



Australian Institute of Traffic Planning and Management
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AITPM Victorian Branch Technical Forum

Austrroads Road Safety Engineering Risk Assessment Project

Wednesday 25th March 2009, 5:00pm – 7:00pm

VicRoads Theatre, 60 Denmark Street, Kew



Australian Institute of Traffic Planning and Management
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Austrroads Road Safety Risk Assessment Project

ARRB has completed a six-year program of research on road safety engineering risk assessment. This Austrroads-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.

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Our speakers today are...

Blair Turner Senior Research Scientist, ARRB Group

Chris Jurewicz Senior Research Scientist, ARRB Group

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"Growing traffic skills and knowledge to deliver sustainable transport."


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Austroads Road Safety Engineering Risk Assessment Project

Blair Turner
Chris Jurewicz


Collaborating with the road industry to turn knowledge into practice



research



consulting



technology

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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

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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

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- 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

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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
- Guide to Road Design

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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, 2006



Country/State/Territory	Rate (per 100,000)
Andorra	100
Australia	14
Austria	10
Belgium	10
Denmark	10
France	10
Germany	10
Italy	10
Japan	10
South Korea	10
Spain	10
Sweden	10
Switzerland	10
United Kingdom	10
United States	10
Canada	10
Netherlands	10
Norway	10
Finland	10
Portugal	10
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What is being done?

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

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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

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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

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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

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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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Risk reduction for various safety treatments

- e.g. splitter islands at intersections:

Issue	Environment type	% Reduction
Channelisation at intersections – splitter and median islands	Splitter island – all environments	40%
	Splitter island – rural	35%
	Splitter island – urban	40%
	Splitter island – T intersection	45%
	Splitter island – X intersection	40%

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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**

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Risk reduction for various safety treatments

- Further information:
 - Risk reporter newsletter #6



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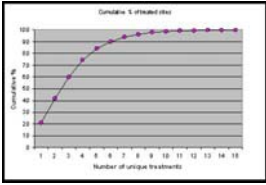
Economic evaluation in road safety

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

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Economic evaluation – key findings

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



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Economic evaluation – key findings

- Errors in many parts of the evaluation process:
 - Crash reduction factors (including multiple countermeasures)
 - Treatment life
 - Treatment cost etc
- Uncertainty should be reflected in evaluation process
 - Sensitivity testing, or provision of BCR as a range

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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

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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)

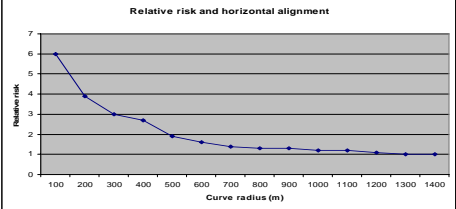


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Road design elements and safety

e.g. horizontal alignment – curve radius

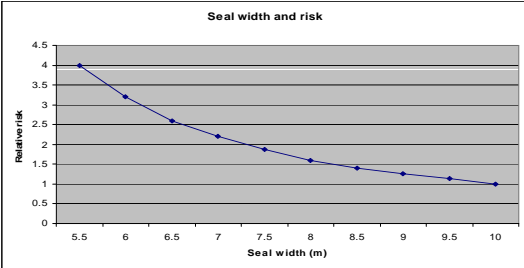
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Zeegeer	2.7	1.6	1.3	1.2	1.1	1.1	1.1	1.1	1.0	1.0	1.0	1.0	1.0	1.0
TRB	10.0	3.7	2.3	1.8	1.6	1.4	1.3	1.3	1.2	1.2	1.1	1.1	1.0	1.0
NZ	6.0	3.9	3.0	2.4	2.0	1.9	1.7	1.6	1.5	1.4	1.3	1.2	1.1	1.0
Krammes	9.5	4.9	3.3	2.7										



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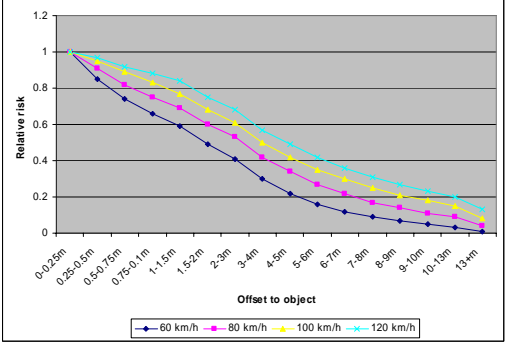
- Shoulder sealing – rural roads

Large scale shoulder sealing program	30% reduction
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- Seal width – rural roads



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- Clear zones



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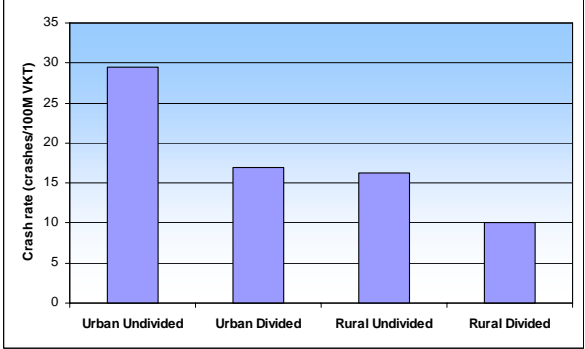
Crash Rates Database

Created to bridge gaps in road safety indicators:

