on existing roads are now limited, with the main emphasis being to complete works recommended by earlier audits.
- The ACT (Department of Urban Services) does not currently have a formal policy regarding road safety audits but this is expected to change in the near future.
- The Northern Territory Department of Transport and Works has adopted the road safety auditing process in an informal manner. Currently, the Department is in the process of implementing road safety audits as part of its policies and practices.

4. A REVIEW OF THE RESEARCH

A review of the available literature supports the Macaulay and McInerney² finding that road safety audits are, in most instances, cost effective. While a number of reports quote various qualitative benefits such as safer roads, better design practice and reduced whole-of-life project costs, only four studies were identified where the economic benefits of road safety audits have been quantified:

- Surrey County Council in the UK³ undertook a study of 19 audited and 19 non-audited traffic schemes. Comparisons were made between the casualty crash reductions achieved as a result of the projects. For sites with audited schemes, the average number of casualties dropped by 1.25 per year (from 2.08 to 0.83) while the change in casualty crashes at the unaudited sites dropped by only 0.26 per year (from 2.60 to 2.34).
- The UK Highways Administration commissioned a study of 22 trunk road projects audited at the design stage. The evaluation consisted of comparing the costs of implementing safety recommendations made by the audit at the design stage, with the costs of making changes after the project was constructed. In effect, it investigated the potential disbenefits of not auditing a project, rather than the benefits of auditing a project. It was assumed that the cost of incorporating audit recommendations into the design was minimal, and they were excluded in the analysis of costs. The cost benefit calculated for the evaluation was the cost of implementation of works after the completion of the project (not allowing for traffic management costs), less the cost of conducting the audit. For the 22 audits, the total cost of the audits was £45,785 (A\$115,000) and the total estimated cost of implementing works after project completion was £296,000 (A\$740,000), giving a total estimated saving of £250,215 (A\$625,000) or an average saving of £11,373 (A\$28,000).
- In Denmark, a study was undertaken on 13 projects using crash prediction methods to estimate expected crash rates if road safety audit recommendations had not been implemented at the design stage. The results of the analysis showed that the total costs and estimated casualty savings for the 13 projects gave a first-year rate of return of 146 per cent. The rate varied considerably from one audit to another, but in all cases was above 105 per cent. Schelling⁴ considered that the crash reduction might have been slightly over-estimated but that, even with a variation factor of two, the first-year rate of return would still be 137 per cent.
- A study in Jordan⁵ focused on investigating newly-constructed sites with demonstrated crash problems. The study considered the potential benefits if the sites had been audited, assuming the audit would have identified the underlying safety problem and the changes made at the design stage. Based on these assumptions, the first-year rate of return of conducting design stage audits was estimated to be 120 per cent.

4.1 Political, social and other factors

The costs of responding to audit recommendations at the design stage are relatively modest: at least some of the changes require no more than altering a pencil line on a plan, compared to changing lengths of concrete or asphalt on the road. Further, the solution to a safety problem is more likely to be complete if tackled at the design stage, whereas post-construction solutions often need to be compromised by other factors. For economic as well as humanitarian reasons, therefore, road safety audits place the greatest emphasis upon 'getting it right' before, rather than after, road construction.

Because road safety audits at any stage aim to deliver positive safety benefits in a pro-active manner (as distinct from blackspot programs, for example, which are essentially reactive), the community is spared the personal trauma associated with road crashes by early identification and correction of safety problems.

To ensure that the limited monies spent on addressing safety issues identified through the road safety audit process deliver optimal safety benefits, it will be necessary to ensure that deficiencies to be corrected are prioritised so as to maximise crash risk.

5. CONCLUSIONS

Road safety audits represent a major, cost-effective engineering tool in preventing road trauma.

REFERENCES

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- ⁵ Al-Masaeid, H. R. (1998). Effectiveness of Road Safety Audit. *Proceedings of the Road Safety in Europe Conference*, Bergisch Gladbach, Germany, September 1998.