Briefing

3560 deaths per day

Photo: D. Best

Every hour, there are nearly 160 road fatalities across the globe. This ever-increasing toll has inspired the United Nations to launch a Decade of Action for road safety. As a world leader in the field, Australia has a key role to play. Articles describing the background to, and plans for the Decade are on pages 2-4.

Lack of skid resistance can have a major effect on the occurrence of crashes and their severity. To focus attention on this issue, ARRB is sponsoring the Third International Road Surface Friction Conference. The articles on pages 5-10 describe some of the projects ARRB has completed or has underway to improve the skid resistance of our roads and thereby reduce the road toll.

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Issue 130 May 2011

Published quarterly by ARRB Group Ltd
ISSN 1328-7206

The Decade of Action for Road Safety 2011-2020

The UN Decade of Action (DOA) for Road Safety was launched around the world on 11 May 2011. This global initiative was instigated by a United Nations Resolution, and co-sponsored by more than 90 countries, including Australia.

It recognised the tremendous global burden of the 1.3 million fatalities resulting from road crashes, as well as many millions of people sustaining non-fatal traffic-related injuries each year. Around 90% of these deaths and injuries occur in low and middle income countries, many of which are Australia's neighbours.

Key points in the development of the DOA have been:

- Global interest in the road safety epidemic has increased significantly in recent years.
- A global Ministerial conference on road safety was held in Moscow in November 2009.
- The conference passed the 'Moscow Declaration' for a Decade of Action in Road Safety.

In March 2010 the UN approved a resolution proclaiming 2011-2020 as a Decade of Action in Road Safety. The goal of the resolution is to stabilise and then reduce the forecast level of road traffic fatalities around the world by increasing activities conducted at the national, regional and global levels.

The Commission for Global Road Safety has estimated that given the right circumstances and actions, a target of a 50% reduction in fatalities could be achieved, resulting in 5 million less fatalities over the decade (Figure 1).

The UN Road Safety Collaboration and its partners developed the Global Plan for the Decade of Action for Road Safety 2011-2020 (available at (www.who.int/roadsafety/decade_of_action/en/index.html).

In September 2010 the Decade of Action 'Tag' was launched, along with the slogan 'Wear. Believe. Act' (Figure 2). The Tag is seen as an important communications tool, and is intended to raise the profile of the Decade of Action

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Figure 2: The DOA tag (Source: FIA Foundation)

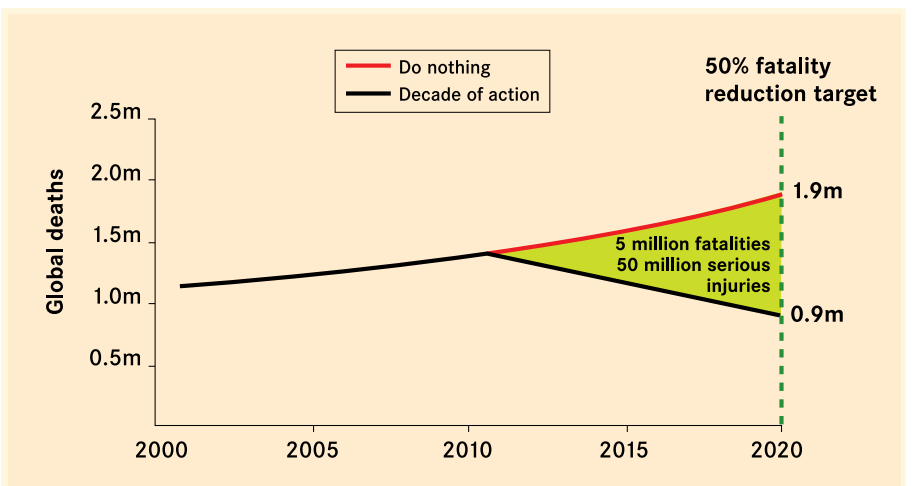

Figure 1: The DOA target (Source: FIA Foundation)

Australia's response to the DOA

A number of meetings have been held to plan Australia's involvement in this initiative. The first occurred at the 24th ARRB Conference (October 2010) when ARRB and REAAA facilitated a workshop.

A number of initial conclusions were reached:

- There is a need to identify areas of safety where we perform well and concentrate on these in our international efforts.
- New professionals are needed for these global initiatives.
- Wider dissemination of our road safety guidance documents should be investigated including the possibility of Austroads providing these documents for free to developing countries.
- Some type of network involving senior road managers in the region would be of value (perhaps based on organisations such as REAAA).
- Australia could conduct further research to address global research needs, for example, little is known about the safety benefit of various road infrastructure measures in developing countries.
- The linkages between the new National Road Safety Strategy for Australia and the DOA needs to be examined.
- Early indications are that the crash reduction targets in the new Australian Road Safety Strategy will be less than those set down in the DOA. This needs to be reviewed, especially given that others in the region look to Australia for guidance on road safety issues.
- There is a need to look at delivery of safety within Australia and New Zealand, as performance over the last decade has not improved greatly.

Organised by ARRB in association with the Australasian College of Road Safety, the second meeting was held on 3 March 2011 in Canberra. The gathering of Australian and international senior road safety professionals concluded:

- For Australia to make a positive contribution to improving regional and global road safety, senior level political support is required. The Prime Minister and other key ministers should be briefed on the DOA and on Australia's potential regional and global role.
- The Australian Government should be encouraged to place road safety performance and programs on the agenda for relevant Departments, and ensure that key ministerial councils (including those involving transport, health and justice) commit relevant agencies to participate.
- Australian road safety expertise is recognised globally, and training and capacity building have been identified as direct ways in which Australia can contribute to help alleviate the global road safety crisis.
- The Australian Government should be encouraged to participate with industry, agencies (health, transport, disability, justice) and research institutions in skills development, professional accreditation, best practice development, and in the extension of existing regional road safety programs.
- Professionals should be encouraged to establish outreach programs. Financial support for such activities should be sought from governments and their agencies, and from industry and road user groups through international bodies, such as the Global Road Safety Facility, WHO, ASEAN, APEC and development banks.
- The Asian Development Bank has extended an offer to embed a small group of Australian road safety professionals in its transport infrastructure programs. This offer should be accepted with appropriate support from the Australian Government.
- AusAID should be encouraged to expand its existing financial support for road safety in aid programs, particularly through the UN DOA Fund.
- Many good road safety initiatives are already occurring across different sectors. In order to maximise the benefits of these, effective coordination of activities is required. The Federal Department of Infrastructure and Transport will have the lead national role in coordinating activities.
- Australia's new National Road Safety Strategy 2011-2020 is due to be released shortly. This should recognise and reference the global Decade of Action.

A workshop is being held at the Road Surface Friction Conference in May to obtain further suggestions as to activities which should be included in the Australian response to the DOA. The workshop will be convened by Dr Peter Cairney and a full report will be included in the next issue of Briefing.

International planning for the DOA

ARRB has also been participating in international planning for the DOA via the United Nations Road Safety Collaboration (UNRSC).

The Collaboration, which meets biannually, is made up of members who are committed to road safety and to implementing measures to prevent road injuries. The UNRSC has since undertaken to carry the Decade of Action forward.

ARRB is a member of the Collaboration and Michael Tziotis from ARRB was invited to the 12th Collaboration meeting in Geneva in October 2010 to assist finalisation of the Global Plan for the Decade of Action. The Plan consists of the following five pillars:

Pillar 1: Road safety management

Pillar 2: Safer roads and mobility

Pillar 3: Safer vehicles

Pillar 4: Safer road users

Pillar 5: Post-crash response.

