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TECHNICAL NOTE

COMMON FINDINGS OF ROAD INFRASTRUCTURE SAFETY ASSSESSMENTS (RISAs)

Author & Presenter

Ian Appleton, PhD, FIPENZ (presenter)
Principal Safety Auditor
Performance Monitoring Unit
New Zealand Transport Agency
Ian.appleton@nzta.govt.nz

ABSTRACT

RISA is a practical evidence based tool for assessing the contribution that road infrastructure features make to road safety. It is a network risk assessment tool. To date it has been developed for sealed rural roads. NZTA (and its predecessors) developed RISA to fulfil its responsibilities to monitor the performance of road controlling authorities in respect of road safety.

In 07/08 RISA was trialled for use as the road safety input into Technical Reviews, and as a result RISA became fully operational in 08/09. RISA is now the formal road safety input into NZTA's Technical Review programme.

This Technical Note describes the common themes emerging from the RISAs conducted in 08/09. The RISA methodology includes scenario testing where the effect of an RCA implementing specific programmes can be assessed. The Technical Note includes an indication of which engineering programmes are most effective in reducing the road toll on the network.

COMMON FINDINGS OF ROAD INFRASTRUCTURE SAFETY ASSESSMENTS (RISAs)

INTRODUCTION

Purpose

The purposes of this Technical Note are to provide the common themes emerging from the RISAs conducted in 08/09 and to indicate which engineering programmes are likely to be most effective in reducing the road toll on rural road networks.

What is RISA?

RISA is a practical evidence based tool for assessing the contribution that road infrastructure features make to road safety. It is a network risk assessment tool. To date it has been developed for sealed rural roads.

The RISA methodology has been described in previous conference papers, for example Appleton (2009) and will not be described here.

Application of RISA

NZTA has a statutory responsibility to audit the performance of road controlling authorities. It has a programme of Procedural Audits and Technical Reviews within its Performance Monitoring Unit to fulfil this responsibility. In 07/08 RISA was trialled for use as the road safety input into Technical Reviews, and as a result RISA became fully operational in 08/09. RISA is now the formal road safety input into NZTA's Technical Review programme.

RISA Outputs

RISA uses the assessment of infrastructure features on a stratified random sample of roads to create:

- Personal Risk (risk to the individual driver) and Collective Risk (risk to all road users) for each road
- Network Risk Number – the Collective Risks scaled up to the whole network. It is an abstract number and relates to the number of crashes on the network
- “What if” scenario testing – the effect of various network wide treatments by changing the input data.
- Intersections – RISA uses a compliance with good practice tests relating to sight distance, design and maintenance issues
- Recommendations – the RISA team uses these data and their own experience to formulate practical cost-effective recommendations.

Common Themes

This Technical Note will describe the common themes from the 12 RISAs conducted in the 08/09 programme. Each theme will not apply all 12 Local Authorities.

GOOD POINTS

The RISA outputs are not all bad news. RISA teams comment on areas where the Council appears to do well. The aspects mentioned most frequently are (in order):

1. Pavements appear to be sound and well maintained (9 out of 12)
2. Delineation, where installed, is to a good standard (5 / 12)
3. Delineation is well maintained (5 / 12)
4. Intersections designed to good standards (5 / 12)
5. Road signs are in good condition (5/12)
6. Road markings are in good condition (5 / 12)
7. Most intersections are conspicuous (4 / 12)
8. Good clear zones where topography allows (3 / 12)
9. Good alignment where topography allows (3 / 12)

RECOMMENDATIONS

Recommendations are always pitched at the network-wide actions. Generally they are phrased in terms of policies and programmes and use words like “review”, “consider”, “develop and implement”.

Policies and Road Hierarchy

Some recommendations have embedded within them a view that Councils do not have policies (on particular subjects) that are based on roading hierarchy and/or traffic volumes. If Councils do have such policies, then the infrastructure does not obviously reflect the policy.

All reports contain a statement about prioritising the report’s recommendations on the basis of traffic volumes and function. There is no expectation that all recommendations will be implemented on all roads, or implemented immediately.

Lane and Shoulder Widths

A very common finding is that sealed shoulders are narrow or non-existent. A lack of standards was identified in 5 out of 12 reports. Providing sealed shoulders is expensive and cannot be justified on lower volume roads. The recommendations typically say ”widen seal as part of the rehab programme where practical”.

Roadside Hazards

Another consistent recommendation is to develop a programme to remove or protect roadside hazards. Recommendations recognise that Councils have difficulty dealing with power poles. The types of hazards mentioned frequently are trees, poles, culvert headwalls, fences, bridge ends, cattle underpasses, drop-offs and drainage features. New trees on road reserve are identified in two reports.

Horizontal Alignment

The most common observation is about inconsistent curve warning signage; inconsistent in both which curves have signs and what signs they do have. Recommendations are phrased around having a policy on the application of signs and a consistent application according to guidelines.

Improving geometry is a more satisfactory treatment for out of context curves but this can be expensive. Half the reports recommend the possibility of improving geometry while undertaking pavement rehabilitation.

Delineation

While delineation was mentioned in 5 reports as a “good point” (see above), it still appears consistently in recommendations. Standards are not applied in a consistent manner and standards do not always match the road hierarchy and/or traffic volumes. Recommendations stress developing a policy for delineation (RTS5 is the current guideline) and a programme for the installation of delineation in a consistent way. What delineation is installed is often well maintained.

