ARRB has completed a six-year program of research on road safety engineering risk assessment. This Austroads-funded research aids in assessing crash locations and prioritising appropriate treatments to reduce risk within the available budget.

The research program delivered several other practical applications:
- the Australian Crash Rates Database
- various risk assessment models, and
- the Road Safety Engineering Toolkit.

The forum will present the key findings from the research program.
Austroads Road Safety
Engineering Risk Assessment
Project
Blair Turner
Chris Jurewicz

Overview
• Road safety context
• What is risk assessment about?
• Crash reduction factors
• Using multiple countermeasures

• Road design and safety
• Crash rates database findings
• Maintenance and safety
• Dissemination

ARRB Group
• Formerly Australian Road Research Board
• Almost 50 years old
• Not for profit
• Government owned
• 220+ staff
• Safety, traffic management, road design, parking, transport economics, asset management, pavements, road surfacing

ARRB Group
• Current / recent road safety engineering projects
  – Austroads Guide to Road Safety; Road Design, Traffic Management
  – Heavy vehicle safety (rural; urban)
  – ITS and VMS
  – Evaluations of new initiatives (e.g. centre of road wire rope barrier)
  – Roadside safety
  – Local government road safety
  – Speed (safe systems; rural treatments; network operations; intersection design)
  – Road safety engineering risk assessment

Guide to Road Safety
Part 1: Road Safety Overview
Part 2: Strategy and Evaluation
Part 3: Speed Limits
Part 4: Local Government and Community Road Safety
Part 5: Road Safety in Rural and Remote Areas
Part 6: Road Safety Audit
Part 7: Road Network Risk Assessment and Management
Part 8: Treatment of Crash Locations
Part 9: Roadside Hazard Management

Other Guidelines
Guide to Traffic Management

Road safety context
• 1.2 million deaths per year worldwide
• 50 million injured
• Australia – 1400 per year die
• Victoria – 300 deaths per year

Figure 1: Road deaths per 100,000 people for OECD nations and Australian states/territories, 2003
What is being done?

- New national road safety strategy
- Safe Systems
- Speed management strategy
- Treat existing crash locations
- Network improvements in infrastructure

Risk assessment - overview of research

- Six years of research (Austroads funded)
- Over 40 ‘sub’ projects
- Key themes:
  - Risk assessment
  - Road design elements
  - Crash reduction factors
  - Economic evaluation in road safety
  - Safety on specific road types (rural roads, unsealed roads, local roads)
  - Crash rates
  - Maintenance and safety

What is a ‘risk based approach’ to road safety?

- Traditional approach: treat crash sites
- However, harder to treat existing crash locations
- Additional approach - risk assessment:
  - Identifying high risk locations by examining road and roadside features, and assessing the level of risk inherent in those features
  - Research program to support this assessment
  - Various tools – e.g. AusRAP, NetRisk, RSRM

Risk reduction for various safety treatments

- Estimating crash reduction benefit in Australian and New Zealand context
- Literature reviewed on over 40 priority issues resulting in around 100 crash reduction factors
- Interested in overall effectiveness, but also effect in different environments
  - e.g. rural versus urban, intersection versus mid-block

Risk reduction for various safety treatments

- Delineation (e.g. RRPMs, guideposts, line marking)
- Intersection issues (e.g. advanced warning, right and left turn lanes, red light cameras, roundabouts, signal timing, signal visibility, splitter islands)
- Signs
- Street lighting
- Speed limits
- Traffic calming

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<th>Issue</th>
<th>Environment type</th>
<th>% Reduction</th>
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<td>Rural road - all environments</td>
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<td>Splitter island - rural</td>
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<td>Type A, B, C + intersection</td>
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<td>Splitter island - X intersection</td>
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Risk reduction for various safety treatments

- e.g. splitter islands at intersections:
Risk reduction for various safety treatments

- Only a low level of confidence in many (around half) of estimates
- Gaps in knowledge identified
- Rating scale could be used to inform funders as to quality they should expect from research
- Be careful where you get your information from

Economic evaluation in road safety

- A number of projects relating to this topic:
  - Multiple countermeasures
  - Crash costs
  - Treatment life
  - Treatment cost
  - Mass action programs

Economic evaluation - key findings

- Multiple treatments
  - Most treated sites use multiple countermeasures
  - Can’t simply add benefits together
  - Analyse clusters of treatments in future

Road design elements and safety

- Important to understand implications of design decisions
- Highest standards typically mean highest cost
- How do changes in design influence safety?
- Extensive review of literature and data analysis on this topic
**Literature review**

- Identified road design elements that affect road safety:
  - horizontal and vertical alignment
  - sight distance
  - cross section (including pavement width and shoulder type)
  - roadside elements (e.g. clear zones)

**Road design elements and safety**

*e.g. horizontal alignment – curve radius*

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**Crash Rates Database**

Created to bridge gaps in road safety indicators:

- Provide nation- and state-wide casualty crash rates
- Create engineering-based crash risk factors
- Road specific road trauma costs
- Individual crash risk (per 100M VKT)
- Collective crash risk (per km or per site)
- Objectively measure safety performance of any intersection or link
... now the crash cost rates

Divided urban arterial Crash Rate Function (CRF), Victoria

Divided urban arterial Safety Performance Function (SPF), SA

Influence of major & minor intersection flows on crashes, VIC

Combined horizontal & vertical curves - effect on safety
Use of crash rates database + GipsiTrac geometry information

A whole lot more...
- Geo-spatial analysis of crash costs
e.g.: combine with socio-economic factors, climatic conditions, road expenditure, maintenance, etc
- Crash prediction models
- Economic evaluation of programs & projects
- Policy development, support
Road asset condition and safety

Issue 1: Effect of asset condition on crash risk

Issue 2: Recognising safety gains from good asset management practice

Effect of asset condition on crash risk

- Knowing the assessment level of the asset
- Relationships – empirical, theoretical, human factors
- At what assessment level is safety reduced?
  Assumptions:
  - an asset below critical level might as well not be there
  - effect of renewing an asset is equal to providing one where none existed.

Roughness and crash rate

Macrotexture and crash rate

Line marking

- Minimum acceptable retroreflectivity 100 mcd/lux/m²
- Studies show effect of providing edge line is a crash reduction of 20%

Recognising safety gains from good asset management practice

- Move to a more objective evidence-based approach
- Asset ‘creep’ a problem, not properly funded
- We can account for safety gains to boost asset renewal/rehabilitation funding case
- ‘Extended design domain’ concept – applying current design standards to a substandard asset may not be appropriate/justifiable
Key findings

- Risk assessment process needs to be considered
- Information available e.g.
  - Crash reduction factors
  - Road design elements
  - Economic evaluation
  - Safety on specific types of roads, or for specific crash types

Key findings cont.

- Many results available through research
- Gaps in knowledge - many, but now known
- Crash rates available for monitoring at local level
- Integration between safety and maintenance required but possible

Dissemination to date

- Newsletter - Road safety risk reporter (www.arrb.com.au)
- Reports (www.austroads.com.au)
- Conference papers / workshops
- RSRM software
- Road safety engineering toolkit (www.engtoolkit.com.au)

Thank you!

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