Michael provided inputs to Pillar 2: Safer roads and mobility. The activities supporting this Pillar are:

- the promotion of road safety ownership and accountability amongst road agencies, road engineers and urban planners
- promoting the requirements of all road users as part of land use-planning, sustainable urban planning and travel demand management
- requirements placed on road authorities to promote the safe operation, maintenance and ongoing improvement of existing road infrastructure
- promoting amongst relevant agencies the establishment of safe new infrastructure that meets the mobility and access needs of all road users
- the encouragement of knowledge transfer/sharing and capacity building in safe infrastructure
- encouraging research and development that will deliver safer road infrastructure.

For more detail go to http://www.who.int/roadsafety/decade_of_action/en/index.html.

Photo: AAP

In April, Blair Turner from ARRB, attended the 13th Collaboration meeting in London. Key issues dealt with at this meeting related to the launch of the DOA on 11 May and the plan for international activities. Significant actions are being planned in many countries for the 11 May launch and these can be found on the above website. Activities planned during the Decade include production of guidance, work related road safety activity, infrastructure improvements and monitoring.

A Charter for Road Safety was also approved and organisations are encouraged to sign up to the Charter to raise awareness and commitment to road safety. Copies of the Charter can be obtained from the UN website or through ARRB.

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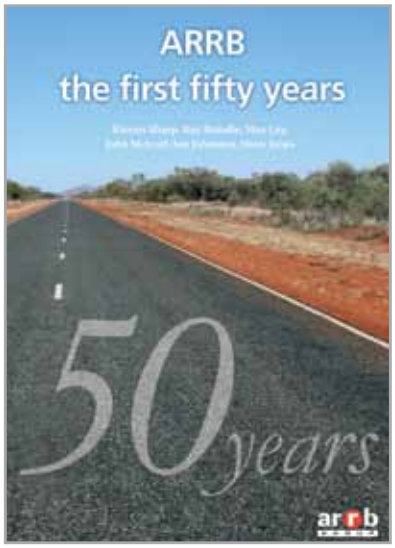

ARRB history published

An organisation to progress road research in Australia was first recommended in 1924 by William Calder. However it was not until 1960 that the Australian Road Research Board was formed and 1972 when the Australian Road Research Centre was opened in the then outer eastern suburb of Vermont South in Melbourne.

This history tells a story woven around the research achievements of ARRB and its people over the last 50 years. The story is told by eminent researchers and identities in the Australian research community with contributions and anecdotes provided by existing and former ARRB staff.

For information on how to obtain a copy of the book visit www.arrb.com.au

Photo: R. Yeo

A multi-disciplinary approach to skid resistance

Some years ago it was recognised that the research and development on skid resistance issues being undertaken in the various discipline areas at ARRB needed improved co-ordination to ensure maximum benefit for ARRB member agencies. This led to the formation of the ARRB Skid Resistance Group, an internal forum where projects and developments were reviewed to ensure each element of the work built on and supplemented work across discipline areas.

Members of the group included Kym Neaylon, Team Leader for surfacings research, Dr Peter Cairney a human factors safety research expert, Paul Hillier, a crash investigation/legal expert and Richard Wix an expert on the collection and analysis of road condition data.

This collaboration has produced some important results.

Some of the outputs provide fundamental knowledge on which ARRB member authorities can build. An example is project TT1608 where ARRB laboratory staff are leading the adoption of a new reference aggregate. In the 1970s a national reference aggregate was developed by ARRB sourced from the Panmure quarry in Victoria. Establishing this Australian reference aggregate was an exhaustive process and 20 years supply was manufactured and stored at ARRB.

Over the years this stone has been distributed to our member agencies as required to enable comparisons of the polished stone value (PSV) and polished aggregate friction value (PAFV) of the wide range of aggregates used in road surfacings. However, 30 years later, this supply was dwindling and the Panmure quarry has long since been closed.

Through the project, ARRB has re-established its laboratory capability in this area working with VicRoads practitioners and procured the required laboratory equipment, gained acceptance for the adoption of the UK standard reference aggregate from Wessex UK (rather than starting from scratch to identify and work up a local stone), designed a national inter-laboratory precision study and manufactured and distributed samples of the new reference stone and the last of the old reference stone for the conduct of this precision study.

On completion, the project will facilitate the change to adoption of the Wessex stone as the national reference as well as a harmonised approach to the polished stone test for assessment of aggregates for surfacings. This will bring Australian methods into line with the rest of the world, and also enable easier translation of the results of international research. As there is a large international market for the Wessex reference stone, this stone is seen as the most viable long term solution to support Australasian needs.

Other projects being delivered by ARRB address issues of direct benefit to member agency current operational requirements. Project AT1131 ***Guidance for the Development of Policy to Manage Skid Resistance*** is an excellent example (see page 8). Another example in a related area is the recent ARRB Systems Division project to update the VicRoads SCRIM machine electronics to the latest ARRB data collection platform. Work on another project, AT1488 Improving Skid Resistance Measurement, is investigating alternative measurement technologies and approaches. Finally, AT1691 Managing Asset Management Related Civil Liability Legal Risk is drawing together information on the historical developments, background and jurisdictional approaches to risk management.

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Photo: R. Yeo

Optimising the impact of 'slippery road' warning signs

Erecting a 'slippery road' warning sign is often the response of road authorities to a perceived reduction in the level of available skid resistance and/or surface texture at a particular location.

However, ARRB's experience is that such signage is often erected without the assistance of condition (test) data to justify its placement. Signs are often used as a semi-permanent or permanent warning sign (often to mitigate more fundamental issues at a location, such as a poor alignment or geometry) or to provide legal comfort in case of future incidents. In practice, this means that such signs are often retained for far too long and for the wrong reasons, diluting their effectiveness at individual locations and also across the network.

The Austroads document ***Guidelines for the Management of Road Surface Skid Resistance*** (AP-G83/05 published in January 2005) provides detailed guidance on the judicious use of such signage and explains that the best signage regimes:

- are data led
- specify correct usage and placement of the signage (to prevent overuse or misuse e.g. sign clutter)
- have a defined time period for sign placement
- have a defined reason and time period for sign removal
- specify minimum record-keeping requirements
- include adequate on-going sign maintenance (e.g. vegetation clearance).

A hierarchy of effectiveness has been suggested to assist practitioners to optimise the road safety returns from such signs, based on each sign's configuration and the use of supplementary plates etc.

ARRB is also aware of encouraging developments in the adoption of vehicle activated 'Slippery Road' warning signage, a good example being current work on the state road network in Queensland, where a protocol has been developed for identifying sites where such signs can be considered for deployment. Sites being considered include the approaches to intersections and curves.

The signs are self sufficient, being solar powered, having a speed sensor capturing vehicle approach speeds and a precipitation sensor. The signs are not permanently on display (i.e. the default for the sign is off), but are triggered by a vehicle exceeding a pre-set dry or wet weather trigger speed.

It is planned that the technology will be on display at the Mount Cotton test day (Tuesday 17 May 2011) of the 3rd International Road Surface Friction Conference.

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Sign type	Effectiveness
No 'Slippery Road' signage	Reliant upon other signage that might be present (e.g. curve or intersection ahead)
'Slippery Road' warning sign	Road users warned of potential issue that road can be slippery
'Slippery Road' warning sign with 'when wet' supplementary plate	Effectiveness increased by advising road users in what conditions road can be slippery
'Slippery Road' warning sign with 'when wet' and 'reduce speed' messages (large sign plate, red backing)	Effectiveness increased by advising road users what is expected of them in response to the condition indicated
'Slippery Road' warning sign with 'when wet' and 'reduce speed' messages (large sign plate, red backing), with supplementary message 'for XX m' with distance set according to condition data	Effectiveness increased by advising road users of the distance over which the condition applies and they are expected to maintain the advised response
'Slippery Road' VAS linked to precipitation sensor/s and with trigger speeds set for dry and wet conditions	Effectiveness increased over a static sign as research into VAS technologies has shown that road users understand and react to direct link between operation of the vehicle's controls and the triggering of the sign. Warning of issue is retained

Least effective

Most effective

'Think Once, Think Twice, Think Bike!'

