Pushing the Envelope

The Development of a Comprehensive Road Research Program and Set of Australasian Best Practice Guidelines

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Content Outline

• Overview of the National Strategic Research Program - examples
• Key outcomes from the past 6 years of research
• Details of the newly developed Best Practice Guideline Series
• Where to from here?
Aims of the Program

- To develop and promote best practice for the safe and effective management and use of the road system
- To provide professional support and advice to member organizations and national and international bodies
- To act as a common vehicle for national and international action
- To undertake performance assessment and assist in the development of Australian and New Zealand standards
- To develop and manage the National Strategic Research Program for roads and their use.
>A$200 billion dollar asset
Australasia – Key Facts

• Australia
  – Length ~810,000 km
  – Lane km ~1,650,000 km
  – Road use ~200 billion-veh-km
  – Sealed ~332,000 km (41%)
  – Gravel ~312,000 km (39%)

• New Zealand
  – Length ~100,000 km
  – Road use ~35 billion-veh-km

Source: Austroads Roadfacts 2005
Best Practice Guides

10 revised, updated and new guidelines in 96 parts covering 9 themes:

- Asset Management
- Project Delivery
- Project Evaluation
- Road Design
- Road Safety
- Bridge Technology
- Pavement Technology
- Transport Planning
- Traffic Management
Best Practice Guides

New guides in preparation covering new themes:

- Asset Management
- Project Delivery
- Project Evaluation
- Road Design
- Road Safety
- Bridge Technology
- Pavement Technology
- Transport Planning
- Traffic Management
- Road Tunnels
- Environmental Management
Background to the Guides

• there was scope to improve the effectiveness of the library
• the current structure was not helpful to users
• some of the codes and guidelines were published more than 20 years ago and did not reflect current practice.
• there was scope to improve the efficiency of publications management.
Development Process

<table>
<thead>
<tr>
<th>Establish Points of Departure and Criteria</th>
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<tr>
<td>Identify “Typical Users”</td>
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<td>Identify and Name “Guides”</td>
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<td>“First cut” at Scoping Guides – Identify Themes</td>
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<td>Categorise Guides in Terms of Work Required to Establish Them</td>
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<td>Identify “Reference Group” to Develop Strategy for each Guide</td>
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<td>Develop Strategy for each Guide</td>
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<td>Develop Indicative 3 year work program, Including Initial 2004/2005 Program</td>
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Figure 1: Process for establishing Guides
User’s Perspective

The main criteria from the user’s perspective were:

– Easy to access in one place
– Easy to find what you are looking for
– The core guide should be succinct supplemented by commentary and reference material
– Duplication of material should be avoided
Key research areas:

- bituminous surfacings
- pavement technology
- road asset management
- road safety engineering
- road network operations

Sustaining a national capability for research
Research to address uncertainty

- Rut depth (mm) vs. loading cycles (kcycles)
- Data for 8 tonne axle load, 12 tonne axle load, and 16 tonne axle load

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Safe System approach

‘Treatments that deliver Safe System outcomes minimise deaths and serious injury’

- road safety experts are often scarce/expensive
- need a quick reference for common problems and solutions

→ there was a clear need for an effective suite of tools
Road Safety Engineering

- extensive research conducted over six years
- findings being used to develop a national risk model
- results also of use as stand-alone findings
Treatment type: Safety barriers

Description:
The term 'safety barriers' refers to a range of devices designed to restrict the lateral movement of errant vehicles, with the intention of either guiding them back onto the roadway or bringing them to a stop safely. Subsets of the safety barriers category include end treatments (terminals) and crash cushions, which reduce the severity of head-on crashes into barrier ends. Safety barriers may be used on roadsides and medians.

Safety barriers fall into three broad categories according to their stiffness:

Flexible barriers

These allow more deflection than semi-rigid barriers and are designed to result in less damage to the colliding vehicle. They are constructed from tensioned wire rope strung between removable posts. Flexible barriers have also been built from W-beam or box-beam sections on weak posts (posts designed to fail on impact), but these types are not common in Australia.