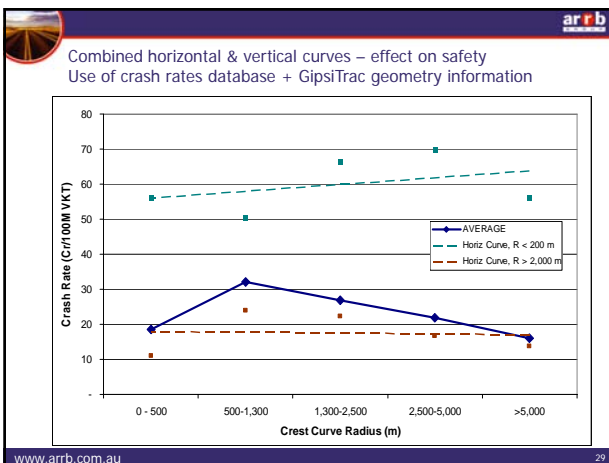
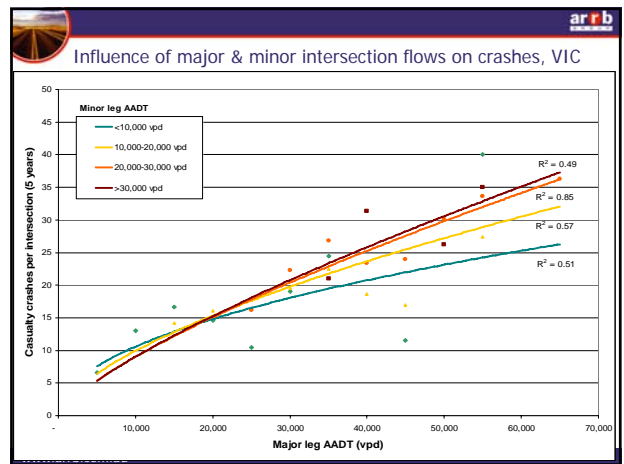
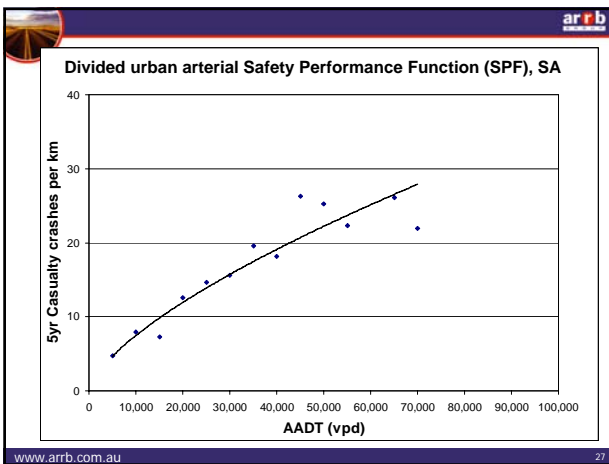
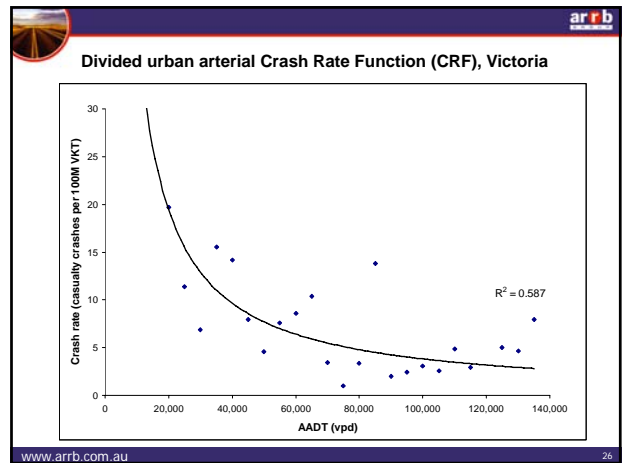
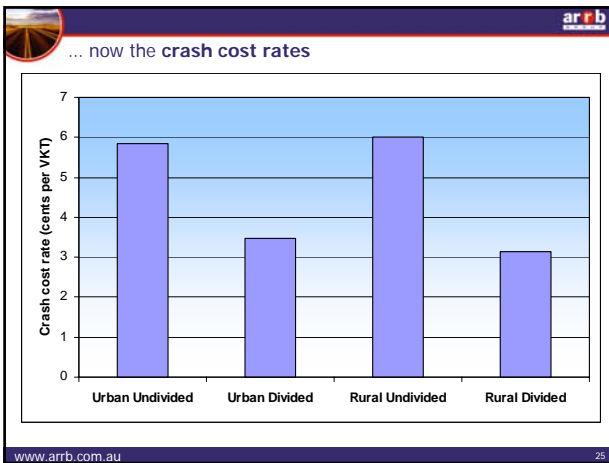
- Provide nation- and state-wide casualty crash rates
- Create engineering-based crash risk factors
- Road specific road trauma costs
- Individual crash risk (per 100M VKT)
- Collective crash risk (per km or per site)
- Objectively measure safety performance of any intersection or link

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Sample of aggregated casualty crash rates by road type:



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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

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Road asset condition and safety

Issue 1: Effect of asset condition on crash risk

Issue 2: Recognising safety gains from good asset management practice

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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.

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Roughness and crash rate

Roughness (counts/km)	Crash rate (casualty crashes per 100M VKT)
20	15
30	20
40	25
50	30
60	35
70	40
80	45
90	50
100	55
120	70
140	90
160	120
180	160
200	200
250	250

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Macrotexture and crash rate

Sand Patch Test Depth (mm)	Crash rate (casualty crashes per 100M VKT)
0.5	75
1.0	65
1.5	55
2.0	45
2.5	35
3.0	30
3.5	25
4.0	25
4.5	25
5.0	20
5.5	15
6.0	15
6.5	15
7.0	15

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Line marking


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

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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

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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

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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

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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)



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Thank you!

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