Photo: P. Roper

The Austroads ***Guidelines for the Management of Road Network Skid Resistance*** (AP-G83/05, published in January 2005) recognise that the safety of the riders of bicycles and motorcycles requires specific consideration. This should be intuitive given the simple physics of riding a two-wheeler and the interaction between the tyres of such machines and the road surface. The reduction in the number and size of the contact patches (and differences in tyre tread) when compared with a car or commercial vehicle is significant.

Cyclists and motorcyclists are particularly prone to sudden changes in the available level of skid resistance and surface texture, and especially when the road surface has been subject to precipitation or contamination. This vulnerability can result from issues with the road alignment and road surfacing material (e.g. its specification, composition, laying and maintenance), but can also result from a failure to mitigate the risks of other situations that car and commercial vehicle drivers can endure but are highly significant to cyclists.

The following situations / occurrences are identified and explained within Section 6 (Network Standards) of the Austroads Guidelines:

- Multiple (repeat) spray seals – introducing further bitumen into the road environment if not designed and controlled adequately.
- Multiple treatments, e.g. a number of pothole repairs at a location - such that the road resembles what has been described as a 'lunar landscape', and with the potential for poor ride quality and differential friction to occur.
- Control of localised and bulk repairs, e.g. haunching, patching and the reinstatement of excavations – where failure to adequately specify and /or control the placement of edge sealants can lead to a differential friction situation and the tracking of excess binder which can then mask available microtexture.
- Control of large and bulk line markings, e.g. large head directional arrows and large speed control markings – where a failure to correctly specify the materials used can lead to a significantly low level of skid resistance.
- Control of the removal or masking of obsolete line markings – where inappropriate materials are specified (with limited texture) or a lack of attention to detail can lead to the old marking being exposed.
- Control of roadworks, e.g. preventing loose aggregate and other contaminants from being left on the road surface during works, or the use of metal road plates with little surface texture – to avoid potentially dangerous situations caused by a rapid drop off in the available level of skid resistance.

Photo: P. Hillier

Mitigation of these situations is often as simple as ensuring that such features do not adversely impact the wheel path of all road users and particularly, riders. Of course it must be remembered that the desire lines and wheel path/s of a cycle will often be much different than that of a car or commercial vehicle.

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Managing skid resistance

Photo: R. Yeo

Current skid resistance monitoring programs and investigatory limits used in Australia were based on systems developed in the UK where the climate, traffic intensity and network configuration are very different. These do not necessarily suit Australian conditions and can have high cost implications in terms of monitoring and maintaining surfaces at sometimes inappropriate skid resistance levels that are not readily achievable or sustainable in an Australian environment.

Austroads recognised a targeted approach applicable to Australian conditions was required and initiated this research project to develop a suitable national approach to skid resistance management. New Zealand has a range of climate, geography and traffic densities such that it could form a subset of the conditions in Australia, with one or more of the resulting zones described herein also applying to New Zealand.

The recently released project report supplements the existing Austroads technical reports – ***Guidelines for the Management of Road Surface Skid Resistance AP-G83/05***, ***Guide to Asset Management Part 5F: Skid Resistance*** and ***Guide to Asset Management Part 5G: Texture*** to provide guidance on a process whereby a road authority can set its own skid resistance policy and/or management practice as applicable to each road authority's individual circumstances and local conditions.

The report begins by introducing the basic contribution of a road surface to skid resistance, being microtexture and macrotexture, followed by the types of skid resistance measurement devices commonly used in Australia. The report then introduces how a road surface provides friction, including how this can vary with the seasons.

There is a large amount of background material in this report. This is considered necessary to build a solid foundation on which to meet the project objective: that is, to give definitive, prescriptive advice on methodologies that need to be applied by Australian jurisdictions.

A new concept of dividing Australia into skid resistance demand zones based on population densities, annual rainfall, topographic environment and traffic has been developed. This innovation was devised by the project team for Australian conditions, and should be reviewed in the future and refined after experience has been gained with its use.

For the first time, instruction in determining investigatory levels, and the updating of these levels, is then provided. Finally, a uniform proforma for undertaking the 'investigation' once the investigatory level has been reached, is appended.

One conclusion from this study is that each jurisdiction should carefully choose their most appropriate testing device and then retain its use over a long period of time.

The prescriptive advice offered for jurisdictions to follow is:

- Determine which zones of similar skid resistance demand apply to which portions of the network within the jurisdiction's responsibility.
- Determine the applicable minimum level of testing from Tables in the report.
- Set investigatory levels, in units for the equipment that will be used in the testing. (Should a jurisdiction choose not to recalculate investigatory levels from first principles, but rather adopt existing levels as a starting point, then even more importance should be placed on updating its investigatory levels.
- Establish and document a skid resistance management plan/strategy.
- When segments of the network reach investigatory level, undertake an investigation specified in the report.
- Rank the treatment of investigated segments into priority order.
- Review and update investigatory levels.

To view or purchase this report visit www.austroads.com.au

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Understanding incidents and identifying high risk locations

Photo: P. Hillier

The four main components of the Safe System approach are safer roads, safer vehicles, safer people and speed management. However, it is not often recognised that there are other components to the system, including 'understanding crashes and risks' which encourages all road authorities to learn from incidents occuring on their road networks.

The level of available skid resistance and/or surface texture at the location of an incident can be assessed using specialist equipment such as SCRIM, GripTester, RoAR and laser profilers, more traditional technology such as the British Pendulum Tester (BPT) and sand patch tests, and visual and manual inspection.

Whilst obviously not providing a numerical output, running a hand over a road surface, along with a close visual inspection, can give the practitioner important early information and knowledge about a site. This information can prompt further investigation, identify locations where testing would be beneficial or importantly, help verify test results already procured. The latter is considered particularly important, given that practitioners will often sub-contract the collection of data and have to view and interpret it within the office environment at face value. It is far better to consider the results alongside important local knowledge.

ARRB is a long-term advocate of capturing test data and would discourage any road authority from basing their skid resistance management strategy on visual inspection and tactile assessments only (except of course where resources are so limited that this becomes a positive action over doing nothing). However, all practitioners should be encouraged to verify test data through first hand assessment of the road surface.

There are a number of other indicators of possible skid resistance and/or surface texture related issues at a site such as damaged roadside vegetation and furniture (e.g. gates and fences), the presence of critical speed marks on the approach to rural curves and vehicle debris. These are obvious signs that a road user has failed to cope with or has misinterpreted the road environment being presented to them. All of these indicators are useful in deciding whether further investigation is required and remedial measures warranted.

Other potential sources of useful local network knowledge include tow truck operators, motoring patrol services and regular users of the network such as bus, taxi and delivery drivers, who detect visually and through driving experience, subtle changes to the network and its operating characteristics. They can be vital extra eyes and ears for the road authority, especially on widespread, remote networks.

Road authorities are encouraged to utilise all available tools in investigating incidents, so that better understanding will lead to a more proactive approach under the Safer Roads component of the Safe System approach.

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Accessibility as a transport network performance index

Photo: J. Best

Accessibility is the variety of opportunities provided to people through efficient arrangement of land use and the provision of transport. ARRB was engaged by Austroads to develop an accessibility metric as a tool for performance monitoring and policy analysis.

The ARRB Accessibility Metric or AAM was the result of this study. The AAM can be used to analyse accessibility for work, education, and shopping & recreation. It covers the four transport modes of car, public transport, walking and cycling. Case studies were conducted in Perth and Melbourne. High resolution neighbourhood-level analysis was also conducted in Mandurah (WA), Joondalup (WA) and Whitehorse (Vic).

Analysis of Perth and Melbourne data on the potential effects of accessibility showed that areas with high accessibility levels tend to be areas with lower average travel distance and higher average property price.