Wire rope flexible barriers are currently available in two common configurations. One uses three or four wire ropes arranged in a vertical plane. The other uses a combination of two intertwined wire ropes (twisting over each other between the posts), and a second pair of cables (or single cable in vertical slots at the top of each post).

The cables are anchored to concrete foundations at each end of a run of barrier, while the posts sit in special sockets set in concrete. No other anchor and terminal is required.

Flexible barriers require more deflection space than semi-rigid barriers; however, the difference in deflection between wire rope and W-beam guardrail is very small. Flexible barriers are preferred as they minimise the risk of injury to vehicle occupants in a collision.

Repair of flexible barriers is simpler than for semi-rigid barriers, which reduces the length of disruption to traffic during maintenance.

Semi-rigid barriers

These are usually steel beam sections (W-beam, box-beam) and are designed to deflect when struck by an errant vehicle. Their deflection contains the movement of the vehicle and absorbs a portion of its kinetic energy.

The most common type of semi-rigid barrier system in Australia is the W-Beam guardrail, which consists of a steel beam with a W profile, mounted sideways on steel posts (so that the bottom vertical of the W points towards traffic).

As semi-rigid barriers are designed to deflect when struck, they must be installed a certain distance from the hazards they are shielding. In areas where reduced deflection is required, closer post spacings may be adopted in accordance with installation standards. Closer spaced posts will, however, increase the amount of damage and injury caused in any impact with the barrier, as the reduced deflection will require an errant vehicle to absorb a greater proportion of the impact energy.
Treatment

The term safety treatment either designates treatments that improve safety on roadsides or treatments that improve safety at intersections.

Flexible barriers

These allow for the construction of flexible barriers that can accommodate traffic flow. Some examples include:

- Wire rope flex barrier: The barrier consists of a series of wires that are anchored at both ends. The wires are flexible and can absorb the impact of vehicles.
- The cables are anchored to prevent the barrier from being pushed over.
- Flexible barrier: This barrier is similar to the wire rope barrier but is made of steel rather than wire. It is also flexible and can absorb the impact of vehicles.
- Repair of flexible barriers: This refers to the maintenance and repair of flexible barriers to ensure they remain effective.

Semi-rigid barriers

These are usually steel beam sections (W-Beam, T-beam) and are designed to deflect when struck by an errant vehicle. Their deflection allows the movement of the vehicle and absorbs a portion of its kinetic energy.

The most common type of semi-rigid barrier system in Australia is the W-Beam guardrail, which consists of a steel beam with a W profile, mounted at the edge of the road or on the median strip. The bottom of the W beam is designed to deflect in the event of a collision.

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Pavement Technology
Pavement Technology

High performance freight vehicles are emerging

Road wear rates changing with different loading conditions

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Factors affecting road asset maintenance costs

- load distribution
- vehicle configuration
- tyre pressure
- recent weather
- current condition
- rate of deterioration
- speed of vehicle

Cost of increased load

Benefit of increased load

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Pavement Technology

- Long term pavement performance monitoring originated in the early 1990’s
- > 15 years of data collected to date at over 70 sites
Pavement Technology

Research on axle group loading
Pavement Technology

Research on axle group loading
Freight Axle Mass Limits

Example output: Rural Arterial (granular pavement)
Pavement Technology

8.2 tonne single axle
13.8 tonne tandem axle
18.5 tonne tri-axle
30 tonne + ??
22.5 tonne quad axle ??
50 tonne + ??

Research on multiple axle loading

Future research
Program Outcomes

• Have a better understanding of the problem

• Road managers have much better tools to identify the vulnerable parts of the road network – asset preservation and road safety

• Able to much better predict the likely future performance of our road assets
Program Outcomes

- Improved understanding of the behavior of lower quality natural materials
- Much better position to address external influences, e.g. importation of foreign bitumen
- More coordinated approach to managing the risk to road network managers and road users
Program Outcomes

• More confident that we are getting value for money from our road spend
• Allowed us to build capability and rescue core capability in very specialized but essential technical areas – national resource, fellowships, academy
Dissemination of research

10 – 15 October 2010
Sebel Hotel Albert Park, Melbourne, Australia
Details at www.arrb.com.au