Intersections

Improving sight distance is the most common recommendation although 5 out of 12 reports identified the design of intersections as a “good point”. Improving sight distance is expensive if it involves earthworks but is relatively cheap if only vegetation control is needed.

The second most common recommendation is about flag lighting. Flag lighting is not provided on many rural intersections and cannot be justified economically on low volume roads. Recommendations are generally phrased around considering a programme of the installation of flag lighting where it can be justified.

Gravel migration is the third most common observation at intersections. The same applies to drive-ways. The recommendation here is to seal the side roads (where the side road is unsealed) or to improve the maintenance.

HOW ARE THE MOST EFFECTIVE RECOMMENDATIONS IDENTIFIED?

Network Risk Number (NRN)

As noted above RISA calculates the NRN. It is an abstract number and represents the contribution that the infrastructure features make to the number of crashes on the network. At present RISA calculates the change in NRN for prescribed network wide treatments and presents the result as a percentage change in NRN.

These percentage changes give a clue about the magnitude of the benefits from different treatments. It is a coarse calculation. It is not intended that the treatment will be implemented exactly as stated or on all roads.

The NRNs for different authorities cannot be compared as the NRN is network dependent. Therefore it may not be valid to average the percentage reduction in NRNs across the 12 RISAs. The first presentation is on maximum and minimum values of the percentage reduction in NRN (Table 1).

Table 1: Percentage reduction in NRN for prescribed network treatments

Treatment	Increase Shoulder width to 1m	Increase lane width to 3.25m	Protect Point Roadside Hazards	Protect Severe Roadside Hazards	Realign Severe Curves to Moderate	Install curve Warning Signs and Chevrons	Install Delineation to RTS5
Maximum	11.35	8.35	2.69	0.73	4.26	2.53	3.46
Minimum	6.31	0.32	0.82	0.1	0.65	0.32	0

This analysis shows that the three treatments with the greatest benefits are likely to be, in order,

1. Increase Shoulder width to 1m
2. Increase lane width to 3.25m
3. Protect Point Roadside Hazards

However, these are the more expensive options, and other less-effective treatments may be more cost-effective.

In the second analysis, within each RISA, treatments are given a rank order from 1 = highest percentage reduction in NRN to 8 = lowest percentage reduction in NRN. Their rank orders are averaged across all RISAs as shown in Table 2.

Table 2: Rank orders of % reduction in NRN for prescribed network treatments.

Treatment	Increase Shoulder width to 1m	Increase lane width to 3.25m	Protect Point Roadside Hazards	Protect Severe Roadside Hazards	Realign Severe Curves to Moderate	Install curve Warning Signs & Chevrons	Install Delineation to RTS5
Average	1.0	4.2	3.3	6.4	3.4	5.2	4.6
Highest	1	2	2	4	2	3	2
Lowest	1	7	6	7	5	6	8=

This analysis provides a slightly different order,

1. Increase Shoulder width to 1m
2. Protect Point Roadside Hazards
3. Realign Severe Curves to Moderate

Again, these are the more expensive options, and other less effective treatments may be more cost-effective.

Intersections

For intersections RISA uses a pass/fail test for compliance with good practice. RISA assesses sight distance, design (Table 3) and maintenance (Table 4) issues. Results are presented as the average, the maximum and the minimum percentage pass rates across all RISAs.

Table 3: Intersections: Safety Related Design Assessment: % pass rate

Feature / Percent pass rate	Sight distance	Lane widths & tracking	Street Lighting	Intersection Conspicuous	Turning paths clearly defined	Free of other safety design issues
Average	65.1	81.8	26.7	81.3	80.1	77.2
Maximum	92	95	56	100	95	100
Minimum	32	61	0	56	28	39

With the exception of flag lighting, these data are encouraging. The sight distance test usually fails because of topography, which can be expensive to fix. Flag lighting is hard to justify on low volume roads, so the low pass rate is to be expected.

Table 4: Intersections. Safety Related Maintenance Assessment: % pass rate

Feature / Percent pass rate	Roadmarking is OK	Surface free of damage or flushing	Free of any loose chip or detritus	Free of Excessive Edgebreak	Free of any obvious stormwater issues
Average	64.0	65.7	52.1	71.1	76.8
Maximum	89	93	100	88	89
Minimum	25	38	13	44	50

These data are not so encouraging. There is room for improvement with the maintenance of intersections. About half of the intersections have loose chip and about one-third have poor maintenance of roadmarkings and pavement surface.

CONCLUSIONS

This Technical Note has identified the common themes emerging from the 08/09 series of RISAs. Many authorities are making a good effort to provide a safe infrastructure e.g. delineation, where installed, is well maintained. However there is room for improvement in the following aspects:

1. Some councils do not appear to have policies relating to road hierarchy or traffic volume
2. Sealed shoulders are narrow or non-existent
3. There are many unprotected hazards
4. Curve warning signage is inconsistent
5. Delineation standards are inconsistent
6. The maintenance of intersections can be improved.

The RISA model found that the most effective treatments are also the most expensive e.g. increase shoulder widths; protect hazards and realign severe curves. The most cost effective treatments may be those that are less effective but less expensive too e.g. Install curve warning signs and installing delineation to RTS5.

REFERENCES

APPLETON, I. (2009) Road Infrastructure Safety Assessment, *4th IRTAD Conference, 16-17 September 2009,* Session 6, Paper 1, Seoul.
http://www.internationaltransportforum.org/irtad/pdf/seoul/6-Appleton.pdf

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