Higher mode shares for public transport, walking and cycling were also observed in areas with higher public transport, walking and cycling accessibility levels, particularly in the case of work trips.

The report titled *Application of Accessibility Measures* is in preparation and will be available via the Austroads website.

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Assessing the effectiveness of road safety measures

Photo: ARRB

Many countries share the need for more reliable estimates on the effectiveness of road safety treatments and strategies (often referred to as crash reduction factors). The development of reliable estimates is costly and time consuming, thus placing a burden on countries to develop estimates independently of other countries. It may not be feasible for small countries to develop reliable estimates, due to the limited number of crash reduction projects available for analysis.

ARRB in association with the Transportation Research Board (TRB) in the US has initiated an OECD sponsored project to facilitate international collaboration to address this issue and to encourage greater efficiency in the development of reliable safety effectiveness estimates and their dissemination. The objectives of the project are to:

- Evaluate opportunities for international collaboration, including the transferability of, and access to the results of assessments of effectiveness
- Develop a theoretical basis for assessing countermeasure effectiveness
- Develop a framework for assessing the confidence that can be placed on crash reduction estimates (based on the quality of individual studies and the consistency of their conclusions)
- Develop methods for applying this theoretical basis to crash patterns or traffic behaviour patterns in different countries to facilitate transferability
- Generate recommendations and an action plan to improve and harmonise research methods and reporting standards, and thereby increase the potential for transferability and mutually beneficial ongoing international collaboration
- Examine the availability of cost-effectiveness assessments of road safety interventions, and review the quality and transferability of the estimates available.

A working group has been formed that includes representatives from a dozen countries. Australia is represented by Blair Turner and Peter Cairney from ARRB.

Work commenced midway through 2010, and is due for completion in the middle of 2012 with the publication of a guidance document. As part of the review process, ARRB will host an editorial meeting in June in Melbourne, with attendees drawn from a number of countries around the world.

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Conferences

Environmental Management in Transport Summit 2011
Sydney, 17-18 May 2011
www.informa.com.au/conferences/Environment/environmental-management-in-transport-summit

2011 International Transport Forum: Transport for Society
Leipzig, 25-27 May 2011
www.internationaltransportforum.org

2011 Australian Trucking Convention
Canberra, 25-28 May 2011
www.ataevents.net.au/atc2011/

2011 IRF Regional Conference: Enhancing Green and Sustainable Transport for Africa and Middle East
Cairo, 14-15 June 2011
szammataro@irfnet.org

13th EAEC European Automotive Congress 2011: The Automobile in the 2nd Decade: Sharing All Energy Solutions
Valencia, 14-16 June 2011
www.eaec2011.com

2011 BusVic Maintenance Conference and Bus Expo
Moonee Ponds, Victoria, 4-5 July 2011
www.busvic.asn.au

AutoCRC Conference 2011 Smarter Safer Cleaner: Securing Australia's Position in the Global Auto Industry
Melbourne, 7 July 2011
www.autocrc.com/conference2011.htm

ISTTT19: 19th International Symposium on Transportation and Traffic Theory
Berkeley, California, 18-20 July 2011
www.isttt19.org

10th International Conference on Low-Volume Roads 2011
Orlando, Florida, 24-27 July 2011
www.trb.org/LowVolumeRoadsConference/Public/LVR10.aspx

Current road industry developments

Photo: R. Yeo

The following are some key issues reported to the March meeting of the National Transport Commission (NTC) by the CEO Mr Nick Dimopolous. They have been reproduced because of their relevance to those in the road industry.

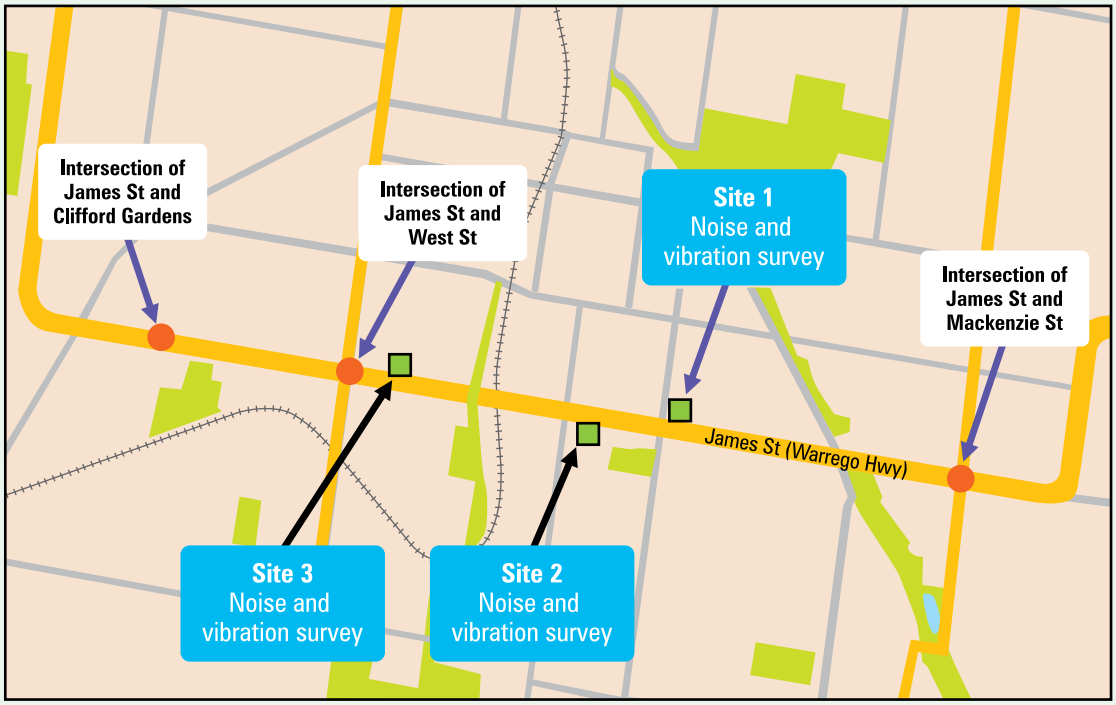
National Heavy Vehicle Regulation – the draft regulatory impact statement (RIS) and exposure laws were released for public consultation on 28 February 2011. Key messages for the draft RIS include the role of the National Heavy Vehicle Regulator as a centralised system to administer heavy vehicles. It is expected to be operational on 1 January 2013, and it will bring $12.4 billion worth of savings via centralised heavy vehicle registration and compliance systems. The NTC and the national project office will run information forums throughout Australia during March and April 2011 for heavy vehicle stakeholders.

COAG Road Reform Plan – the *COAG Road Reform Plan* (CRRP) team consulted with local governments in March 2010 on potential changes to the way in which road funds could flow back differently to local roads and governments, and is engaging with treasuries, via road agencies, about the way in which road funds flow to road agencies. NTC's contribution to the feasibility report includes the development of models to evaluate the transport sector benefit from alternative pricing models. A marginal cost paper, which underpins the work on feasibility, has been developed for external release 2 (in conjunction with Austroads) in March/April 2010. The draft feasibility report due in mid-2011 will incorporate pricing analysis, the benefits of linking revenue back to actual expenditure on roads and business system costs.

Heavy vehicle telematics strategy – The draft *National In-Vehicle Telematics Strategy* is being finalised for SCOT and ATC. The draft policy paper for *Electronic Systems for Heavy Vehicle Driver Fatigue and Speed Compliance*, the Austroads draft *Performance-based Specification for Electronic Work Diary* and *Heavy Vehicle Speed Monitoring* underwent public consultation from October to December 2010. The paper was submitted to the 31 March SCOT meeting before submission to ATC. NSW is leading a 2 year national pilot program to resolve implementation issues and demonstrate the effectiveness of electronic record keeping. NTC will work closely with the NSW RTA to ensure that the outcomes of the pilot can be translated into a smooth rollout of necessary regulatory and operational structures.

Maintenance and review – The 9th Package of amendments to the *Australian Road Rules* has been finalised, and an accompanying implementation plan in conjunction with States and Territories is being finalised. Progress was reported on other maintenance projects including the 7th Package of amendments to the *Australian Vehicle Standards Rules*, the revised edition of *Assessing Fitness to Drive*, and the review of implementation of the 7th edition of the *Australian Code for the Transport of Dangerous Goods by Road or Rail*.

National Road Safety Strategy 2011-2020 – NTC responded to the draft strategy, commending the draft for enshrining the Safe System approach as the basis for future road safety improvements. It was noted that the proposed target reduction of 30% in road users killed and seriously injured over the next decade should be more ambitious to match the targets being pursued by developed countries which are already performing better than Australia in providing a safe road network.



Map: G. Davis

Signal coordination for heavy vehicles

The Queensland Department of Transport and Main Roads (TMR) funded ARRB recently to evaluate the benefit of signal coordination for heavy vehicle progression over a 3.7 km length of James Street (Warrego Highway) in Toowoomba. A before-and-after study was undertaken to evaluate the scheme. The evaluation made use of performance metrics such as travel times and stops of heavy vehicles and general traffic, pavement vibration and roadside noise levels. The key results were as follows:

- Automatic number plate survey (ANPR) - For all eastbound and westbound general traffic, mean travel times were reduced by 17% and 9% respectively due to heavy vehicle signal coordination. For eastbound and westbound heavy vehicles, travel times were reduced by 9% and 6% respectively. These results were all statistically significant at a 95% confidence level.
- Floating-car survey – Findings and observations from the floating-car survey with respect to travel time reduction were in line with the findings from the ANPR survey. The mean number of stops was reduced by 25% and 17% for eastbound and westbound heavy vehicles respectively. These results were statistically significant at the 85% level.
- Vibration – Levels of vibration measured were insufficient to draw firm conclusions on the impact of the heavy vehicle signal coordination scheme at selected test sites. The sites where vibration was measured were different from the sites where the signal priority scheme was in place.
- Noise – Amongst three test sites, only the noise level at Site 3 was reduced after signal coordination with the change ranging from a 2.9% decrease (3.2 dBA) to a 4.3% decrease (4.9 dBA). This level of change is deemed significant to the human ear. The noise levels at the other two sites were not improved after treatment. Other factors such as type and load of heavy vehicles, pavement conditions and environmental conditions may have influenced the noise measurements. Again, the sites where noise was measured were different from the sites where signal coordination for heavy vehicles was in place.

In summary the heavy vehicle traffic signal progression system was found to result in an overall travel time reduction for both heavy vehicles and all vehicles. Results of the environmental impact on noise and vibration were less conclusive.

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Photo: V. Jaeger

Ride quality testing

Photo: A. Cox

Short-scale pavement condition testing, such as ride-quality roughness assessment, is an important component in ensuring pavement works are delivered in line with the required specifications. Of these tests, it is important that both the contractor and the client have a high degree of confidence in the methods, ensuring a fair outcome for both parties. As well as new roads, these tests can also be useful tools for pre and post-construction dilapidation surveys, remedial works assessments and airport pavement testing.

ARRB has an established reputation in offering these ride-quality tests to complement their network testing services. Recent improvements in survey vehicle technology now provide pavement contractors with greater certainty in delivering quality work.

As well as being compliant with all Australian and international standards for road profiling, ARRB is one of the few providers to offer National Association of Testing Authorities Australia (NATA) certified results. Additionally, ARRB's ISO 9001-2008 accredited testing procedures ensure reliable and repeatable results, regardless of the vehicle or operator.

New optical sensors allow start and end points to be triggered to an accuracy of ± 100 mm, eliminating human error which can be as great as ±5 m. The new Hawkeye 1000 DUO system also collects digital images to complement the laser data. These visuals can be used to check results and identify data discrepancies such as debris on the road. The images can also be used by contractors as the basis for remedial works.

Using inertial profilers for roughness testing originated in the 1960s with laser-based testing becoming prevalent in the 1990s. Laser based systems provide a far more accurate and reliable method of measuring profile compared with the older bump vehicles. ARRB's current testing fleet utilises specially developed, high precision lasers which have an accuracy of 0.01 IRI (approx 0.2 NAASRA counts).

As well as ride-quality, ARRB can offer a suite of short-scale testing, such as road geometry, advisory speed, asset location and identification and Walking Profiler surveys.

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ASFT road traffic technology

Sweden based ASFT develops and supplies equipment, control technologies and services related to the measuring of friction on roads, providing an effective tool for improving safety. In partnership with ARRB Group since last year, ASFT is committed to providing friction testing equipment for roads and airports and is the world's market leader in the field of airport runway friction testing.

ASFT offers friction testing systems mounted in-vehicle (on the rear axle) and trailer based systems. These systems utilise touch screen monitors and remote communication to provide extremely fast and reliable results directly to the road or runway operator. The ASFT Continuous Friction Measuring Equipment (CFME) uses the skidometer principle or fixed slip device. It operates with a fixed longitudinal slip of about 13% on the test wheel. The advantage of a slip measurement is that it can provide a continuous record of pavement friction.

ASFT has built a strong reputation due to its heavy investment in research and development, and customer support. This has resulted in products of unmatched quality and life expectancy, with the average ASFT friction tester being used for at least 20 years. ASFT friction testers have been demonstrated as having the best repeatability and correlation in the industry. More than 300 ASFT friction testers are in operation around the world.

Photo: ASFT

ARRB is currently working with ASFT to integrate the CFME with the Hawkeye road survey platform. As another module of the Hawkeye acquisition system, the friction results will be collected alongside and synchronised with other survey parameters such as macrotexture, roughness, road geometry and imagery.

This will enable users to utilise the power of the Hawkeye Processing Toolkit to map the friction results in a GIS format alongside other pavement parameters and video images. The integration will also enable ASFT to report macrotexture simultaneously with real time friction results over a remote communications link.

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Cycling aspects of Austroads Guides

The report titled ***Cycling Aspects of Austroads Guides*** has now been released by Austroads. The publication brings together cycling related information found in various Austroads guides, primarily the ***Guide to Road Design*** and the ***Guide to Traffic Management***.

It contains key information that relates to planning, design and traffic management of cycling facilities. The publication has been produced to ensure that this information is easily accessible by practitioners who have an interest in cycling issues and facilities.

It provides an overview of planning and traffic management considerations, and a summary of design guidance and criteria relating to on-road and off-road bicycle facilities. ***Cycling Aspects of Austroads Guides*** provides extensive cross-referencing to the Austroads Guides for more detailed information.

Due to the widespread interest in this publication, particularly from community and cycling user groups, Austroads is offering the report for free download in electronic format from the Austroads website www.austroads.com.au through the Publications portal. The publication can also be purchased as a hard copy.

Photo: V. Jaeger

iRAP India project update

Good progress continues to be made on the iRAP India 4 states project. The road inspections, which commenced in February in Karnataka, were completed in early April with the IRSM survey team surveying approximately 1000 km of roads in the north-eastern state of Assam. This brought the total length of road network surveyed in Assam, Gujarat and Karnataka to over 3,300 km.

The Assam road network posed numerous challenges for the IRSM survey team dealing with harsh terrain and poor road and weather conditions. However, the ARRB Hawkeye 2000 network survey vehicle performed admirably, despite the conditions, to collect the visual and pavement condition data needed to undertake the iRAP safety assessment and generate star ratings of the selected road corridors.

At the beginning of April, ARRB's coding (rating) team leader, Ms Van Hoang, travelled to Vadodara in Gujarat to oversee the next phase of the project, the coding of the road inspection data. A team of coders drawn from the local iRAP stakeholders undertook the assessment of over 600 km of visual data collected during the road inspections in Gujarat

using work stations provided by ARRB. The team was based at the Gujarat Engineering Research Institute facilities. The assessment of the road inspection data in Karnataka commenced at the end of April.

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Abu Dhabi road safety audit

ARRB Group has been engaged by the Abu Dhabi Municipality to undertake a comprehensive road safety audit review of the road network under the care and control of the Municipal authority.

The key objectives for Abu Dhabi Municipality in commissioning this project include:

- identifying key crash and road safety issues through analysis of crash data
- identifying crash black spots on the Abu Dhabi Municipality network
- undertaking a risk assessment of the Abu Dhabi Municipality network
- identifying locations for further investigation
- preparation of a remedial works program to address the road safety issues identified via the analysis of crash data and detailed assessment of high risk locations.

The total road network in Abu Dhabi is 2000 km. In order to address the identified safety issues on the 300 km that has the highest risk profile and up to 200 of the highest priority intersections, a project level risk assessment will be undertaken to assess the preferred risk reduction treatment options.

This project will deliver a program of works that will improve road safety in the Abu Dhabi Municipality.

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Valuing travel time savings: the key to road project appraisal

Photo: W.Hore-Lacy

Illustration: J. Best

Valuing travel time savings (VTTS) has major implications for properly evaluating transport investments, for understanding and pricing scarce road space and for use as an efficiency indicator for road transport projects.

ARRB Group Ltd. has been commissioned by Austroads to conduct a review of the international theory and practice of considering the notion of individually small travel time savings and the valuation of travel time reliability (TTR) in project evaluation.

In Australia and New Zealand, current practice does not distinguish between small and substantial travel time savings in project evaluation, and the evidence found in the literature regarding the way small travel time savings are defined is mixed. For example, there is some support for defining small travel time savings in terms of the percentage of the trip the time savings account for. In comparison, the actual number of time units saved are regarded as difficult to interpret and can be misleading.

Regarding the definition and measurement of small travel time savings, the following suggestions are made:

- There is a need for improving definitions and measurement of travel time savings, and recognition of the potentially misdirected nature of the arguments surrounding the notion of 'small' travel time savings.
- There should be a focus on the development of a more appropriate methodology that defines and measures the concept of travel time reliability instead of the measurement of minutes saved.

The literature found there is no clear-cut definition of TTR and there is also limited agreement about the best approach to use in measuring TTR. The multitude of definitions used tends to give rise to the numerous measures found in the literature.

Key findings obtained suggest a way forward in terms of the approach to TTR for Australia as follows:

- The concept of TTR appears to be gaining acceptance as a more effective measure for understanding and valuing travel time in project appraisal.
- The use of a consistent definition of TTR appropriate for Australia would be required, if the advantages of this concept are to be explored.
- A robust definition suggested in the literature which refers to the ability to provide a level of service/quality expected by the user and performance (in supplying the required functions) is suggested for consideration.
- A practical measure of reliability consistent with the suggested definition, which can be developed by specifying and estimating the most appropriate models is also suggested.
- There are a number of techniques to use in data capture for measuring reliability. The choice of approach and model to use would affect the collection method adopted.
- When developed, use of robust TTR estimates is likely to influence the BCA results of projects. However, there are several methodological and measurement challenges to be met before the concept of TTR influences how travel time is valued in project evaluation in Australia.

A consensus among jurisdictions needs to be reached on the definition, measure and theoretical models of reliability, and eventually application of reliability to project evaluation. In the end, these developments will affect decisions about the allocation of available funds between rural and urban roads and between new construction and rehabilitation/ maintenance of existing road networks.

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Managing road safety in Yemen

Photo: R. Shuey

Road deaths and injuries are a growing public health, social and economic development problem in low and middle income countries. In contrast, fatality rates in high income countries are decreasing despite the growing traffic. This demonstrates that road deaths and injuries can be mitigated through a combination of well planned measures which are applicable even to low and middle income countries.

Yemen has one of the poorest traffic safety records in the Middle East and North African region. The number of crashes, injuries and road deaths is rising at an alarming rate with an estimated 3,000 killed every year on the road network. Between 1996 and 2006, fatalities per year have more than doubled from 1,267 to 2,711. This is an annual growth rate of more than 8.5% which sadly is faster than the Yemen population growth.

In late 2009, WSP Group, in association with ARRB, was engaged by the World Bank to assist the government of Yemen in assessing the current status of their road safety program and to prepare a national strategy for road traffic injury prevention.

The final report was delivered and well received at the National Road Safety Conference in Yemen (12-13 Dec 2010). Amongst the recommendations outlined in the report was the encouragement towards adopting a Safe Systems approach in Yemen. The simple intention of this model is that the road safety agencies within a country should adopt a more holistic approach to projects and programs in order to achieve road safety outcomes.

The National Road Safety Strategy and Action Plan for 2011- 2016 in the report provides simple principles and strategies towards achieving the vision of reducing the number of road fatalities and injuries per 100,000 population by 30% over the next five years.

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Infrastructure safety management for Greece

To improve road safety on the trans-European road network, the European Union introduced Directive 2008/96/EC that obligated member countries to implement infrastructure safety management initiatives.

To assist meet its obligations under the Directive, the Greek Ministry of Infrastructure, Transport and Networks engaged Anka Consulting Engineers, in association with ARRB, to respond to the Directive.

The key tasks undertaken by ARRB, in collaboration with Professor George Kanellaidis and Dr Sophia Vardaki from the National Technical University of Athens (NTUA), entailed:

- identification of well performing safety management systems that may be implemented in Greece
- capacity building through training/ education and accreditation of road safety auditors.

The project report is now with the Greek Ministry for their consideration and action.

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Use of recycled glass in roads

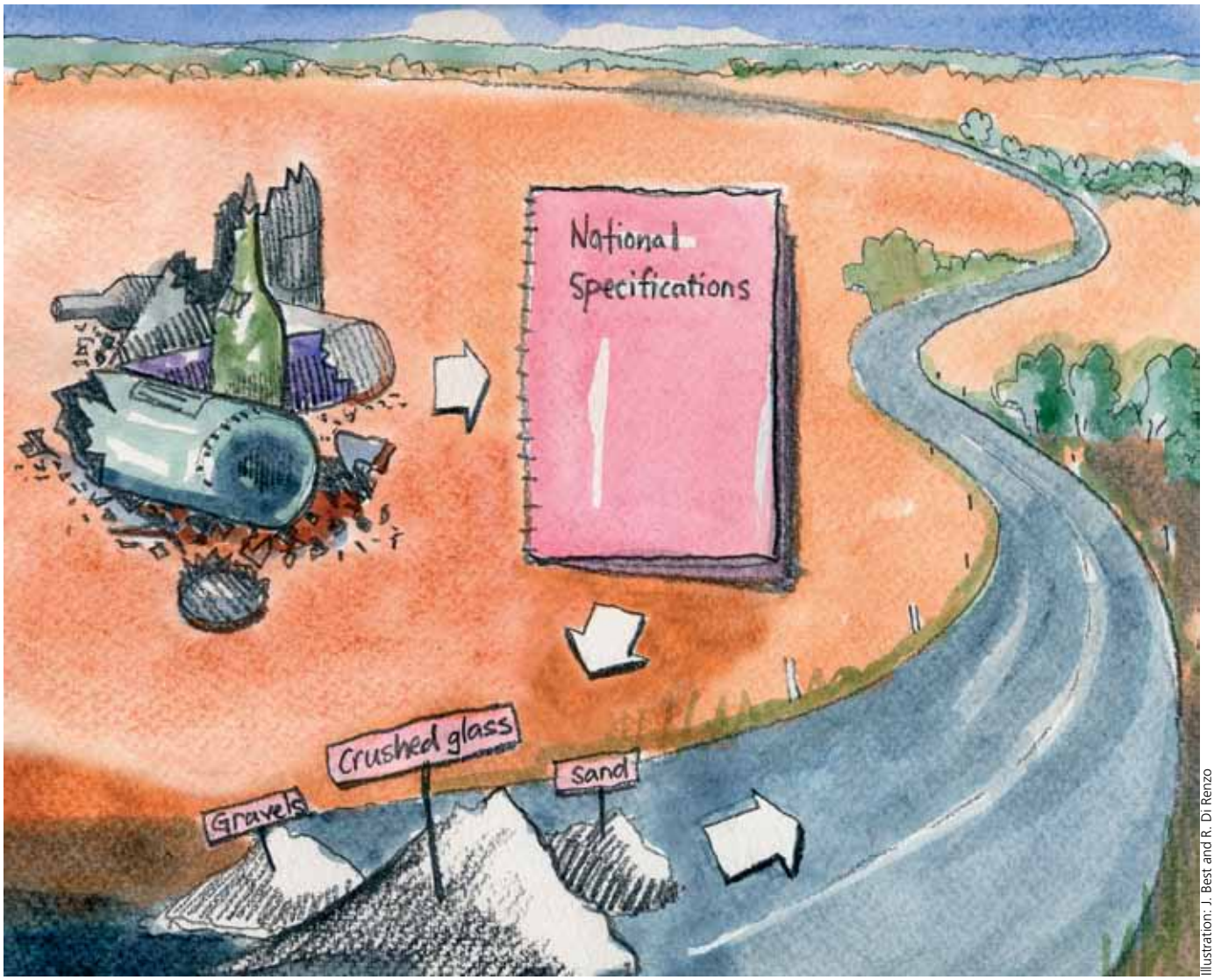

Illustration: J. Best and R. Di Renzo

About 30% of the glass collected each year (or 130,000 tonnes nationally) cannot be recycled back into bottles due to breakage and/or contamination.

The Australian Food and Grocery Council's Packaging Stewardship Forum (PSF) represents Australia's major beverage companies and their packaging suppliers. It has identified the need to develop sustainable and economically viable alternate markets for this recovered glass.

During 2010, the PSF commissioned ARRB to develop the first national specifications for the manufacture and supply of recycled crushed glass in various civil engineering applications for products with a maximum nominal size of 5 mm, the common size commercially manufactured in Australia.

A review of international and industry specifications for recycled crushed glass was undertaken, together with a summary of typical blend volumes for particular applications. Five Australian manufacturers of recycled crushed glass provided samples of their glass mix aggregate.

The specification provides the appropriate proportions and technical requirements for blending recycled crushed glass with natural gravels and sand for use in pavements and as partial replacement in concrete and pipe embedment. Environmental contaminant testing has also been included in the specification.

Whilst the requirements will vary by jurisdiction, the specification is based on ***The recovered glass sand exemption 2010*** of the NSW Department of Environment, Climate Change and Water in relation to type and frequency of testing (details at: http://www.environment.nsw.gov.au/resources/waste/ex10glasssand.pdf.

For the first time, Australia has a nationally consistent framework based on international best practice and local conditions for the use of recycled crushed glass in civil construction applications. These specifications have been developed for use by state and local authorities and others responsible for the procurement of materials and the construction of paving and roads.

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Matt Elischer joins Brisbane office

Matt has taken up the role of Team Leader (Heavy Vehicles), Queensland / Northern Territory. The ARRB heavy vehicles team comprises highly qualified and experienced engineers, with extensive theoretical and practical understanding of heavy vehicle dynamics, and the safety and operational issues involved with freight transport.

Matt was a Senior Vehicle Dynamics Engineer in Victoria and he brings to Queensland a wealth of experience in:

- heavy vehicle dynamic performance
- heavy vehicles safety and regulations
- computer modelling and simulation
- vehicle-pavement interaction
- road network access
- Performance Based Standards (PBS)
- data acquisition and analysis
- instrumentation and field trials
- experimental design and analysis.

Recent major projects include:

- Predicting dynamic wheel loading and its effect on the network
- Performance based standards length limit review
- Heavy vehicle mass compliance study
- Quad/tri semi-trailer trials
- Development of ESA relationships for all heavy vehicle classes
- Heavy vehicle route assessment.

Matt would be pleased to assist you with your heavy vehicle issues.

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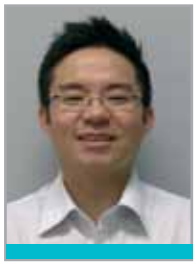
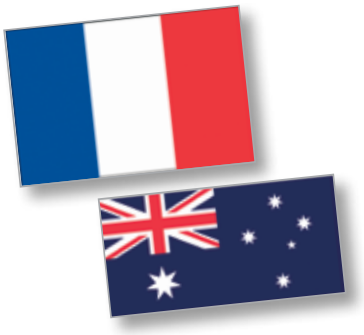
New staff



Darren Chow has joined our Systems group in the position of Project Officer working with Bruce Clayton and his data collection team. Darren has a BEng through Monash University and has approximately two years of project planning experience working as a project planner with Dartnell Grant and Associates.

Ashray Fuletra has joined our Perth office as a Graduate Engineer. Ashray has previously been working with ARRB in a casual capacity but has now been made permanent for a 12 month term. Ashray has a BEng(Civil) and has just completed his MCEng (Transportation Engineering - Pavement Design) through the University of Western Australia.

ARRB links with IFSTTAR in France



ARRB Group has signed a collaboration agreement with the LCPC (Laboratoire Central des Ponts et Chaussées) which is the research centre for roads and bridges in France. ARRB has had a long history working with the LCPC, commencing with John Metcalf's involvement in PIARC (now World Road Association) in 1975, then Kieran Sharp with pavement tests (in Italy in 1984) and more recently through the development of the OECD ITF publication ***Moving Freight with Better Trucks***. The collaboration agreement was signed by ARRB Managing Director, Gerard Waldron and LCPC General Director Hélène Jacquot-Guimbal and is under the technical direction of Anthony Germanchev (ARRB) and Bernard Jacob (LCPC).

The agreement covers the following topics:

- On-board weigh-in-motion (WIM)
- Heavy vehicle behaviour, efficiency, safety and interaction with infrastructure
- Impact of heavy vehicles on roads and bridges (development of bridge formulae in Australia and Europe)
- Bridge and Culway WIM
- Pavement materials characterisation, design and analysis methods and performance trials
- Development of new programs and assessment methods for accelerated pavement testing.

The signing of this agreement coincides with the merging of LCPC and INRETS (National Institute for Research on Transport and Safety) on 1 January 2011. This merger resulted in the formation of a new organisation IFSTTAR (The French Institute of Science and Transportation Technology).

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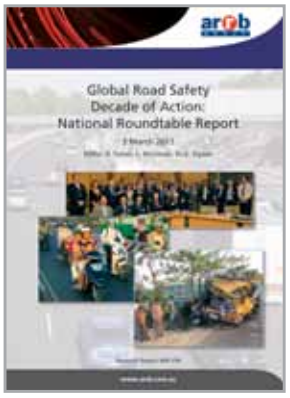

New publication from ARRB

In preparation for the launch of the Global Decade of Action for Road Safety, a roundtable meeting was convened in Parliament House, Canberra, on 3 March. Initiated by ARRB Group and the Australasian College of Road Safety, the objectives were to:

- provide information on the Decade of Action
- help plan a coordinated response of how Australian organisations and agencies can contribute to regional and global road safety
- help plan an Australian launch of the Decade of Action on 11 May 2011.

ARR 378 provides an outline of the objectives of the Decade of Action, and summarises key points made during discussions. The report is available as a free downloadable PDF from www.arrb.com.au or contact booksales@arrb.com.au

Knowledge transfer program 2011

NEW SOUTH WALES

- Planning and design of parking facilities, 5 July 2011, Sydney
- Local area traffic management, 6-7 July 2011, Sydney
- Basic geometric road design, 26-28 July 2011, Sydney
- Speed limits and speed management, 16 August 2011, Sydney
- Level 1 bridge inspection, 12-13 October 2011, Port Macquarie
- Legal issues facing road authorities, late 2011, Sydney

VICTORIA

- Level 1 bridge inspection, 1-2 June 2011, Melbourne
- Speed limits and speed management, 6 September 2011, Melbourne
- Level 1 bridge inspection, 15-16 November 2011, Bendigo
- Transport modelling and accessibility, 9-10 November 2011, Melbourne

QUEENSLAND

- Planning and design of parking facilities, 19-20 May 2011, Brisbane
- Traffic theory and applications, 7-8 June 2011, Brisbane
- Basic geometric road design, 21-23 June 2011, Brisbane
- Speed limits and speed management, 19 July 2011, Brisbane
- Unsealed local roads, 2-3 August 2011, Gympie
- Unsealed local roads, 8-9 August 2011, Townsville
- Unsealed local roads, 11-12 August 2011, Emerald
- Level 1 bridge inspection, 23-24 August 2011, Brisbane
- Local area traffic management, 8-9 September 2011, Brisbane
- Level 1 bridge inspection, 13-14 September 2011, Townsville

WESTERN AUSTRALIA

- Managing road pavement assets – ROMAN II, 1-2 June 2011, Perth
- Level 1 bridge inspection, 22-23 June 2011, Perth
- Speed limits and speed management, 27 September 2011, Perth

SOUTH AUSTRALIA

- Managed freeways, 24-25 May 2011, Adelaide
- Speed limits and speed management, 12 July 2011, Adelaide
- Level 1 bridge inspection, 26-27 July 2011, Adelaide
- Transport modelling and accessibility, 24-25 August 2011, Adelaide
- Unsealed local roads, 2-3 November 2011, Whyalla

TASMANIA

- Transport modelling and accessibility, 22-23 February 2012, Hobart

AUSTRALIAN CAPITAL TERRITORY

- Speed limits and speed management, 18 August 2011, Canberra
- Transport modelling and accessibility, 19-20 October 2011, Canberra

NEW ZEALAND

- Basic geometric road design, 17-19 May 2011, Auckland
- Level 1 bridge inspection, 5-6 December 2011, Hamilton
- Level 1 bridge inspection, 8-9 December 2011, Wellington

An introduction to geotechnical investigation and design: A one day training workshop on best practice in geotechnical design considerations in road design with case studies on identification of important geotechnical issues that have an impact on road design elements

Basic geometric road design: Good road design will achieve operational efficiency, be safe and cost-effective, and minimise the environmental impact. The role of the road designer is to produce the most appropriate design that achieves the specified functionality using the design inputs from stakeholders and road users. Participants will obtain a clear understanding of the key geometric design requirements for road design.

Fundamentals of transport modeling: Estimates of future demand are essential to the formulation of transport plans and policies. Transport demand modelling is therefore one of the core skills of a transport planner. This workshop will provide participants with an understanding of the fundamentals of transport modeling and a background on the four-step demand model.

Legal issues facing road authorities: The two-day workshop provides a comprehensive appreciation of the current and emerging issues associated with, the liability of road authorities, as well as a useful toolkit for practitioners involved in legal proceedings. The aim is to ensure that those attending are prepared in the event of future representation of their organisation. The two day workshop particularly relevant to those just starting a career with a road authority.

Level 1 bridge inspection: A two-day workshop for those involved with the routine maintenance inspection of bridge structures and culverts. The workshop will assist participants develop skills to conduct the Level 1 inspection

(continued next page)

Knowledge transfer program 2011

and complete the Level 1 inspection report form, on which to base the required maintenance intervention. Also the workshop will enable delegates to recognise and assess bridge condition problems essential for Level 2 inspections.

Local area traffic management: A two-day workshop on the latest practices applying to local area traffic management. The information presented will be based on the background material supporting the Austroads *Guide to Traffic Management Part 8: Local Area Traffic Management*. It will cover material relating to best practice techniques, available resources, design principles, device selection, special needs of different road users, legal issues and a syndicate exercise to provide hands-on experience applying the latest practice.

Managed freeways: In Australia and New Zealand the term managed freeways has emerged describing a new way of using integrated tools and technologies to manage congested urban freeways in order to bring about a high level of traffic throughput, reduced travel times, improved reliability and increased safety. This two day workshop will cover all aspects of managed freeway systems, including best practice for freeway ramp metering.

Managing road pavement assets – ROMAN II: The first day will provide participants with an overview of the fundamentals of road pavement asset management and their relevance to the ROMAN II package, while the second day will outline in greater detail the tools now available in Western Australia (the ROMAN II software) to effectively identify, record and manage your road pavement assets.

Planning and design of parking facilities: Based on the material supporting the Austroads *Guide to Traffic Management Part 11: Parking* with additional information drawn from Australian Standard AS2890.1-5. It will cover material relating to best practice techniques, available resources, design principles, on and off-street requirements, special needs of different users, architectural and urban design considerations, and a syndicate exercise to provide hands-on experience applying the latest practice.

Speed limits and speed management: Speed management is a key factor in the safe and efficient operation of the road network. Speed limits are a key tool in speed management. Safe speed limits are an integral part of the Safe System approach to road safety. Speed limits also need to reflect varying user types, road environments and community needs such as safety, amenity and efficiency. This one-day workshop will provide practitioners with an appreciation of the speed limit setting processes

Traffic theory and applications: Analyses of traffic behaviour are essential to both traffic management and road design, and also have application in the broader transport planning field. Such analyses draw upon many aspects of traffic theory, an appreciation of which greatly enhances the technical insights and capabilities of traffic engineers, road designers and transport planners. This workshop will present and explain the key areas of traffic theory, illustrate their application to various types of traffic analysis and provide participants with hands-on practice in identifying and undertaking the analyses appropriate to different situations.

Transport modelling and accessibility: The first day will focus on the fundamentals of the four-step modelling practices, which include trip generation/ attraction, origin-destination trip matrix, modal split and traffic assignment. The second day is on the much neglected topic of accessibility which attempts to study how transport/land-use planning should be a function of both transport network efficiency (congestion) and opportunities offered by land-use attributes. The workshop will use real-world case studies to illustrate that efficiency and land-use are two sides of the same coin and can be combined within a single software platform.

Other workshops to look out for:

Intersections, interchanges and crossings: The workshops will provide practitioners with sound knowledge of traffic management and road design guidelines relating to all types of intersections. The workshop will be based on various Austroads Guides relating to intersections. Coming to all Australian capital cities in late 2011-mid 2012

Level 2 bridge inspection: The three-day Level 2 bridge inspection course will equip participants with the skills to make detailed assessments of bridge component conditions, as well as maintenance and repairs. Coming to all Australian capital cities, and some regional locations in late 2011-2012.

Treatment of crash locations: A two day training workshop on the *Guide to Road Safety Part 8: Treatment of Crash Locations*. The workshop will cover providing a safe system, road safety engineering, human factors, police investigations, identifying crash locations, diagnosing the crash problem at the site, selecting an effective solution, crash costs and economic appraisal. Coming to New Zealand in late 2011

Unsealed local roads: A two-day workshop on the latest practices in the management of unsealed roads based on the popular ARRB *Unsealed Roads Manual*. It will cover recent research findings, best maintenance techniques and case studies demonstrating how to get greater value from available funding. The workshop will be a practical hands-on presentation with group participation, worked examples, case studies and a field inspection of unsealed road sites. Coming to most Australian states in mid-late 2011

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